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Experiences and challenges of healthcare professionals

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Experiences and challenges of healthcare professionals

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ORIGINAL RESEARCH
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Gene Therapy Knowledge and Attitude Among Healthcare Professionals: A Cross-Sectional Study

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This study aimed to assess healthcare professionals' knowledge, attitudes, and concerns toward gene therapy in Saudi Arabia. We conducted an online cross-sectional survey via convenience sampling during the period from December 2018 to March 2019. A total of 419 (358 pharmacists and 61 physicians) responded to our questionnaire. Three hundred and nine (73.7%) were male, and the mean (±SD) age of 32.0 ± 7.7 years. The mean knowledge scores of all participants, pharmacists, and physicians were 3.8 ± 1.9, 3.8 ± 1.9, and 3.7 ± 1.9, respectively ($P = 0.73$). Higher knowledge score was associated with younger age (Coefficient: −0.03; $P = 0.02$), male (Coefficient: 0.57; $P = 0.01$), master's degree (Coefficient: 0.93; $P = 0.003$) and Ph.D. holders (Coefficient: 1.10; $P = 0.01$), and participants graduated from Canada (Coefficient: 2.10; $P = 0.01$).Moreover, about half of the respondents (55%) were concerned about gene therapy, and genetics training at college was considered the best gene therapy education method by 69.4%. Attitude score was not significantly associated with the profession ($P = 0.88$) but positively correlated with the knowledge score (rho= 0.4; $P < 0.001$). In conclusion, pharmacists and physicians showed limited knowledge with a positive attitude toward gene therapy. Therefore, educational programs on gene therapy need to be considered, focusing primarily on the safety, and social acceptance of such new therapeutic management.

Keywords: gene therapy, healthcare professionals, knowledge, attitude, Saudi Arabia

INTRODUCTION

Gene therapy is a medical procedure in which a healthy genetic material is introduced into a patient's cells to replace defective genetic material (1). More than twenty gene and cell-based gene therapy products have already been approved (2). A similar number or even more new gene therapy drugs in the pipeline are anticipated to be approved by regulatory bodies in the next 5 years (3), with a significant upswing in the investments in such technologies.

Driven by the positive and evident impact as well as clinical and economic outcomes, gene therapy is emerging as a method that potentially offers new and unique approaches to treating devastating, rare, and inherited diseases as well as incurable illnesses or those with limited alternative therapies (4, 5). However, the process remains complex. The currently used techniques need better understanding by health care professionals (HCPs), entailing comprehensive grasping of the ethical issues that cover the use of this procedure (6). For these reasons, there is a need to address healthcare providers' knowledge, perceptions, and confidence toward gene therapy and its implementation and tailor such research further for the local context.

Although numerous studies on this subject have been carried out among clinicians and the general public, they have mostly been confined to developed countries (7–9). For example, a study assessing the knowledge and attitudes of medical residents in Rome concluded that Italian residents have insufficient knowledge on genetic testing for colorectal cancer (7). In the United States, a study evaluating U.S. public health educators' attitudes toward genomic competencies, their awareness, and their basic and applied genomic knowledge revealed unfavorable attitudes and limited genomic knowledge among this group of HCPs (8). Besides, a Chinese study highlights the lack of knowledge on gene therapy among many public and around one-third of clinicians in China (9). Hitherto, little is known about similar outcomes in the Eastern Mediterranean region despite that genetic disorders are not uncommon in the region due to several factors, including consanguinity (10). Only two studies have been published in the region, one in Qatar (11) and another in Kuwait (12) to date. Practicing physicians and pharmacists in Saudi Arabia have diverse educational backgrounds, having trained in Saudi Arabia, the United States of America, Canada, the United Kingdom, India, and many other Middle Eastern, European, and Asian medical schools (13). However, no published studies are available on the current status of the knowledge and attitudes toward gene therapy among HCPs in Saudi Arabia. Consequently, a cross-sectional survey of physicians and pharmacists working in Saudi Arabia aimed to understand their knowledge, attitudes, and concerns related to therapeutic modalities.

METHODOLOGY

Study Design and Setting

A cross-sectional survey was conducted via convenience sampling during the period from December 2018 to March 2019. Eligible participants included practicing physicians and pharmacists working in different healthcare institutions and hospitals. The study sample size was based on the assumption that the proportion of responses to most of the main questions would be about 70%. No previous studies are available on this subject from Saudi Arabia. The survey was distributed through WhatsApp as a snowball method with an expectation to reach 2,000 participants, and the expected good gene knowledge was 75% among the participants. The estimated sample required was 360 participants with a margin of error of $\pm$ 0.05 and a confidence level of 95%.

Ethical approval for this study was obtained from King Saud University College of Medicine Institutional Review Board with approval number E-18-3495.

Study Population

A cohort of physicians and pharmacists was randomly selected and first contacted electronically and provided an explanation of the study's objectives to guarantee a good response rate and participation. Those who agreed to participate were then offered the questionnaires. The study survey was made available on the online survey platform "Google Forms," which is considered user-friendly and easily accessible with the different web browsers (14). Only one reminder was sent to participants 2 weeks later. The participants were assured of personal information confidentiality and asked to complete the written consent before contributing to the study.

Study Questionnaire

Based on an extensive literature review of previously published studies, the survey was refined from validated questionnaires that were previously used to address our objectives (11, 12). The research group established the content validity of the adapted questionnaire at the Department of Clinical Pharmacy, King Saud University, with extensive knowledge of the study field. The face validity of the survey was assessed by ten expert HCPs (five pharmacists and five physicians) to assure the clarity and the premise of each question within the questionnaire. The survey was amended after reviewing the received feedback. The survey was then piloted for content, design, readability, and comprehension by another ten HCPs (five pharmacists and five physicians). Suitable amendments were made based on their feedback to develop the final questionnaire. The self-reported questionnaire comprised a series of questions to assess respondents: (i) demographics and personal and professional characteristics; (ii) their perceived level of knowledge ($n = 9$) and attitudes toward gene therapy and its application ($n = 4$); (iii) their self-estimated level of knowledge and training needs ($n = 4$); (iv) reasons to be concerned and not to be concerned about gene therapy ($n = 2$). A list of reasons was provided, and participants were allowed to choose one or more if they wished. Knowledge was assessed by giving 1 to the correct answer and 0 to the wrong answer. The scale measured knowledge of a maximum of 9 to minimum 0. A score of < 4 was taken as poor while ≥ 4 as good. The attitude score consisted of four items; participants were given 1 if they answered yes and 0 for other answers.

Statistical Analysis and Data Presentation

Continuous variables were checked for normality using the Shapiro-Wilk test, and normally distributed variables were compared using the student *t*-test, and non-normally distributed variables were compared using the Mann-Whitney test. Homogeneity of variances was checked using Levene's test before the *t*-test. Continuous data were described as mean and standard deviation, and categorical variables as frequencies and percentages. Categorical data were compared using the

Chi-square test or Fisher exact test if the expected frequency was <5. Knowledge and attitude scores were calculated by giving 1 point for correct answers and 0 points for wrong or "I don't know" answers. Cronbach's alphas were calculated to estimate the internal reliability of items relating to respondents about gene therapy using the entire sample of participants (reliability coefficient = 0.77). Correlation between knowledge and attitude scores was assessed using the Spearman correlation. Stata 16.1 was used to perform the statistical analyses (Stata Corp- College Station- TX- USA), and a P-value of less the 0.05 was considered statistically significant.

Regression Analysis

Linear regression analysis was used to assess factors affecting the knowledge score (normally distributed). Collinearity was tested for factors included in **Table 1** with variance inflation factor (VIF), and the "years of experience" was omitted. All variables included in the final model had a VIF of <1.3.

Normality of the residuals was tested with the Shapiro-Wilk test, and Breusch-Pagan was used to test for heteroskedasticity ($P = 0.75$). Link test was used to test model specification (Predicted value (_hat) $P = 0.01$, linear predicted value squared (_hatsq) $P = 0.41$), and a regression specification error test was used for omitted variables ($P = 0.26$). These results indicate proper model specification. Poisson regression was used to assess factors associated with the attitude score. The relation between knowledge and attitude scores was assumed to be non-linear, and locally weighted scatterplot smoothing (LOWESS) was used to plot the relationship between the two scores.

RESULTS

Socio-Demographic Characteristics

A total of 419 healthcare professionals (HCPs) participated in the study. Of these, 358 (85.4%) were pharmacists, and 61 (14.6%) were physicians. Of the respondents, 309 (73.7%) were male with a mean (±SD) age of 32.0 ± 7.7 years. About two-thirds of the respondents (65.9%) were Bachelor's degree holders. Respondents' demographics characteristics and professional information are summarized in **Table 1**.

TABLE 1 | Socio-demographic characteristics of the study participants.

Variables	Physicians ($n = 61$)	Pharmacists ($n = 358$)	Total ($n = 419$)	*P*
Male	37 (61%)	272 (76%)	309 (73.7%)	0.01
Age (Years)	36.1± 10.4	31.3± 7.0	32.0± 7.7	<0.001
Educational level				
Bachelor's degree	15 (24.6%)	261 (72.9%)	276 (65.9%)	<0.001
Master's degree	6 (9.8%)	41 (11.4%)	47 (11.2%)	
Ph.D.	5 (8.2%)	39 (10.9%)	44 (10.5%)	
Residency	16 (26.2%)	13 (3.6%)	29 (6.9%)	
Fellowship	17 (27.9%)	4 (1.1%)	21 (5%)	
MD	1 (1.6%)	0	1 (0.2%)	
Other^	1 (1.6%)	0	1 (0.2%)	
Position				
Academic	8 (13.1%)	43 (12%)	51 (12.2%)	0.04
Clinical	48 (78.7%)	234 (65.4%)	282 (67.3%)	
Administrative	5 (8.2%)	81 (22.6%)	86 (20.5%)	
Experience in years				
< 5	22 (36.1%)	144 (40.2%)	166 (39.6%)	0.046
5–10	15 (24.6%)	130 (36.3%)	145 (34.6%)	
11–20	17 (27.7%)	65 (18.2%)	82 (19.6%)	
More than 20	7 (11.5%)	19 (5.3%)	26 (6.2%)	
Country of graduation				
Saudi Arabia	42 (68.8%)	189 (52.8%)	231 (55.1%)	<0.001
USA	1 (1.6%)	15 (4.2%)	16 (3.8%)	
UK	2 (3.3%)	13 (3.6%)	15 (3.6%)	
Canada	4 (6.5%)	2 (0.5%)	6 (1.4%)	
Australia	1 (1.6%)	1 (0.3%)	2 (0.5%)	
Other #	11 (18%)	138 (38.5%)	149 (35.6%)	
Time spent in clinical practice				
<25%	5 (8.2)	73 (20.2)	78 (18.6)	<0.001
25–50%	9 (14.7)	47 (13.1)	56 (13.4)	
>50%	16 (26.2)	39 (10.9)	55 (13.1)	
100%	24 (39.3)	26 (7.3)	50 (11.9)	
Not working in clinical practice	7 (11.5)	173 (48.3)	180 (42.9)	

^ *Other levels of education are specialized training programs/examination (e.g., MRCPCH).*
#Other countries include Egypt, Sudan, Jordan, Japan, Syria, Pakistan, Kuwait, Yemen, Germany, India, Bahrain, Sweden, and Iraq.
Continuous data are presented as mean and S.D., and categorical data as number and percentage.

Assessment of General Knowledge of Gene Therapy

In the second section of the survey, we explored HCP's knowledge about gene therapy. The mean knowledge scores of all participants, pharmacists, and physicians were 3.8 ± 1.9, 3.8 ± 1.9, and 3.7 ± 1.9, respectively. There was no statistically significant difference in knowledge between pharmacists and physicians ($P = 0.73$).

Most of the respondents ($n = 366$; 87.4%) knew gene therapy as an experimental technique that uses genes to treat or prevent disease(s). In addition, 27.7% of the participants thought that gene therapy is currently available in a research setting only. However, more than half ($n = 218$; 52.0%) of the participants were aware that gene therapy could be targeted to egg and sperm cells allowing the inserted gene to be passed on to future generations. Moreover, less than half of the respondents ($n = 190$; 45.3%) thought that the procedure could have very serious health risks, such as toxicity, inflammation, and cancer (**Table 2**).

Additionally, 54% of the pharmacists, compared to 39% of the physicians, correctly answered the statement, "Gene therapy could be targeted to egg and sperm cells which would allow the inserted gene to be passed to future generations." Similarly, 73.2% of the participating pharmacists and 63.9% of the physicians did not know which cells are targeted by gene therapy (**Table 2**).

Self-Assessed Knowledge of Gene Therapy

Table 3 reports the self-assessed level of knowledge and suggested approaches to educate participants on gene therapy. A clear

TABLE 2 | Information about the respondent's knowledge of gene therapy.

Statement	Physicians ($n = 61$)	Pharmacists ($n = 358$)	Total ($n = 419$)	*P*
Gene therapy is an experimental technique that uses genes to treat or prevent disease(s)	49 (80.3%)	317 (88.5%)	366 (87.4%)	0.16
The U.S. Food and Drug Administration (FDA) has approved only a limited number of gene therapy products for sale in the United States	4 (6.6%)	34 (9.5%)	38 (9.1%)	0.63
Gene therapy is currently available in a research setting only	16 (26.2%)	100 (27.9%)	116 (27.7%)	0.67
Gene therapy can have very serious health risks, such as toxicity, inflammation, and cancer	23 (37.7%)	167 (46.7%)	190 (45.3%)	0.15
Gene therapy could be targeted to egg and sperm cells which would allow the inserted gene to be passed to future generations	24 (39.3%)	194 (54.2%)	218 (52.0%)	0.06
Gene therapy is approved only for adults	26 (42.6%)	123 (34.4%)	149 (35.5%)	0.64
How do you think gene therapy works?	36 (59%)	221 (61.7%)	257 (61.3%)	0.38
Which cells do you think are targeted by gene therapy?	22 (36.1%)	96 (26.8%)	118 (28.2%)	0.05
What type of vector is used to carry modified genes in the targeted cells?	3 (4.9%)	15 (4.2%)	18 (4.3%)	0.73

Knowledge was assessed by giving 1 to the correct answer and 0 to the wrong answer. The scale measured knowledge of a maximum of 9 to minimum 0. A score of < 4 was taken as poor while ≥ 4 as good.
Data are presented as numbers and percentages. Numbers presented refer to the number of participants who answered the questions correctly.

TABLE 3 | Self-assessed knowledge and suggested approaches to educate gene therapy.

Statement	Physicians ($n = 61$)	Pharmacists ($n = 358$)	Total ($n = 419$)	*P*
Do you know the meaning of gene therapy?				
Yes	50 (82%)	299 (83.5%)	349 (83.3%)	0.78
No	6 (9.8%)	32 (8.9%)	38 (9.1%)	
I do not know	5 (8.2%)	27 (7.5%)	32 (7.6%)	
Overall, I feel that I am well-informed about gene therapy				
Yes	7 (11.5%)	113 (31.6%)	120 (28.6%)	0.01
No	39 (63.9%)	173 (48.3%)	212 (50.6%)	
I do not know	15 (24.6%)	72 (20.1%)	87 (20.8%)	
From where you have learned about gene therapy**				
School	20 (32.8%)	108 (30.2%)	128 (30.5%)	0.001
Practice	27 (44.3%)	78 (21.8%)	105 (25.1%)	
Seminar	19 (31.2%)	56 (15.6%)	75 (17.9%)	
Media	34 (55.7%)	131 (36.6%)	165 (39.4%)	
Journal	26 (42.6%)	80 (8.7%)	106 (25.3%)	
Colleagues	26 (42.6%)	135 (37.7%)	161 (38.4%)	
The best way to educate HCPs about gene therapy**				
During college studies	37 (60.7%)	254 (70.9%)	291 (69.4%)	0.02
During residency training	34 (55.7%)	168 (46.9%)	202 (48.2%)	
Seminars	30 (49.2%)	174 (48.6%)	204 (48.7%)	
Continuous medical education (CME)	38 (62.3%)	152 (42.5%)	190 (45.3%)	
Scientific journals	28 (45.9%)	135 (37.7%)	163 (38.9%)	
Grand rounds	18 (29.5%)	100 (27.9%)	118 (28.2%)	

***Multiple responses.*
Data are presented as numbers and percentages.

majority of the respondents ($n = 349$; 83.3%) were aware of the meaning of gene therapy, while only a smaller proportion ($n = 120$; 28.6%) reported being well-informed about it in detail (**Table 3**).

Gene Therapy Education

The largest proportion of respondents indicated that they have learned about gene therapy from the media ($n = 165$, 39.4%), followed by colleges ($n = 161$, 38.4%). In addition, the majority of them felt that the best way to educate HCPs about gene therapy was during college studies ($n = 291$, 69.4%) or through seminars ($n = 204$, 48.7%), or during residency training ($n = 202$, 48.2%) (**Table 3**).

Relationship Between Socio-Demographic Factors and Gene Therapy Knowledge

High knowledge score was associated with younger age, male gender, Master's and Ph.D. degree holders, graduation from Canada or other countries (**Table 4**). Knowledge score was not associated with the profession.

General Attitudes Toward Gene Therapy

Respondents' attitudes toward gene therapy are reported in **Table 5**. When HCPs were asked whether they believed that gene therapy is or will soon become a useful treatment strategy, 81.4% ($n = 341$) said that they would be, while 3.8% ($n = 16$) said that they would not. The remaining 14.8% ($n = 62$) indicated that they did not know (**Table 5**).

Moreover, when the study cohort was asked whether they agreed with the statement, "If it is possible to cure adults with debilitating diseases (e.g., Alzheimer or Parkinson disease) and children with usually fatal genetic disease (e.g., sickle cell anemia, muscular dystrophy, etc.) using gene therapy," more than 61% ($n = 256$) of the respondents agreed to gene therapy being allowed to be used in such populations (**Table 5**).

Concerns About Gene Therapy

More than half (54.7%, $n = 229$) of respondents agreed when asked if they were concerned about the use of gene therapy. The most frequent reasons for the concern were patient safety (30.3%,

TABLE 4 | Linear regression analysis for factors affecting knowledge score ($n = 419$).

	Coefficient (95% confidence interval)	*P*
Age	−0.03 (−0.06 to −0.005)	0.02
Male	0.57 (0.13 to −1.01)	0.01
Profession	0.17 (−0.45 to 0.78)	0.60
Educational level		
Master vs. Bachelor's	0.93 (0.33 to 1.53)	0.003
Ph. D. vs. Bachelor's	1.10 (0.34 to 1.86)	0.01
Country of graduation		
Canada vs. Saudi Arabia	2.10 (0.57 to 3.60)	0.01
Others vs. Saudi Arabia	0.63 (0.21 to 1.05)	0.003
Position	−0.20 (−0.55 to 0.14)	0.25
Not working in clinical setting	−0.12 (−0.23 to −0.01)	0.04

TABLE 5 | Information about the respondent's attitude toward gene therapy.

Statement	Physicians ($n = 61$)	Pharmacists ($n = 358$)	Total ($n = 419$)	*P*
I believe that gene therapy is or will soon become a useful treatment strategy				
Yes	47 (77.5%)	294 (82.1%)	341 (81.4%)	0.49
No	2 (3.3%)	14 (3.9%)	16 (3.8%)	
I do not know	12 (19.7%)	50 (14%)	62 (14.8)	
If it is possible to cure adults with debilitating diseases using gene therapy, do you agree that those people ought to be allowed to be treated by gene therapy?				
Yes	37 (60.7%)	219 (61.1%)	256 (61.1%)	0.76
No	7 (11.5%)	31 (8.7%)	38 (9.1%)	
I do not know	17 (27.9%)	108 (30.2%)	125 (29.8%)	
If it is possible to cure children with the usually fatal genetic disease, do you agree that those children ought to be allowed to be treated using gene therapy?				
Yes	47 (77%)	213 (59.5%)	260 (62%)	0.03
No	3 (5%)	43 (12%)	46 (11%)	
I do not know	11 (18%)	102 (28.5%)	113 (27%)	
Are you concerned about the use of gene therapy?				
Yes	35 (57.4%)	194 (54.2%)	229 (54.7%)	0.64
No	26 (42.6%)	164 (45.8%)	190 (45.3%)	

Data are presented as numbers and percentages.

$n = 127$), high cost (26.5%, $n = 111$), adverse events (22.7%, $n = 95$), and a belief that genetic changes would be passed on to offspring (21.0%, $n = 88$).

While the greatest reason for not being concerned about gene therapy was that it would only be prescribed for particular conditions (fatal conditions) and certain patients (20.5%, $n = 86$), the procedure would be well-regulated and not go against nature (20.0%, $n = 84$), and it was a product of high technology; therefore, safety should not be a concern (15.5%, $n = 65$).

The Attitude Toward Gene Therapy

The mean attitude score was 2.7 ± 1.3 among physicians and 2.6 ± 1.3 among pharmacists ($P = 0.35$). Attitude score was not significantly associated with the profession ($P = 0.88$). However, there was a positive correlation between knowledge and attitude (rho 0.4, $P < 0.001$). The relation between both scores is plotted in **Figure 1**.

DISCUSSION

This is the first survey that aimed to explore the knowledge and attitude toward gene therapy among HCPs in Saudi Arabia to the best of our knowledge. Gene therapy has been an acquainted theme in the medical research community for the past few years (15). However, one of the main challenges has been the lack of familiarity and understanding of this technique among HCPs. The study revealed low awareness and limited knowledge about gene therapy among the participating physicians and pharmacists. Furthermore, most respondents regarded it as essential to improve the understanding of the procedure and considered college studies, seminars, or residency training as the best way to educate HCPs. In Kuwait, physicians and pharmacists revealed little awareness regarding pharmacogenetics and pharmacogenetics testing, and 16.0% showed confidence in applying these tests in their practice settings (12). In addition, another cross-sectional survey comparing the level of awareness and attitude toward pharmacogenomics of pharmacists vs. doctors within a large medical corporation in Qatar reported a low level of awareness toward pharmacogenomics among participants (11). Besides, a study conducted in Malaysia found that most respondents had poor to fair knowledge, and nearly half had no pharmacogenomics education (16). These results point to the need for better strategies and guidelines for enlightening HCPs on gene therapy. Recent research demonstrated a positive impact on improving physicians' knowledge and confidence in using genetic services resulting from availing those genetics educational outreaches (17, 18). Our study highlights the need to develop strategies to ensure multi-faceted, accessible educational outreach programs for the medical community at large in Saudi Arabia. Such programs are essential to correct any misconceptions related to gene therapy and will facilitate future implications of gene therapy in different diseases (19). Moreover, several countries had launched gene therapy educational programs to both healthcare professionals and patients (20).

Rather than addressing disease symptoms, gene therapy can address the core causes of genetic illnesses by changing the expression of a patient's genes or repairing or replacing a defective gene (21). Three gene therapies have been approved for human medical use in the United States in 2017 (22–24), with many more approvals being expected to follow in the near future. The results from this study provide acumens into HCP attitudes toward gene therapy. Our findings indicated that most participants accepted the technique for conditions perceived as severe and fatal genetic diseases. Furthermore, both clinicians and pharmacists believe that the technique will soon become a useful treatment strategy and would be beneficial for improving human health in the near future. Hence, HCPs in this study expressed a positive attitude

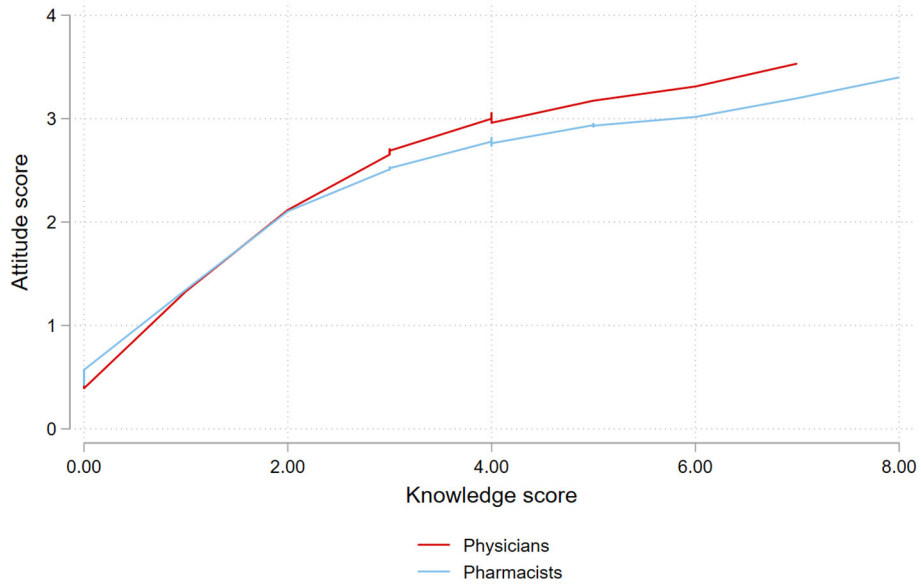

FIGURE 1 | Locally weighted scatterplot smoothing (LOWESS) of the attitude and knowledge scores.

and a desire to adopt the strategy into their practices in the near future.

Today, gene therapy holds promise for treating a wide range of genetic and non-genetic diseases, such as cancer (25, 26), cystic fibrosis (27, 28), heart disease (29, 30), and diabetes (31, 32). Moreover, the participants in this study strongly supported gene therapy to treat fatal or debilitating diseases in both adults and children. Similarly, Wang et al. (9) reported a broader acceptance of gene therapy to treat fatal diseases by both clinicians and the public (83 and 88%, respectively). On the other hand, Xiang et al. (33) found a large proportion of respondents not accepting gene therapy for complex and potentially severe diseases such as breast cancer (63.7%) and congenital heart disease (60.3%).

Gene therapy involves changing the body's genetic setup, raising many unique medical and ethical concerns. Many people oppose gene therapy on religious grounds, believing that altering genetic material is against God's will (34). In recent years, the widely reported occurrence of adverse events in gene therapy clinical trials had strengthened the fear in public perceptions of the therapeutic approach (35). Indeed, medical concerns, including patient safety, high cost and adverse events, and ethical issues, are the main concerns raised by the participants in our study. This trend has also been described in other studies (9, 33). A study investigating current opinions of clinical genetic professionals on genome editing reported concerns about the safety and ethical aspects of the technology, as well as fears over its potentially inappropriate applications (36).

One of the limitations of this study relates mainly to self-report by participants as the survey relied on their conviction to appraise their knowledge and attitude. Thus, some participants may have overestimated or underestimated their capabilities in responding to the questions, possibly leading to recall bias. Also, the cross-sectional nature of the survey represented one point in time, limiting the ability to generalize this finding to all healthcare providers in Saudi Arabia. The study included physicians and pharmacists only since they are the first-line healthcare workers dealing with gene therapy. Future studies including all healthcare professionals are recommended. Moreover, there is an imbalance in gender distribution among participants; however, this distribution reflects the gender distribution among healthcare professionals in Saudi Arabia (37).

CONCLUSION

Our findings highlight limited knowledge but a positive attitude toward gene therapy among HCPs in Saudi Arabia. The safety of gene therapy was among the primary concerns for both clinicians and pharmacists. Our results point to a need for both clinicians and pharmacists to be more aware of the progress in gene therapy and its implications. Educational programs about the procedure need to be considered and should focus on the safety and social acceptance of such new therapeutic management.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by King Saud University College of Medicine Institutional Review Board (Approval No. E-18-3495). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MA, TA, SA, HA, and FK conceptualized the study. MA, AA, SK, and NB collected data. MA analyzed and interpreted the data. MA and FK wrote the first draft. MA, TA, SA, DB, and FK reviewed and edited for the final manuscript. All authors approved the final version.

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Community Health Workers' Experiences in Strengthening the Uptake of Childhood Immunization and Malaria Prevention Services in Urban Sierra Leone

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Introduction: Community health workers (CHWs) play an integral role in Sierra Leone's health systems strengthening efforts. Our goal was to understand CHWs' experiences of providing immunization and malaria prevention services in urban settings and explore opportunities to optimize their contributions to these services.

Methods: In 2018, we conducted an exploratory qualitative assessment in the Western Area Urban district, which covers most of the capital city of Freetown. We purposively selected diverse health facilities (i.e., type, ownership, setting) and recruited CHWs through their supervisors. We conducted eight focus group discussions (FGD) with CHWs, which were audio-recorded. The topics explored included participants' background, responsibilities and priorities of urban CHWs, sources of motivation at work, barriers to CHWs' immunization and malaria prevention activities, and strategies used to address these barriers. The local research team transcribed and translated FGDs into English; then we used qualitative content analysis to identify themes.

Results: Four themes emerged from the qualitative content analysis: (1) pride, compassion, recognition, and personal benefits are important motivating factors to keep working as CHWs; (2) diverse health responsibilities and competing priorities result in overburdening of CHWs; (3) health system- and community-level barriers negatively affect CHWs' activities and motivation; (4) CHWs use context-specific strategies to address challenges in their work but require further support.

Conclusion: Focused support for CHWs is needed to optimize their contributions to immunization and malaria prevention activities. Such interventions should be coupled with systems-level efforts to address the structural barriers that negatively affect CHWs' overall work and motivation, such as the shortage of work supplies and the lack of promised financial support.

Keywords: community health worker (CHW), Sierra Leone, immunization, malaria, urban slum

INTRODUCTION

Although Sierra Leone continues to have one of the highest mortality rates among infants and children under 5 years of age (under-five) globally, some progress has been made. Infant mortality rate and under-five mortality rate declined from 190 to 80 per 1,000 live births and from 333 to 109 per 1,000 live births, respectively, between 1970 and 2019 (1). However, vaccine-preventable diseases (VPDs) such as measles and other preventable diseases such as endemic malaria pose serious challenges to the country's fragile health system while it continues to recover from 2014 to 2016 Ebola epidemic (2, 3). Maternal and child health (MCH) services, including immunization and malaria prevention services, were severely disrupted during the epidemic (4) due in part to bi-directional fear and stigmatization associated with Ebola among healthcare workers and patients, as well as resource constraints in the health system (5).

The Ebola epidemic's impact on Sierra Leone's VPD prevention activities is evidenced by an increase in the incidence of confirmed measles, which remained higher than pre-epidemic levels through 2017 (2). In 2019, 75% of the children aged 12–23 months in the country received the first dose of the measles-containing vaccine (MCV1) and 78% had received all three doses of the diphtheria-tetanus-pertussis (DTP) vaccine (6)—below the World Health Organization's goal of 95% MCV1 and 90% DTP vaccine coverage in the Africa region (7, 8). Globally, immunization programs in urban areas, including slums, face unique challenges. For instance, frequent population movement can impede the immunization program's ability to identify target populations and defaulters—a recurring challenge in urban settings in low- and middle-income countries (LMICs) (9). Estimates from an urban district in Sierra Leone indicate suboptimal vaccination coverage, with reported MCV1 coverage of 77% as of 2019 (8).

In addition to its VPD burden, Sierra Leone is among the 17 countries that account for 80% of all malaria deaths, globally (10). In 2016, the malaria prevalence among under-five children was 40% in the country (11). Recognizing the high burden of malaria in infants, Sierra Leone became the first country to nationally implement intermittent preventive treatment of malaria in infants (IPTi) via its existing childhood immunization program (12).

Recent estimates of the vaccination coverage and malaria incidence in Sierra Leone show that both have been improving (13, 14), which is a testament to the intensified post-Ebola health systems strengthening efforts. As part of these efforts, community health workers (CHWs) play an integral role especially given the country's ongoing health system challenges, such as the shortage of human resources (15). CHWs comprise a diverse category of laypersons who commonly work outside of the fixed health facilities and have some formal, yet limited, training related to the specific tasks they perform (16). The effectiveness of CHW programs in improving an array of health outcomes has been documented elsewhere, including those related to immunization and malaria prevention and treatment (16, 17). In Sierra Leone, the national CHW programme was formally launched in 2012 (18). Although the estimated 15,000 CHWs in Sierra Leone are not considered part of the National Civil Service (19, 20), they act as the first contact point for health problems at the community level (21). In addition to community sensitization and health promotion, they are expected to perform duties such as rapid diagnostic tests for malaria and referral of defaulted children to health facilities for catchup vaccination (21–23). Changes in CHWs' responsibilities during the Ebola epidemic have been documented (e.g., suspension of activities that require physical contact) (21), but there is limited literature on their experiences in the post-Ebola context especially as they relate to immunization and malaria prevention activities in urban areas.

As Sierra Leone sought to rebuild trust and confidence in child health services after the Ebola epidemic ended, we aimed to gain a qualitative understanding of the role and experiences of CHWs in promoting immunization and malaria prevention services in an urban context. The assessment was carried out as part of larger mixed-methods assessment for understanding the range of barriers and facilitators that may influence the delivery of immunization and malaria prevention services in urban areas in Sierra Leone, including slums.

METHODS

In 2018, we conducted an exploratory qualitative assessment with CHWs in an urban district in Sierra Leone to (1) characterize the nature of their work and their attitudes toward it, (2) identify barriers to their work and strategies currently used to address them, and (3) explore opportunities that optimize their contributions to community health, with a focus on improving vaccination demand and malaria prevention. The methods of the assessment have been described in accordance with the Consolidated Criteria for Reporting Qualitative Research (24), a widely accepted framework for reporting qualitative methods such as focus group discussions (FGD).

Study Setting

We conducted this qualitative assessment in Sierra Leone's Western Area Urban (WAU) district. With an estimated population of 1,055,964, it is the most populous district in the country and covers most of the capital city of Freetown (25). During Sierra Leone's civil conflict between 1991 and 2002, the district experienced rapid urbanization, and many unplanned slums were created (26). It is also a destination for people from rural communities, seeking economic opportunities; therefore, it has a transient population residing in informal settlements (27, 28). The district was severely affected by the Ebola epidemic, reporting a total of 3,142 cases during the epidemic period (27).

Sierra Leone has ∼1,300 health facilities across 16 districts. All health facilities in Sierra Leone are assigned a set of geographic catchment communities that they serve. A total of 10 CHWs are assigned to each health facility to support the promotion and utilization of essential primary care services including malaria prevention and routine childhood immunization. Each set of 10 CHWs are overseen by a supervisory CHW who is also the CHW liaison to the assigned health facility.

TABLE 1 | Characteristics of the focus group discussions with community health workers (CHWs), qualitative assessment, Western Area Urban, Sierra Leone, 2018.

Descriptor	Characteristic	Number of FGDs
Community	**Community setting**	
	Urban slum communities	4
	Urban non-slum communities	4
	Geographic zone	
	West	2
	Central	3
	East	3
Health facility	**Type of health facility**	
	Hospital	2
	Community health center	2
	Maternal child health post	4
	Ownership of health facility	
	Private	3
	Public (government owned)	4
	Non-governmental organization	1

Sampling and Recruitment

We purposively selected eight health facilities in the WAU district to ensure diversity in facility type (community health center, maternal child health post, and hospital), ownership (private, public, non-governmental organization), zones (west, central, east), and community settings (slum or non-slum) (**Table 1**). All 10 CHWs assigned to each of the eight facilities were invited to participate in the FGDs if they were available and willing. Their recruitment was coordinated through their supervisors. Because the supervisors of the CHWs assisted in the recruitment and because of the possibility of socially desirable response bias, they were excluded from participating in the assessment. We did not collect demographic information of the individual CHWs because our unit of analysis was at the group level, namely the collective experience of urban CHWs as a functional unit. It was also deemed inappropriate to collect personal information of the CHWs due to complications involved in protecting the identity of individuals in small known groups.

Data Collection

First, we piloted the moderator guide with one FGD to refine the questions and probes and excluded its transcript from the analysis. Then, the moderators used the revised guide to facilitate the eight FGDs, and each FGD consisted of 6–8 participants. The guide was orally translated into Krio, the most widely spoken language in the WAU district that is predominantly oral. The topics explored included participants' background, responsibilities and priorities of urban CHWs, sources of motivation at work, barriers to CHWs' immunization and malaria prevention activities, and strategies used to address these barriers. Data collection took place in August–September 2018.

The staff facilitating the FGDs were trained in qualitative research methods, had experience conducting FGDs in Sierra Leone and could speak Krio. The FGDs were held in pre-identified community-based settings around 8 health facilities included in the assessment. The data collection teams liaised with the CHWs' peer-supervisors to ensure that the location was quiet and conducive for the discussion. One facilitator and one note-taker participated in each FGD. We audio-recorded the FGDs with the permission of participants;. The FGDs lasted for approximately 90 min. The data collection team held a debriefing session after each FGD to immediately document their observations, make note of the key points raised by CHWs, and identify ways to improve probing questions in the subsequent FGDs. The audio-recordings from the FGDs were transcribed and translated jointly by the same two team members that collected the data. The process usually took place in three steps: (1) they listened to short segments of the audio recording together, (2) one of them translated the audio segment from Krio to English, (3) the other team member either agreed with the translation or provided suggested edits that they then discussed and agreed upon. Whenever the two could not reach consensus during translation, then a locally hired supervisor with advanced proficiency in Krio was consulted to assist with resolving the translation issue. This process continued until each audio recording was fully translated and transcribed.

Data Analysis

Two analysts under the supervision of a senior analyst who has extensive experience conducting qualitative research in Sierra Leone analyzed the data, using qualitative content analysis. First, the two analysts read the transcripts and summarized textual excerpts into condensed meaning units (29). Second, each analyst independently coded the meaning units and compared their lists of codes, addressed discrepancies through discussion, and iteratively created a unified set of inductive codes. Third, they grouped the codes into mutually exclusive categories that described various underlying concepts. Finally, they identified the themes that cut across multiple categories of codes through an interpretative, iterative process. To assess data saturation, we used an approach proposed by Malterud, wherein we examined the extent to which our sample provided adequate information power for the requisite analysis to address the aims of the assessment (30). We organized the codes, categories, and themes, using Microsoft Word and Excel.

Ethical Considerations

All participants provided a written, signed, or thumb-printed informed consent before joining the FGDs. The assessment was approved by the Columbia University Medical Center Institutional Review Board and Sierra Leone Ethics and Scientific Review Board. The assessment was determined to be non-research by the U.S. Centers for Disease Control and Prevention's Human Subjects Office. The participants received no compensation.

RESULTS

Table 1 summarizes the community- and facility-level characteristics of the FGDs. **Tables 2.1–2.4** outlines the

TABLE 2.1 | Codes and categories for Theme 1: "Pride, compassion, recognition, and personal benefits are important motivating factors for CHWs", qualitative assessment, Western Area Urban, Sierra Leone, 2018.

Code	Category
Past related experience	Exclusive process of becoming CHW
Emphasis on being selected	
Receiving training before becoming CHW	
Wanting to improve general health	Desire to improve health
Wanting to improve MCH	
Wanting to improve malaria prevention	
Perceived Impact of CHW activities on community health	
Community wanting us to always be there	Positive recognition from community
Increased popularity among community members	
Increased respect among community members	
Positive interactions with community members	
Increased health knowledge and skills as a benefit	Personal benefits with CHW status
Better access to health facility as a benefit	
Official government status as a benefit	

CHWs, community health workers.

TABLE 2.2 | Codes and categories for Theme 2: "Diverse health responsibilities and competing priorities result in overburdening of CHWs", qualitative assessment, Western Area Urban, Sierra Leone, 2018.

Code	Category
MCH as a priority area	Top CHW priorities
Malaria prevention as a priority area	
Immunization as a priority area	
Hygiene as a priority area	
Older adults as a priority area	
Community outreach as a priority area	
Patient referral as a priority area	
Patient referral and escorting	General health activities
Community education on MCH (maternal and child health)	
Community education on general health	
Community education on WASH (water, sanitation, and hygiene)	
Other community outreach activities	
Engagement with other organizations	
Miscellaneous activities	
Community education on immunization	Immunization activities
Defaulter tracing	
Involvement in immunization campaigns	
Community education on malaria prevention	Malaria prevention activities
Performing malaria diagnostic tests	
Bed net distribution	
Administration of malaria treatment	
Involvement in other jobs	Time management
High workload and demand	

CHWs, community health workers.

TABLE 2.3 | Codes and categories for Theme 3: "Health system and community-level barriers negatively affect CHWs' activities and motivation", qualitative assessment, Western Area Urban, Sierra Leone, 2018.

Code	Category
Delay or lack of stipend disbursement	Lack of stipends
Sense of betrayal due to lack of stipend	
Community members not going to health facility	Challenges related to patient referral
Poor access to health facilities	
Lack of medical supplies	
Not adhering to CHW health advice	Challenges related to community education and outreach
Negative attitudes toward CHWs	
Lack of identification	
Shortage of materials	
Caregivers misplacing or not showing children's health cards	Challenges related to immunization activities
Reluctance or refusal among Fulas	
Seeking immunization from providers of choice	
Fear due to not following vaccine schedule	
Concerns about adverse events	
Hard-to-reach areas	
Stockout or lack of bed nets	Challenges related to malaria prevention
Lack of rapid test kits	
Lack of malaria drugs	
Community members refusing to use bed nets	
Community members complaining about bed nets or not using them properly	
Difficulty in CHW collaboration across communities	

CHWs, community health workers.

TABLE 2.4 | Codes and categories for Theme 4: "CHWs use context-specific strategies to address challenges in their work but require further support", qualitative assessment, Western Area Urban, Sierra Leone, 2018.

Code	Category
Interpersonal communication	Current strategies
Community engagement	
Help from senior health workers	
Suggestion for addressing structural challenges	Proposed strategies for improvement
Suggestion for improving community education	

CHWs, community health workers.

categorization of the meaning units into themes. Four themes related to different aspects of CHW experiences emerged from the FGDs. The themes describe the underlying motivation for CHWs' work, various challenges they experienced in their work, and the strategies they used to overcome recurring challenges.

Theme 1: Pride, Compassion, Recognition, and Personal Benefits Are Important Motivating Factors to Keep Working as CHWs

CHWs took great pride in their work and were highly motivated to improve community health. They particularly expressed that

their work has a positive impact on the health of women and children—a responsibility that they took seriously. Most participants in our assessment had already been volunteering in a myriad of health areas before they were eventually selected or recruited to receive further training to become CHWs. They stressed the exclusivity of the journey to becoming a CHW, which strongly reflected their pride and sense of responsibility in their duties.

> "I have worked as a CHW for 1 year because of the suffering of the people, especially pregnant women. We talk to them to attend the clinic. Sometimes they are not happy, but we encourage them… I am happy to join the CHW [program] because it has reduced disease cases."—CHW, FGD 2, non-slum.

They emphasized that they have become "more popular" in their communities because of working as CHWs. Similarly, some mentioned that they have gained "more respect" from the community. Positive recognition sometimes translated into demonstrations of appreciation for CHWs through in-kind offerings and gestures from community members.

> "A lot of people also know me now in the community. Like for instance, sometimes when I board a vehicle, I will not pay at all as someone in the vehicle who might have gained from advice I have given to community members will say 'my sister, don't pay, I'll pay for you as you spoke to me the last time and I really saw the benefit of what you told me."—CHW, FGD 5, non-slum.

CHWs acquired new skills and knowledge through their work, which helped them professionally as well as in their personal lives. For example, participants shared that they were able to care for sick family members because of what they had learned during their CHW engagements. Another perceived benefit among CHWs was the ability to gain access to healthcare facilities and build relationships with healthcare workers.

> "Before now I've got no business at this health facility, but now I'm proud to say that, everyone in this facility knows me by name and by face. Now I can access the facility at any time and also help the nurses in doing their work."—CHW, FGD 1, slum.

The first thematic area strongly pointed to CHWs' personal pride and dedication to community health that helped them stay motivated. They also gained certain benefits from their work, such as new skills and community recognition, which elevated their social standing and enhanced their ability to help people. Despite these motivating factors, CHWs sometimes appeared to be overburdened, which has been elaborated in the second thematic area.

Theme 2: Diverse Health Responsibilities and Competing Priorities Result in Overburdening of CHWs

CHWs performed wide-ranging activities, including daily household visits in their designated communities, referral or escort to local healthcare facilities, and support for MCH activities in areas, such as community education and outreach. Their activities for malaria prevention included distributing bed nets, providing community education on bed net usage as well as water, sanitation, and hygiene (WASH) issues, performing rapid diagnostic tests, and distributing medications for treatment. Specific to immunization, CHWs actively promoted immunization via community education and reminders. They described playing an active role in defaulter tracing, which usually involved scanning of child health cards during household visits or conversations with defaulters to promote catch-up vaccination.

> "We don't just ask the mothers whether their children have taken the immunization or not but rather we'll ask for their cards… If we discover a mother who has become defaulted, maybe the time stated on the card has passed and she has not taken the child for immunization, we'll not be angry with her but rather we'll try to know the [cause]. And with a soft voice, try to encourage her to take the child for the immunization. Sometimes we'll even go with them and make sure they go to the health facility."—CHW, FGD 3, slum.

It was evident in the discussions that CHWs were responsible for a wide range of health promotion tasks that overburden them and require prioritization. Many considered MCH (e.g., supporting pregnant women and sick children) to be an important area of work. Some CHWs explicitly referred to childhood immunization when describing their priorities. Other priority areas mentioned included malaria prevention, hygiene, and household visits. CHWs recurrently expressed that some of their activities particularly demanded significant time commitment, including the community health education and outreach sessions. Some community members visited CHWs' homes to seek advice, which meant that they had to respond even when they were not on duty. Moreover, they often had to work late hours to help community members navigate health emergencies.

> "Sometimes when I go out during the night, I use to pass the night if there's any case especially when it comes to the pregnant women or when it has to do with a pregnant [woman] who may have to be admitted to the hospital who might have got an attack during the night, in such a case I use to pass the night going up and down from the affected household to the hospital until there's a permanent solution."—CHW, FGD 6, slum.

In addition to the long and extra hours CHWs volunteer, they had income-generating responsibilities to support themselves and their families. This meant that they had to balance multiple jobs, such as small retail businesses, petty trading, teaching, and hairdressing in addition to frequently being the primary caregiver of their own children. Overall, heavy workload and multiple work responsibilities were commonly noted as a part of being a CHW. Although CHWs did not explicitly tie their heavy workload to their performance, it is possible that their performance may be hindered by having an unrealistic workload under a volunteer scheme. This becomes more evident in the third thematic area where performance-related connections are made between workload and other systemic challenges.

Theme 3: Health System and Community-Level Barriers Negatively Affect CHWs' Activities and Motivation

The lack of stipend disbursement was a major source of frustration and demotivation among CHWs. Although CHWs were initially told to expect financial support for their work, they expressed that they had not received stipends as promised, which was viewed as a form of "betrayal" by the CHW program. The lack of financial support was also mentioned as a reason for pursuing multiple income-generating activities outside of their CHW volunteer duties.

> "They promised to give us incentives…it is just a lot of promises and nothing good has come out of those promises… What is more painful is that they'll just call us sometimes and pass information that [they] are going to give us the money...but that hasn't come to past till now. There were colleagues of ours who have been waiting for this money and have died without receiving it. Some have got different plans for that money… they were going to pay the school fee of their children."—CHW, FGD 7, non-slum.

CHWs faced a series of challenges with patient referrals. Some community members were reportedly reluctant to go to health facilities because of the perceived financial costs of healthcare services. CHWs also cited access challenges, such as the refusal of services.

> "I've [had] an incident in which two of the pregnant women that I referred to the health center were rejected. I filled a form for them and sent them to the hospital but when they showed up, they were rejected by the nurse. The nurses said, we should not be the ones to go and register people and refer them to the health center."—CHW, FGD 1, slum.

A common challenge with community education and outreach was that some community members did not adhere to CHWs' health advice. Community members' distrust in CHWs, which sometimes stemmed from rumors about CHWs' involvement in financial fraud, was also reported. Community outreach was further complicated by the lack of work identification cards, which prevented public acknowledgment and evidence of CHWs' official status when carrying out their duties.

CHWs also encountered challenges that were specific to immunization activities. Sometimes defaulters were not easily identified because it was difficult to obtain child health cards from caregivers who were either uncooperative or had misplaced them. Though uncommon, CHWs encountered instances where caregivers refused recommended immunization services because they claimed to be receiving services from "private doctors". Additionally, the Fula community, an ethnic group residing in the WAU district, was perceived by CHWs as unaccepting of immunization services for unspecified reasons.

> "Our biggest problem for this immunization is the Fulas. They're very stubborn when it comes to issues of immunization, even if you explain to them the importance of the immunization, and they'll still try to give you an excuse so that they'll prevent their children from taking the immunization."—CHW, FGD 4, slum.

CHWs stated that, based on misinformation, some caregivers were worried about adverse events following immunization. They purportedly believed that vaccination may have harmful effects on their children's short- and long-term health. For example, one CHW noted:

> "[Defaulters] are saying, their children get malaria through the injection they give them, so they will not take their children to any hospital for any treatment that has to do with giving them an injection."—CHW, FGD 8, non-slum.

CHWs encountered situations where community members refused to use bed nets or opted to use them for other livelihood purposes, such as agriculture. Common complaints CHWs received about bed nets included discomfort associated with heat generated while sleeping under bed nets. In addition, the lack of malaria test kits and medications was cited as a barrier that limited CHWs' contributions to malaria control.

In this third thematic area it was evident that CHWs' work involved navigating complex challenges resulting from community perceptions and health practices, as well as health systems issues beyond their control. As outlined in the fourth thematic area, however, CHWs were able to develop context-specific strategies to mitigate recurring challenges.

Theme 4: CHWs Use Context-Specific Strategies to Address Challenges in Their Work but Require Further Support

CHWs used interpersonal communication techniques to address some of the challenges they encountered in their communities. They persistently communicated with uncooperative community members and made multiple household visits to engage them. Sharing their own positive experiences with vaccination was another strategy CHWs used to persuade some caregivers to accept vaccination.

> "The woman was so desperate telling me not to think of giving her child the immunization so I allow her to express herself, then later I apply my own experience to make sure she knows the importance of the immunization. When I finished with my explanation, she came to realize the importance of the immunization and later told me to please inform her about the next immunization schedule."—CHW, FGD 3, slum.

Community engagement was another way in which CHWs addressed community-level challenges. CHWs collaborated with members of the Fula community to conduct sensitization and communicate the importance of immunization. In other cases, they sought assistance from their supervisors when confronted with particularly challenging situations.

> "We do identify that house that refuses vaccination with a symbol for the supervisor to know… to inform them about the refusal of immunization and the nurses do come and [those who were originally reluctant] will allow the nurses to administer it."—CHW, FGD 2, non-slum.

CHWs also proposed potential strategies for improving their work. Most of their suggestions pertained to different types of support needed to address structural challenges in their work. Their suggestions, which were mostly directed at the government, included asking for increasing the supply of materials and medications, improving management and accessibility of healthcare facilities, creating a sanitary environment by providing communal trash cans, and securing financial support. They suggested that their work would be more effective if the government empowered them through these avenues, as one CHW noted:

> "If we tell people to use veronica bucket [water container with a tap used for handwashing] and wash their hands then when they go and visit our households, we don't have anything like that, then it becomes ridiculous on our side. Therefore, [the] government shouldn't neglect our role as they have been doing but also capacitate us so the community will continue to listen to us and do what we tell them when it comes to immunization, malaria prevention, and many other things."—CHW, FGD 7, non-slum.

DISCUSSION

Our qualitative assessment provides important insights into the experiences of CHWs working in an urban context in Sierra Leone, including slums. We found that CHWs in urban capital of Sierra Leone were overburdened and had insufficient support for overcoming the multitude of barriers they experienced in their work. These barriers negatively affected their motivation and abilities to effectively carry out immunization and malaria prevention activities. Nonetheless, CHWs valued the altruistic nature of their work and remained motivated to improve the effectiveness of their work, including employment of adaptive strategies in responding to the challenges encountered. Additional support from the health system is needed to enhance their contributions to immunization and malaria prevention activities. Critical barriers such as the shortage of supplies and the lack of financial support require systems-level interventions.

Motivating factors described by the CHWs in our assessment largely overlap with those from previous studies (31–35). A study carried out in Tanzania found that dedication to public service, desire for health knowledge, personal pride, and positive reception by community members served as sources of CHW motivation (32). Other studies have explored different interventions designed to enhance these motivations, such as supportive supervision to equip CHWs with new knowledge and skills (36) and participatory community activities to improve the community perception of CHWs (37). Factors such as the pride CHWs take in their work and satisfaction received from social recognition by their community should be maximized to motivate CHWs.

Previous research suggests that CHWs in LMICs tend to be inundated with many tasks (22, 33, 38), which reinforces the results of our assessment. In addition to multiple responsibilities, research from Sierra Leone, Liberia, and the Democratic Republic of Congo suggests that CHWs sometimes take on second jobs because financial incentives they receive are limited, and this may result in CHWs being not fully committed to their healthcare duties (31, 39). Unfulfilled stipend disbursements demotivated CHWs in our assessment, which is also a persistent challenge in other settings (33, 40, 41). Our assessment adds to the evidence that CHW financing needs to be prioritized to strengthen and maintain their essential role in community health engagement. This issue requires larger systems-level attention of developing different funding mechanisms for CHW financing and assessing needs for CHW scope of work that aligns with country priorities in different health areas (42, 43).

The shortage of medical supplies and other work equipment for CHWs has been well-documented (17, 31, 44). To avoid disruptions to CHWs' performance and confidence in the health system, system-level measures should be considered to address the barrier in a sustainable fashion. In the context of COVID-19, it is particularly important to ensure CHWs have access to essential supplies because they are expected to continue playing a critical role in the ongoing pandemic response (45).

A household survey conducted in the WAU district echoed the findings from our assessment regarding the fear of side effects and missing child health cards as barriers to immunization uptake (8). Another study in the WAU district found little evidence of CHWs' involvement in structured defaulter tracing, such as the use of defaulter lists generated from an immunization registry (23). Although CHWs in our assessment indicated that they played a role in defaulter tracing, it is unclear how structured their involvement was. CHWs in our assessment also reported the challenges relating to vaccine acceptance by the Fula ethnic group. This could be explained by religious convictions regarding vaccination or other social and behavioral factors as evidenced by studies involving Fula populations in other settings (46–48). More research is needed to understand the reasons for vaccine refusal among the Fula ethnic group, including traditional or religious beliefs (49), and how best to support CHWs in addressing this challenge—especially because Fula populations also reside in other parts of West Africa. Given the high level of trust CHWs receive as messengers of health information (8, 50), interpersonal communication could be considered as a strategy to address vaccine acceptance issues. Future research can explore in more depth the interpersonal communication techniques currently used by CHWs, how effective they are, and whether there are opportunities to further build capacity in this area.

Taken together, our findings point to the overarching need to consider interventions targeted at the specific barriers that CHWs face in their immunization and malaria prevention activities. These interventions should be coupled with systems-level efforts to define an achievable set of duties for CHWs to allow them to perform realistic workload as volunteers. Otherwise, to accommodate an expansive workload, Sierra Leone may have to formally integrate CHWs into the paid cadre of the health workforce, which would realistically enable them to meet expanded responsibilities that require full-time commitments and help ensure their performance quality. Such integration, however, may require careful and strategic allocation of financial resources for health services. Non-monetary incentives, which have previously been shown to be effective motivating factors,

could also be considered (51). Beyond cost implications, integrating CHWs into the formal health system requires effective supportive supervision, continuous on-the-job training, and greater collaborations with healthcare workers (52).

Our assessment has several limitations. The involvement of the CHWs' supervisors in the recruitment process could have potentially led to CWHs providing socially desirable responses. To address the potential social desirability bias, we excluded the supervisors from participating in the FGDs so that CHWs could candidly share their opinions. Moreover, we explicitly explained to participants the voluntary basis of the assessment while obtaining informed consent. Another limitation is the variability of probing among data collection teams. A few potentially important issues were not adequately followed-up to gather more information in some FGDs. For instance, in one of the FGDs, it became evident that there were potential tensions between CHWs and the paid cadre of formal healthcare workers, which resulted in healthcare workers refusing to accept some referrals made by CHWs.

CONCLUSION

Our qualitative assessment revealed the important role of CHWs in an urban district in Sierra Leone while the country was rebuilding public trust in the health system after the 2014–2016 Ebola epidemic. Although our assessment focused on a single urban district, it would be critical to ensure the availability of essential supplies and the promised stipends throughout the country. Moreover, the potential tensions between CHWs and the paid healthcare workforce may require further investigation in urban and rural settings. Given the severe shortage of a paid healthcare workforce in Sierra Leone, CHWs will continue to fulfill an important role in the health system. Focused support to facilitate CHWs' work for immunization and malaria services should therefore be considered, while also addressing structural barriers that negatively affect their overall work and motivation.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because of reasons related to data confidentiality and participant privacy. Requests to access the datasets should be directed to Mohamed F. Jalloh, yum8@cdc.gov.

AUTHOR CONTRIBUTIONS

MJ oversaw all aspects of the assessment. RS, AM, LP, OE, SK, TS, LC, AW, AA, MT, and ML contributed to the assessment's conceptualization, data acquisition, and/or analysis. AI led the analysis and manuscript development. All authors reviewed and approved the manuscript.

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Perception and Challenges of Preventive Measures of COVID-19 Among Nepalese Frontline Health Professionals: An Unexplored Realism

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Background: A new coronavirus causes COVID-19, a developing respiratory illness. Unfortunately, there is little information assessing healthcare workers' understanding of technology and preventative strategies during the Nepalese epidemic. Researchers from other subspecialties uncovered some mythical thoughts. As a result, we decided to put it to the test with healthcare personnel on the front lines. The research also looked at the problems experienced by frontline health care personnel (HCP) because of the COVID-19 strategic shift in work policy.

Methods: Nepalese healthcare workers participated in web-based cross-sectional research. A pre-tested, structured questionnaire utilizing a Google form was used to get self-informed, digitally typed consent, and examine critical perspectives and problems with current technology and COVID-19 prevention efforts.

Results: In total, 243 participants with mean age of 29.66 ± 7.61 years agreed to participate and were doctors ($n = 27$), health assistants ($n = 2$), medical intern doctors ($n = 1$), paramedical ($n = 139$), pharmacy ($n = 1$), and paramedical interns ($n = 73$) in this study. The calculated mean percentage score of knowledge on instruments and tools was 73.64 (SD ± 10.43) %, and perception on COVID-19 transmission and control was 70.06 (SD ± 18.30) %. At various levels, frontline health workers faced significant challenges, including the adoption of digital health technology.

Conclusion: Frontline HCPs are anticipated to have updated knowledge from what the study has outlined. It is recommended to follow national guidelines. Policies should be put in place so that every frontline worker can demonstrate high standards in prevention, control, and equipment use that do not create misinformation among HCPs. Throughout, support for digital health materials and disease control methods for HCPs is essential.

Keywords: COVID-19, health care personnel (HCP), personal protective equipment (PPE), myths, challenge

INTRODUCTION

COVID-19, a coronavirus, is a pandemic globally. There seems to be no other way for the virus to stop its spread other than to prevent it. Proper use of personal protective equipment (PPE) is the key to stopping the spread of the virus from the patient to the caring personnel. The Centers for Disease Control and Prevention (CDC) has given health care personnel (HCP) guidelines for working at health centers and isolation centers (1). Vaccines for the virus have been in the world news but did not reach Nepal until the last day of data collection. Vaccines create an antibody against the virus, but it's not guaranteed that a vaccinated person cannot get infected by the virus, provided the severity is less than that of a diseased non-vaccinated person. So, HCP involved in the frontline must use PPE properly even after the vaccination (2). The latest data have indicated an upsurge in the number of cases in several countries (United Kingdom, India, and Australia) as the second wave of COVID-19 (3–5). South Asian countries' health policies, including Nepal's, appear to be less prepared to deal with such pandemics (6, 7). Thus, to limit the spread of the coronavirus, almost all governments worldwide have "lockdown" as one of their guidelines (8). Furthermore, the Nepal government through the Ministry of Health and Population (MOHP) has been actively broadcasting public awareness messages regarding the prevention and control of the virus through loudspeaker recordings, radio, television, social media, press briefings, etc. Despite all these efforts, there have been reports of the deaths of HCPs throughout the world, and Nepal was not spared either (9–11). This could be due to many reasons, like inattention to the appropriate use of PPE in situations of anxiety, depression, traumatic stress, and burnout due to COVID-19 (12, 13), or just a simple myth, mask-carbon dioxide intoxication in prolonging usage (14), can wear one mask for several days with/without washing, belief in inappropriate use of mask (15); gloves can mimic the spread of the virus (16); thermal scanner: all COVID-19 infections can be detected as a result of high temperatures (14); polymerase chain reaction (PCR) dilemma: it is not superior, and it gives favorable/adverse effects just like that, even if we are scared/asymptomatic, short of misleading (17). So, logically, HCP could become infected with COVID-19 regardless of preventive measures taken, because they are the ones who work on the frontlines of Nepal's and the rest of the world's communities (18). It is also possible that one could get infected just by chance with an unknown etiology, irrespective of any conditions. Research is still evolving in studying the broad etiology of this coronavirus.

Digital technologies and protective instruments used in testing, treatment, and management of COVID-19 are the pillars for protecting and restricting the spread of diseases among people, especially for the frontline HCPs (19, 20). Although the advancement of digital technology has a significant positive impact in situations such as COVID-19, there appear to be several challenges in implementing it in a suitable manner (21, 22).

A pilot test of the same tool revealed poor knowledge of the HCP. Hence, this study was conducted to access the knowledge of current critical technology and understand the perceptions of health professionals toward the spread and control of the pandemic. In addition, we looked at the challenges faced in treating the patients and adapting the digital health material to prevent COVID-19 among frontline HCP in Nepal with the help of a comprehensive yet straightforward questionnaire tool.

METHODOLOGY

Materials

A web-based qualitative descriptive cross-sectional study was carried out from August 10 to December 23, 2020, among frontline healthcare workers. The Nepal Health Research Council (NHRC) granted permission to conduct the study with mandatory written consent as the criterion. Each participant was asked to sign a digitally written and informed consent form. The research tool and design were adopted and streamlined from Sanyam's et al. (23) work. Unlike the previous study with multiple questions, we shortened the previous tool and created three simple ways to analyze the critical views of frontline health workers working during the COVID-19 pandemic: (1) perception of COVID-19 virus transmission and control; (2) perception of instruments and tools; and (3) challenges. Each perception heading consisted of five questions, whereas the challenges heading had two questions, all to be answered mandatorily. All the questions had one-word answers. The questionnaire tool can be viewed in the **Supplementary File** as an annexure questionnaire tool.

Method

A qualitative method was implemented to construct the questionnaire of perceptions and challenges. It is demonstrated that questions created this way enhance the quality and emphasize the validity of the subject matter (24). The final questions elicited by this technique are tailored to the target population rather than researchers. Furthermore, focus group discussion among public health researchers, statisticians, and professors supported the reliability of the test and retest method, which were used twice in a 10-day interval on the same pilot population. This survey was expected to take no more than 10 min to complete for the respondents as it was voluntary and anonymous. The survey invitations were sent to 742 (altogether 82 COVID-19 dedicated centers are there in Nepal as per MOHP, and if we assume an average of 40 COVID-19 dedicated frontline health workers at each center, then it is about 22% of the frontline health workers) participants working in the COVID-19 centers of all seven provinces of Nepal through What's App, Facebook Messenger, Viber, Telegram, and email. One person (known through personal contact) at each center was given the responsibility to circulate it to other frontline workers in their community and inform the primary investigator about their social media account if a reminder message was needed. The study population includes medical and paramedical health personnel working on the frontline at COVID-19 centers. After their acceptance, the survey took them to the questionnaire section. Participants were allowed to withdraw their participation any time before the first week of February 2021 without experiencing any disadvantage. The same person was not allowed to take the survey twice. This was countered with the help of

unique email identification bracketing from the Google form, and those who didn't respond the first time were sent a reminder twice in 2 weeks. The information's confidentiality was guaranteed through protecting privacy.

The "Yes" option added one point to the respective question, whereas the "No" option also gave one point, provided a respondent could select only one option for each question. The correct answers were averaged based on the perception group mentioned above. The perception of disease transmission and instruments were analyzed as the calculated mean percentage of overall responses. The obtained percentage was further graded as "Excellent" if it was >80%, "Satisfactory" if it was >65%, and "Poor" if it was <55% as a total. The options-based response of an individual was used to analyze challenges.

Data Analysis

The response record was exported from Google form to Microsoft Excel 365 to clean the data, and later, the Statistical Package for Social Sciences (version 20.0) for statistical analysis was used. Finally, the data were presented in percentage, mean, standard deviations (SD), and frequency using bar diagrams and tables.

RESULTS

The survey questionnaire was sent to 742 people, of whom 243 (male: 118, female: 125), mean age of 29.66 (SD ± 7.61) years, agreed to participate, whereas three did not consent from the list of overall respondents. Participants were doctors ($n = 27$), health assistants (HA, $n = 2$), medical intern doctors ($n = 1$), paramedical ($n = 139$), pharmacy ($n = 1$), and paramedical interns ($n = 73$) in this study. The remaining 496 did not turn up even after the second reminder. The calculated response rate was 32.74%.

The details of socio-demographics are presented in **Table 1**. The majority of participants were from province three and the least from province six. Most health professionals have a bachelor's degree regarding educational background, except for HAs and proficiency nurses. All of them, with and without prior work experience, work as frontliners. In terms of work setting, most frontline health professionals were employed in health institutions as full-timers with a continuous 8-h duty base. In addition, all health care professionals were involved in direct care like swab collection, fever reporting, long-term (admitted patients' care) and short-term (OPD clinics), laboratory department, dead body management, x-ray department, nursing care, pharmacy, etc. using masks, round caps, gloves, protective gowns, boot covers, and goggles or face shields.

There is a scarcity of protective equipment, exacerbated in low- and middle-income countries due to limited resources. Health workers were self-motivated to know and be updated about this pandemic using government websites, awareness messages, and social media. That means a well-associated positive attitude toward obtaining the information. In this study, we asked about the instruments, the virus transmission, and control. About 50% ($n = 127$) felt that PCR is mandatory for everyone, whereas a similar ($n = 116$) number of responses were noted for temperature screening, which was not helpful in screening for COVID-19. A limited yet considerable (about 10%, $n = 19$) number of participants were unsure about the importance of teleconsultation in contagious diseases like COVID-19. The obtained detailed perception responses are tabulated in **Table 2**.

TABLE 1 | Socio-Demographic characteristics.

Variables		Frequency	Percentage
Gender	Male	118	48.6
	Female	125	51.4
Province	Province 1	66	27.2
	Province 2	28	11.5
	Province 3	91	37.4
	Province 4	14	5.8
	Province 5	40	16.5
	Province 6	1	0.4
	Province 7	3	1.2
Types of health person	Doctor	27	11.1
	HA	2	0.8
	Medical intern	1	0.4
	Paramedical	139	57.3
	Pharmacy	1	0.4
	Paramedical intern	73	30

TABLE 2 | Perception on COVID-19 transmission and control.

Knowledge	Yes *n* (%)	No *n* (%)
Everyone must get a PCR test done	**127 (52.3)**	116 (47.7)
Hygiene training is necessary for the spread of viruses	**206 (84.8)**	37 (15.2)
Fever screening helped to prevent the spread of viruses	**167 (68.7)**	76 (31.3)
Temperature screening is helpful to screen COVID-19 infected patients	**127 (52.3)**	116 (47.7)
Teleconsultations reduce the risk of disease spread	**224 (92.2)**	19 (7.8)

The actual answers are in bold and non-bold indicates the incorrect responses from the participants.

The calculated mean knowledge score of perception on COVID-19 transmission and control was 70.06% (SD ± 18.30), at a satisfactory level.

Figure 1 shows the descriptive analysis of responses related to perceptions of instruments and tools. Participants gave their agreement (80.25%) to Polymerase Chain Reaction (PCR) superiority over chest X-ray. Similarly, they responded positively to the masks not being effective after many days of use, but surprisingly, they still don't (38.68%) believe that masks and PPE are 100% effective. About 21% of those polled had no understanding of how to interpret PCR data.

The calculated mean percentage score of perception on instruments and tools was 73.64% (SD ± 10.43), at a satisfactory level.

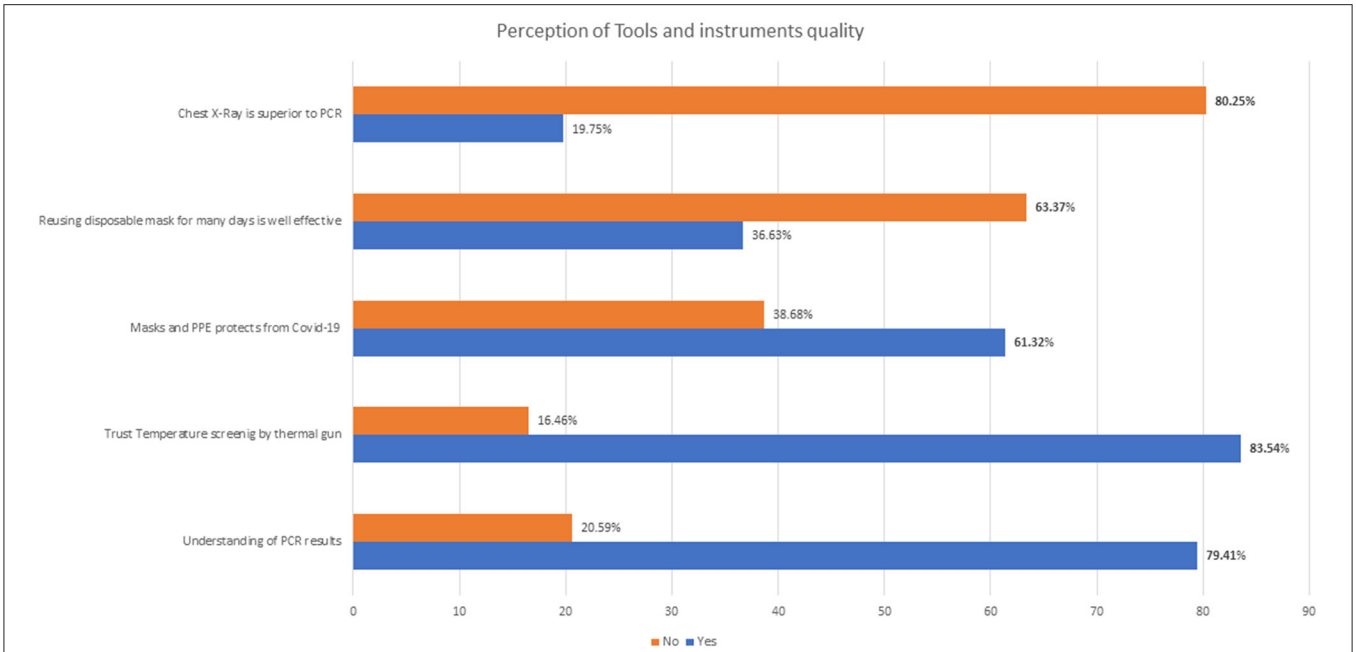

FIGURE 1 | Responses regarding perception on instruments and tools. Bold percentage values indicate the true/expected answers.

TABLE 3 | Challenges faced by health professionals.

Challenges		Frequency	Percentage
During the COVID-19 pandemic	Personal	20	8.3
	Institutional	20	8.3
	Technological	11	4.5
	Policy	12	4.9
	All the above	176	72.4
	None	4	1.6

CHALLENGES

There was a significant issue with adapting and using the protective measures during the pandemic, and this had a drastic impact on the lifestyle and working habits of the health professionals. In **Table 3**, we have illustrated the challenges of coping with the restrictions and adjustments to the lifestyle in the day-to-day COVID-19 wave. Very few (1.6%, $n = 4$) who did not encounter any problems adapting to COVID-19 made variations in health strategies. In contrast, the majority (72.4%, $n = 176$) agreed on challenges faced at personal, institutional, technological, and policy levels.

Similarly, the challenges were in using digital health materials. Health systems have started to emphasize telemedicine and teleconsultation for non-emergency cases. Institutions have moved their educational delivery and examination system to digital platforms. The below bar diagram shows that the highest (33.75%, $n = 82$) challenge faced was lack of appropriate training to use digital health and educational materials. Only 8.2% ($n = 20$) of health professionals did not have any sort of difficulties in adapting to and using digital devices to make the health system more effective. The overall challenge of using digital health materials by frontline health workers during COVID-19 is shown in the bar diagram (**Figure 2**).

DISCUSSION

Even the well-established health systems in the world are hit very hard by COVID-19, leading to a public health crisis (25). Despite all the public health problems, HCPs accepted it as the "new normal" and kept their service continuing to serve humankind using PPE and other protective measures. The perception of frontline HCP on COVID-19 transmission and control, instruments, and tools was satisfactory. There were challenges in dealing with the COVID-19 pandemic at different levels and the challenge of using digital health materials. The knowledge of disease transmission, control, and instruments necessary for the frontline HCPs is sensitive, and HCPs must reflect it with an updated and clear understanding.

Altogether, 69.33% of the participants felt that awareness messages and hygiene training regarding COVID-19 by MOHP were essential in controlling the spread of the virus. PPE is considered a shield for virus transmission from the patient to the frontline HCP (26). But, the uniform sizing for all and the long hours of wearing might cause discomfort, leading to body parts of HCPs working at critical care units (27). Visual impairment makes it difficult to communicate quickly, especially for older inpatients with impaired hearing, as noted by Hampton et al. (28), while there is no doubt about the positive effects of PPE. There were barriers to the resulting "hello hi effect," "intimacy,"

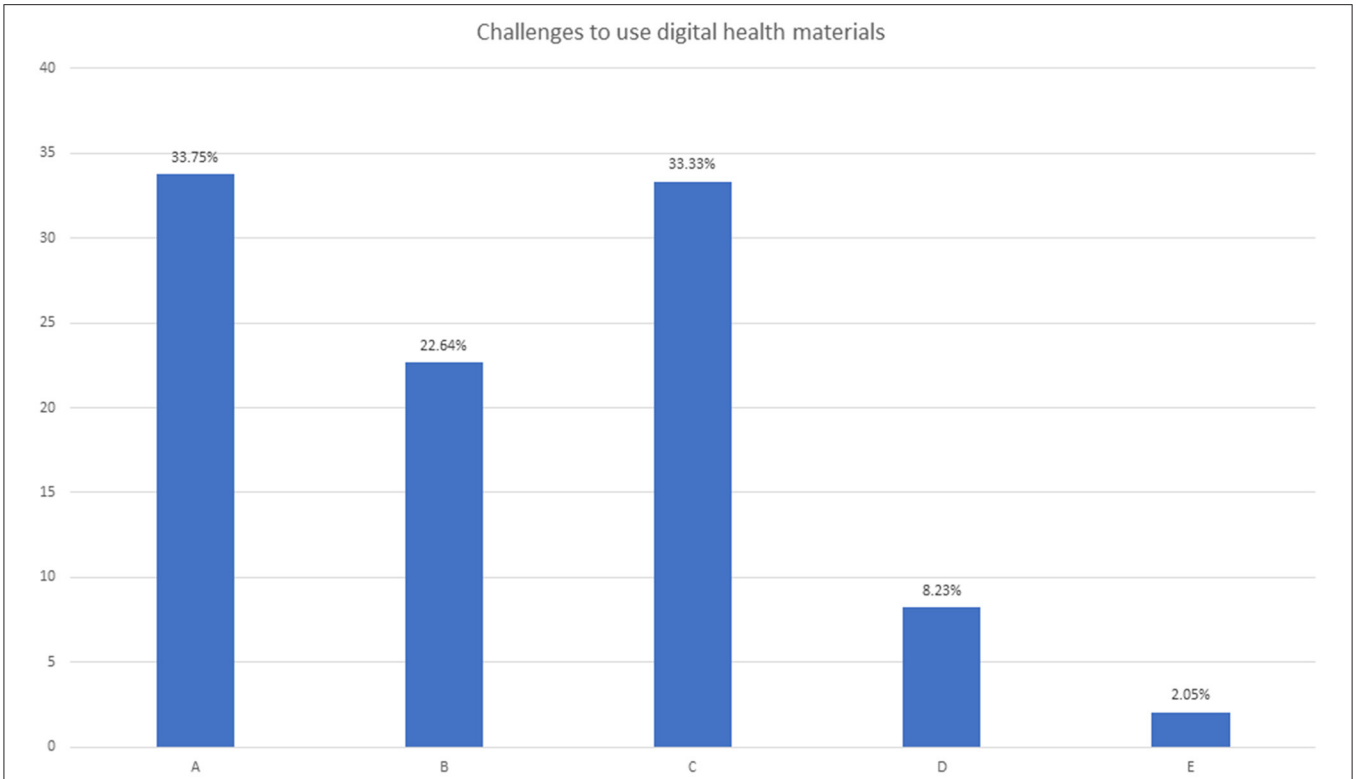

FIGURE 2 | Responses regarding challenges to using digital health materials. In the figure, A = Lacking proper training, B = Lacking the monitoring and supervision, C = Lacking the technical support, D = None, E = all of the above.

and "closeness" between patients and staff. The muffled voices of health professionals and facial expressions using monosyllabic words were not perfectly adequate. It reduced the understanding between the health staff in the operation theater (OT) and the intensive care unit (ICU). Despite this level of stress and the mortality of patients in the ICU, HCPs don't give up and unknowingly might pile up anxiety, depression, and work-related burnout (12). This may result in careless performance and may be a factor in the death of frontline HCPs. About 39% of the participants said that PPEs don't work well. Similarly, 36.97% thought that reusing daily disposable masks was effective. This is a contagious belief that medical/surgical daily disposable masks don't protect against COVID-19 if used for a long time (29). Wearing a mask for longer working hours doesn't cause carbon dioxide intoxication (14), as no study has proved it so far.

There were some valid concerns raised about the dependability and validity of temperature-sensing technologies such as the thermal gun. Our question on thermal gun and temperature screening resulted in 83.61% saying it works well, and 84.87% disagreeing that "Temperature screening is helpful to screen COVID-19 infected patients," but 52.52% believed that screening fever helps to prevent the spread of COVID-19. Thermometers have been in existence since the 1600s in clinical practice. Still, forehead hitting may affect variety of factors (anti-fever medicine use, sunlight, hormonal production, external environment, physical activities, hot beverages, pregnancy, circulatory issues, stress, etc.). All those factors can impact the body temperature; thus, it may not be adequate to declare the thermal gun report as standard care (30), but it's okay to use it as a screening device.

PCR is considered the gold standard in the diagnosis of COVID-19. However, the understanding of PCR seemed insufficient in this survey, as 20.59% of the participants could not interpret the PCR result and seemed to have poor knowledge. Similarly, 19.33% believed that chest X-ray is superior to PCR in the COVID-19 suspects. However, roughly half of the participants, 52.10%, said that everyone must get a PCR test done with or without symptoms. This is not the fact; the reality is that it is mandatory to have knowledge about PCR and get it done if the patient has symptoms or is asymptomatic but exposed to COVID-19 aerosols (31, 32). Various countries also ask for mandatory adverse COVID-19 PCR reports from travelers across the border. The news about fake reporting and paid negative PCR reports has created cloudiness in the view of HCP in Nepal, leading to a situation of fear and dilemma simultaneously (17, 31, 33). The government should have strong regulatory rules (punishable offense) and an inspection team to bring up the standards and trust in health and laboratory reports.

The challenges faced by HCP are under-studied by the nation, which is a matter of concern. About two-thirds (72.4%,

$n = 176$) of the participants said they faced challenges at all levels (personal, institutional, technology, and policy) in adopting the change in health strategy amended due to COVID-19. The government (MOHP) should take this as a matter of seriousness and support the frontline HCPs in a more effective implementation model (34). Telemedicine and digital health service delivery are considered a boon for the health system, specifically in conditions like the COVID-19 pandemic (35). In a country like Nepal, where development has not reached every corner of the country, there are places where no transportation service is available, and one should walk for 2–3 days to get there. The internet, telephone networks, and electricity are not accessible equally around the nation, which is required in digital technologies. The bar graph in **Figure 2** gives an idea of the challenges (no or inadequate training, 33.75%; inadequate monitoring and supervision, 22.64%; and poor/no technological support, 33.33%) faced by frontline HCPs. Digital services like telemedicine, smartphone tracking and tracing, virtual training, operating sophisticated instruments, etc., need specialized training, monitoring, and support (36–38). Health professionals lacking the proper training to use digital technologies, supervision, and technical support do not add to the security and confidence they lack, resulting in poor implementation strategy and outcome.

Since this was an online study, the response rate and the number of participants were lower. Although only one-third of the participants responded to the survey, although it was randomly selected, it may have led to selection bias. Because of the need for timely data during a pandemic and a lack of proper resources with nationwide restrictions, a non-probability (convenience) sampling method was chosen. The COVID-19 pandemic is still evolving, and there might be a change in perception throughout the data collection until the publication of the report. Although the sampling technique was non-probability-based, the overall sample of this study is sufficient to draw the required conclusion. This study has the potential to be useful in highlighting some of the public health concerns and implementation issues that are mandatory for the Nepal government to consider. Also, there is critical public interest in understanding health workforce capacity and strain during the COVID pandemic. The government should carry out more robust training and awareness for frontline healthcare workers to recompense any misinformation. Also, it is recommended that MOHP carry out a similar but detailed study at the policy level, making it mandatory for all HCPs to analyze the gap and develop a strategic work plan to overcome the challenges and update knowledge.

CONCLUSION

Although the perception of instruments and tools and disease transmission and control scores seemed satisfactory in HCP, it cannot be considered acceptable for public health concerns like COVID-19. Inadequate information about disease control, communication, and tools employed are indicators of poor health outcomes. Some of the perceptions were so based on fiction that they may have implications for hospitals, COVID centers, and respective government bodies. HCPs must seek out relevant information on disease management and continue to upgrade their skills following MOHP regulations. The difficulties encountered by HCPs in this study are expected to obstruct the result. So, the challenges faced by HCP should be addressed with the appropriate strategy regularly. Any form of training given to HCP must have 24/7 support in terms of tech or monitoring.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Nepal Health Research Council. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SDS, KP, TG, and BB designed the study. KP, SDS, JH, and BB reviewed the design. SDS, SKS, KP, SP, TG, and PB collected and cleaned the data. KP and BB oversaw the study. SDS drafted the manuscript. KP, JH, and SI crucially evaluated the manuscript. SDS, KP, and JH revised the reviewers' comments extensively. All authors analyzed the data and have authorized the final manuscript for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2021.747070/full#supplementary-material

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Incidence, Knowledge, Attitude and Practice Toward Needle Stick Injury Among Health Care Workers in Abha City, Saudi Arabia

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Background: A needle stick injury is a serious occupational health hazard in health care settings. Health care workers are at risk of bloodborne diseases and the psychological consequences of these injuries. This study aims to estimate the incidence of needle stick injuries among healthcare workers during the previous 12 months and to assess their knowledge, attitude, and practice toward these injuries.

Methods: This cross-sectional study was conducted from 1st August 2019 till 15th February 2020, and included 786 healthcare workers in Abha city, Saudi Arabia. A structured questionnaire was used to collect the data.

Results: The incidence of needle stick injury among healthcare workers during the previous 12 months was (91/786) 11.57%. Nurses, females, and Saudis reported most needle stick injuries. More than half (52.7%) of the injuries went unreported. About 52.7% of needle stick injuries occurred during using sharp devices, and 42.9% of injuries happened in the patient room. The incidence of needle stick injury was significantly higher among those working at the secondary healthcare level ($p = 0.003$) and those practicing surgery ($p < 0.001$). Out of 786 participants, 94.7% knew the definition of needle stick injury, and 81.0% were aware of the procedure and guidelines to follow on sustaining a needle stick injury. Only 61.2% recognized that the recap of the needle is not recommended. Almost half of the participants (47.1%) agreed, and 33.6% strongly agreed that needle stick injury is preventable. A majority of healthcare workers (89.1%) had been vaccinated against Hepatitis B. Nearly 27.5% of healthcare workers incorrectly practiced recapping the needles with two hands and 8.7% bent needles before disposal. Recapping the needles was statistically significantly higher among healthcare workers who had a history of needle stick injury ($p = 0.046$).

Conclusion: Needle stick injury and its under reporting among healthcare professionals is still a prevalent risk. Raising awareness among healthcare workers and improving the reporting systems for needle stick injuries to ensure more protection and early use of post-exposure prophylaxis is required. Implementation of safety precautions and safe injection practices and providing engineered safety devices may further reduce the risk.

Keywords: incidence, needle stick injury, health care workers, Abha, attitude, practice, bloodborne diseases, safe injection

BACKGROUND

A needle stick injury (NSI) is a penetrating or cut wound in the skin caused by a needle or sharp instrument in the health care setting. Health care workers (HCWs) are at risk of accidental NSIs and sharp injuries because of the nature of their work. NSI is a severe occupational health hazard worldwide and around 3 million HCWs sustain NSIs and/or sharps injuries each year (1). In the USA, up to 800,000 sharp injuries have been estimated each year (2). In 2011, US EPINet™ reported 16.5 injuries per 100 occupied beds in 23 hospitals (3).

The rate of NSIs in the Kingdom of Saudi Arabia (KSA) at the national level was reported to be 3.2 per 100 occupied hospital beds in a study conducted during 2012 involving 52 hospitals (3). Analysis of reported data from King Saud Medical City in the Riyadh region shows a high rate of 13.8 NSIs per 100 occupied hospital beds during 2009 (4). Different rates have been reported from various health care institutions in other regions in KSA based on recorded data for reported injuries (5–10). However, these rates may underestimate the actual situation because injuries may usually go unreported. A review of studies on injury rates in the United Kingdom shows the difference between estimated rates and what was reported was up to 10-fold (11).

These injuries are a major source of infections with blood-borne diseases like Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and Human Immunodeficiency Virus (HIV) (12). The risk of transmission of this infection after exposure to percutaneous injuries with infected blood is 2–40% for HBV, 2.7–10% for HCV, and 0.3% for HIV (13). Additionally, studies show an influence on the mental health of the injured HCWs. Anxiety, depression, and worry about being infected or transmitting the infection to their family affected their quality of life (14, 15).

Health care institutions must take preventive measures to reduce this risk among HCWs. Education to raise awareness among health workers, training them on universal safety precautions, safe injection practices, sharp waste disposal, and provision of engineered safety devices have been reported to reduce such incidents by 62% in a meta-analysis study (16). In addition, according to UK guidelines, sound reporting systems for injuries and early use of post-exposure prophylaxis will reduce the risk of HIV infection (17).

Studies have been conducted to assess the incidence and prevalence of NSIs among health workers in KSA. However, these studies either have been among specific workers or are limited to localized institutions (18–23).

Therefore, up to our knowledge, no previous study has been conducted to evaluate the incidence/prevalence of NSIs among health care workers from different specialties at different levels of health care in KSA. This study was undertaken to estimate the incidence of NSIs among HCWs of different specialties at primary, secondary, and tertiary healthcare levels in Abha city, KSA. The knowledge, attitude, and practice of these HCWs toward NSIs and sharp object injuries were assessed.

MATERIALS AND METHODS

Study Design and Setting

This analytical cross-sectional study was conducted from 1st August 2019 to 15th February 2020 among HCWs, who currently work in Abha city, Aseer Region, KSA. Different healthcare institutions from different healthcare levels (primary, secondary, and tertiary healthcare levels) were included.

Inclusion and Exclusion Criteria

Different professions like physicians and nurses were included. HCWs grades such as consultants, specialists, or residents were encompassed. However, interns, medical and health-college students were excluded.

Sample Size

A total sample of 786 HCWs (231 physicians including dentists, and 555 nurses) was required to estimate the expected rate of 50% NSIs among HCWs (24). A margin of error of 5% at a 95% confidence level and a design effect of 2 was considered for calculating the sample size. The sample units were selected from the different health facilities and PHCCs using a stratified approach based on sample probability proportionate to the size method.

Sampling Technique

A stratified multistage cluster sampling technique was applied. The first stage of stratification was at the levels of healthcare institutions [primary (12), secondary (2), and tertiary (1) healthcare institutions]. The second stage was according to the profession of HCWs (physicians and nurses). A simple random sampling technique was used to select HCWs from each stratum.

Sampling Frame

Sampling frame Fifteen healthcare institutions were included (12 primary, 2 secondary, and 1 tertiary healthcare institutions) with a totalsampling frame of 2,205 physicians and nurses. Of

TABLE 1 | The sample size and sampling frame.

Healthcare institutions	Total physicians	Total nurses	Total healthcare workers	Total sample	Physician sample	Nurse sample
Tertiary healthcare hospital	355	743	1,098	335	98	237
Secondary healthcare hospitals	192	526	718	289	94	195
Primary Healthcare Centers	103	286	389	162	39	123
Total	650	1,555	**2,205**	**786**	**231**	**555**

whom Fifteen healthcare institutions were included (12 primary, 2 secondary, and 1 tertiary healthcare institutions) with a total sampling frame of 2,205 physicians and nurses (**Table 1**).

Data Collection Tools

Data were collected by using a structured questionnaire that was developed by the investigators. The questions were derived from The Saudi Ministry of Health guidelines (25, 26). Questionnaires were tested for their clarity, feasibility, and practicability. Four academic experts from King Khalid University, Abha, assessed content validity, and some minor modifications were made.

The final tested questionnaire consists of 39 questions with five components. The first part obtained information about HCW's socio-demographic data such as age, gender, nationality, and years of work practice. In the second part, 12 questions regarding HCWs experiences toward NSIs and the circumstances relating to the injuries, such as type of device, time, place, of injuries were assessed. In the third part, the knowledge of HCWs toward NSI was assessed based on their responses to questions related to the prevention and risk factors, disease transmission, and post-exposure measures. In the fourth part, HCWs attitudes toward NSIs were assessed based on their responses to statements using the Five-point Likert scale approach.

In the last part, HCW's practice toward NSIs was assessed based on their responses to 6 closed-ended questions with "yes" or "no" responses.

Data Analysis

Statistical Package for Social Sciences (SPSS) version 25.0 was used for data entry and analysis. The data were described as frequencies and percentages for categorical variables. A chi-square test or Fisher test was used to test for associations between categorical variables, and Mann–Whitney U test was used to test for associations between ordinal variables. P-values < 0.05 are considered statistically significant.

Ethical Considerations

All necessary official permission and ethical approval were obtained. The study's objectives were explained to all participants and assured them their responses would be fully confidential. A written informed consent form was obtained from each participant before administering the study questionnaire. Research teams distributed and collected the questionnaire manually on the same day.

RESULTS

Seven hundred and eighty six HCWs from different levels of health care completed the survey questionnaires. Out of the total, 62% were Saudis, 71% were females and 70.6% were nurses. About 44.7% of them were within the age range from 30 to 39 years. Regarding years of practice, 31.8% had between six to 10 years of experience, and 19.3% had less than two. About 81.3% were residents or general practitioners in terms of position, while specialists and consultants were 11.3 and 7.4% respectively. A higher proportion (42.6%) of HCWs were from a tertiary healthcare hospital (**Table 2**).

The incidence of NSIs among HCWs in Abha city was 11.57%. **Table 3** shows HCWs responses to items regarding NSIs in the previous year. Regarding the type of injury, 61.5% of respondents described their injuries as superficial (little or no bleeding), whereas 38.5% as moderate (skin punctured, some bleeding). Almost half (47.3%) of these injuries were reported by a HCW to appropriate authorities, and the majority of them (83.7%) reported immediately after the incident (**Figure 1**). However, 52.7% (48/91) did not report their injuries, and their reasons for not reporting were too busy at the time of injury (41.7%), did not know they should report (14.6%), and did not know how to report (6.3%). Nearly 20.8% stated that sharp devices caused injuries that were never used on a patient (**Figure 2**).

In terms of the location of these injuries, 91.2% were in the hands, mainly fingers of which the right index finger represents the most common site (46.2%). About 76.9% of HCWs who sustained NSIs washed the injury site with soap and water, 38.5% identified the source patient, 44.0% got tested for HIV, hepatitis B, hepatitis C, and only 23.1% got post-exposure prophylaxis.

An intravenous cannula (33.0%) followed by a hypodermic needle (18.7%) were the most common devices involved in most of NSIs. More than half of NSIs occurred during the use of sharp devices (52.7%), while 22.0% occurred after use and before disposal. About 42.9% of injuries happened in the patient room. From the HCW perspective, handling/passing devices during or after use (25.3%) and disposal-related causes (24.2%) were the significant causes of NSI, followed by recapping (14.3%). In comparison, stress training represents only 1.1% of all causes (**Figure 3**).

Factors such as level of healthcare and area of practice were found to be significantly associated with NSIs. The incidence of NSIs was significantly higher among those who

TABLE 2 | Socio-demographic characteristics among the HCWs.

Variables	Total HCWs *N* = 786	HCWs with NSI *N* = 91	*p* value*
Gender			>0.05
Male	226 (28.8)	28/226 (12.4)	
Female	560 (71.2)	63/560 (11.3)	
Nationality			>0.05
Saudi	487 (62.0)	57/487 (11.7)	
Non-Saudi	299 (38.0)	34/299 (11.4)	
Profession			>0.05
Physician	231 (29.3)	28/231 (12.1)	
Nurse	555 (70.6)	63/555 (11.4)	
Position			>0.05
Consultant	58 (7.4)	4/58 (6.9)	
Specialists	89 (11.3)	11/89 (12.4)	
Resident/general	639 (81.3)	76/639 (11.9)	
Age			>0.05
20–29	282 (35.9)	37/282 (13.1)	
30–39	351 (44.7)	43/351 (12.3)	
40–49	96 (12.2)	7/96 (7.3)	
≥50	55 (7.0)	3/55 (5.5)	
Years of work practice			>0.05
≤2	152 (19.3)	21/152 (13.8)	
3–5	178 (22.6)	24/178 (13.5)	
6–10	250 (31.8)	23/250 (9.2)	
11–15	108 (13.7)	15/108 (13.9)	
≥16	91 (11.6)	8/91 (8.8)	
Healthcare Institution			
Primary Healthcare center	162 (20.6)	10/162 (6.2)	**<0.05****
Secondary healthcare hospital	289 (36.8)	47/289 (16.3)	
Tertiary Healthcare hospital	335 (42.6)	34/335 (10.1)	
Area of practice			
Medicine/Medical department	239 (30.4)	23/239 (9.6)	**<0.001****
Surgery/Surgical department	148 (18.8)	32/148 (21.6)	
Intensive Care Unit	66 (8.4)	6/66 (9.1)	
Emergency department	43 (5.5)	8/43 (18.6)	
OPD /PHC	94 (12.0)	3/94 (3.2)	
Obs-Gynae / Pediatrics	50 (6.4)	8/50 (16.0)	
Laboratory	23 (2.9)	2/23 (8.7)	
General practice	50 (6.4)	1/50 (2.0)	
Others	73 (9.3)	8/73 (11.0)	

**p value- according to Chi-square test applied.*
***Statistically significant.*
p < 0.05 means statistically significant, p < 0.001 means highly statistically significant.

TABLE 3 | Experiences regarding NSIs.

Items	Frequency (%)
Number of NSI (*N* = 91)	
Once	36 (39.6)
Two to four times	45 (49.5)
≥ five times	08 (8.8)
Don't remember	02 (2.1)
Injury type (*N* = 91)	
Superficial (little or no bleeding)	56 (61.5)
Moderate (skin punctured, some bleeding)	35 (38.5)
Severe (deep stick/cut, or profuse bleeding)	—-
Reporting the NSI (*N* = 91)	
Yes	43 (47.3)
No	48 (52.7)
Receive medical attention within 2 h after injury (*N* = 91)	
Yes	42 (46.2)
No	49 (53.8)
Action taken after injury (Multiple responses question)	
Washed with soap and water	70 (76.9)
Get tested for HIV, hepatitis B, and hepatitis C	40 (44.0)
Identify the source patient	35 (38.5)
Get post-exposure prophylaxis (PEP) when the source patient is unknown or tests positive for HIV, hepatitis B, and hepatitis C	21 (23.1)
Device involved in the last incident (*N* = 91)	
Intravenous (IV) cannula	30 (33.0)
Butterfly needle	5 (5.5)
Hypodermic needle	17 (18.7)
Phlebotomy needle	6 (6.6)
Lancets/ Razors/ Scissors	9 (9.9)
Suture needles	14 (15.4)
Others	10 (11.0)
When the sharps injuries occurred (*N* = 91)	
During use	48 (52.7)
After use and before disposal	20 (22.0)
Between steps in procedures	13 (14.3)
During disposal	5 (5.5)
While re-sheathing or recapping a needle	5 (5.5)
Work area where recent injury occurred (*N* = 91) Patient room	39 (42.9)
Outside patient room (hallway, nurses station, etc.)	4 (4.4)
Emergency department	12 (13.2)
Intensive/Critical care unit	5 (5.5)
Operating room/Recovery	24 (26.4)
Outpatient clinic/Office	5 (5.5)
Others	2(2.2)

worked in the secondary healthcare level ($p = 0.003$), and those who were practicing surgery ($p < 0.001$). Physicians, males, and younger HCWs reported more NSIs than others, but these differences were not statistically significant (**Table 2**).

Out of 786 respondents, 94.7% knew about the definition of NSI, and 82.4% of them were aware of sharps disposal containers recommendation, whereas 61.2% recognized the recap of the needle was not recommended. The majority of respondents (78.9%) gave a correct answer regarding the doses of the Hepatitis

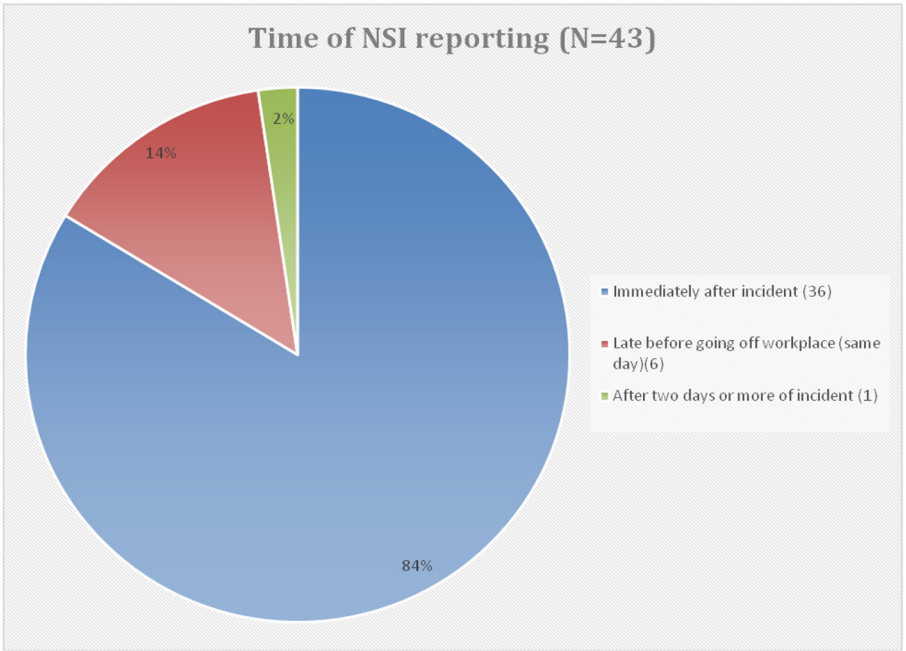

FIGURE 1 | Time of NSI reporting.

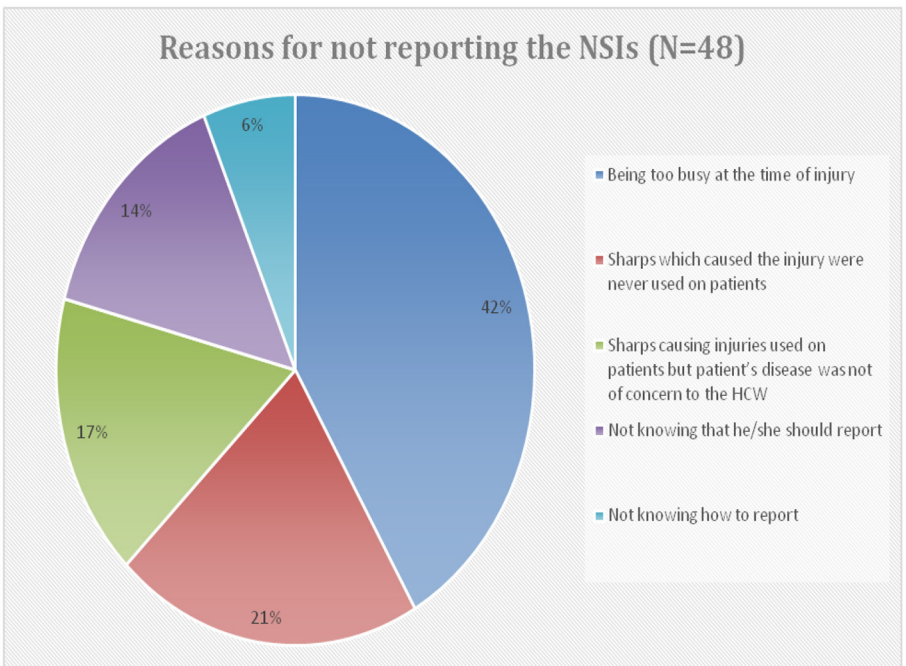

FIGURE 2 | Reasons for not reporting the NSIs among those HCWs who did not report their NSIs (48/91).

B vaccine, while 43.5% knew that there is no vaccine for Hepatitis C (**Table 4**).

Regarding the responses on diseases transmission questions, 92.5% of HCWs knew that NSIs could transmit HBV, HCV, and HIV, and 87.4% of them were aware that these are the most common diseases that medical staff is exposed to after NSI. Most of the respondents (76.7%) knew that Hepatitis B carries the most significant risk of

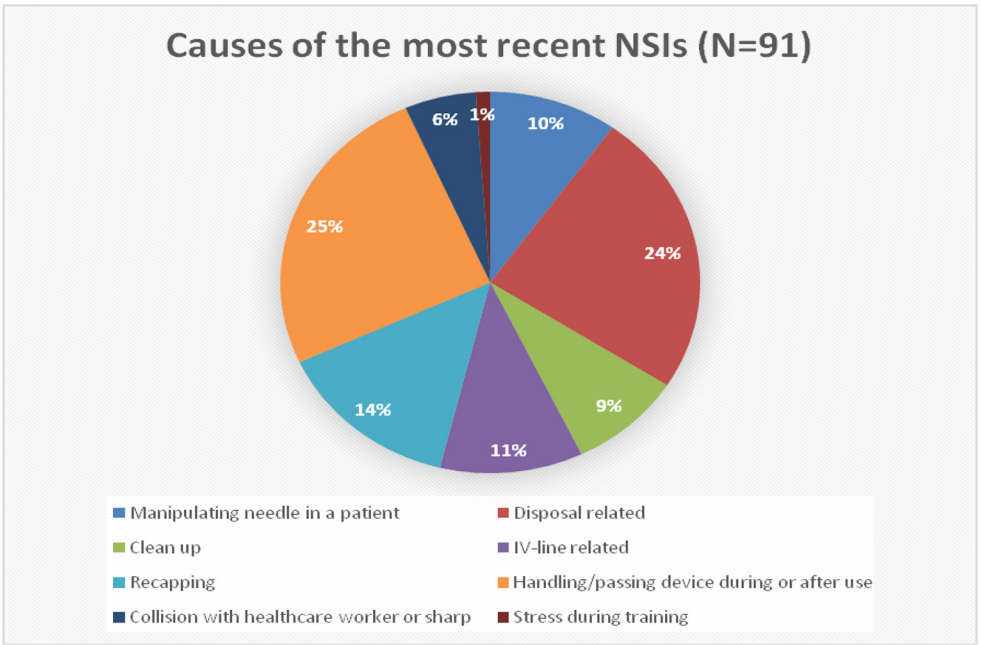

FIGURE 3 | Causes of the most reasons NSIs.

transmission, while 65.8% knew that this risk is higher than HIV (**Table 4**).

When respondents were asked about the post-exposure measures, most (81.0%) were aware of the procedure and guidelines to follow if they sustained an NSI. About 58.5% of them correctly answered a question about HCV antibody testing, and 43.3% were aware that there is no approved post-exposure prophylaxis (PEP) for HCV. In comparison, only 22.9% knew that the tetanus vaccine is not a part of PEP (**Table 4**).

Regarding immediate action to be taken when exposed to NSI, 75.3, 75.2, and 49.7% of respondents gave correct responses to wash their hands with soap and water, water only, and antiseptic solution, respectively. There were no statistically significant differences in knowledge between HCWs who had and did not have NSIs (**Table 4**).

Two-thirds of the participants had a positive attitude toward worrying about having NSI. Most participants either strongly disagree (46.8%) or disagree (28.5%) that patient care is more important than their safety. The majority strongly agreed (59.4%) or agreed (30.9%) that all sharps injuries at work should be reported immediately. Almost half of the participants agreed, and 33.6% strongly agreed that NSI is preventable. Additionally, 93.5% had a positive attitude to the fact that a professional company should dispose of the needle and sharp objects waste (**Table 5**).

Out of 786 respondents, 27.5% incorrectly practiced recapping the needles with two hands, and 8.7% bend needles before disposal. Regarding the disposal container, 95.3% confirm its availability, and 97.1% were always using it when disposed of sharp items. A majority of HCWs (89.1%) had been vaccinated against Hepatitis B, while only half of them had received training on the use of safety devices in the last year. Practicing recapping the needles with two hands before disposal was statistically significantly higher among HCWs who had a history of NSI (36.3 vs. 26.3%; $p = 0.046$) (**Table 6**).

DISCUSSION

NSIs are one of the most important risks to HCWs during their careers. Several studies were conducted to determine the incidence rate of these injuries in KSA among HCWs related to the number of beds in their hospitals based on data records during different periods (3–9). Other studies have explored the incidence/prevalence of NSIs in specific populations like laboratory workers and dental assistants (22, 23).

In our study, the incidence of NSIs among HCWs was 11.57% during the previous 12 months. This finding was less than those (14% in Jazan and 15% in Abha respectively) reported in previous local studies conducted among primary HCWs (18, 19). Additionally, this incidence is also lower than the finding (19%) in UAE (27), 40 % in Iran (28), 22.7 % in Lebanon (29), and 67.9% in Egypt (30). Different studies have used different criteria to report the incidence, prevalence or needle stick injury rate making it difficult to compare them. The low incidence may be attributed to the regular training of HCWs in recent years in KSA (31). In addition, limiting the reported incidence to the previous 12 months and self-reporting of injuries in the questionnaire may underestimate the incidence. Information about the age and the tasks assigned to workers and the ratio of HCWs to the patients is important for a fair comparison. In this study, 42% of HCWs had less than five years of experience; there is no doubt that a large

TABLE 4 | Percentages of correct responses to the knowledge questions related to NSI.

Knowledge questions related to NSI	Percentage of correct responses			
	Total HCWs	HCWs injured with needle stick	HCWs not injured with needle stick	*p* value*
	N = 786	*N* = 91	*N* = 695	
Prevention				
NSI is defined as wounds caused by needles that accidentally puncture the skin. (Yes)	744 (94.7)	86 (94.5)	658 (94.7)	1.000
Recap of the needle after performing nursing procedures is recommended to decrease the risk of needlestick injury. (No)	481 (61.2)	51 (56.0)	430 (61.9)	0.283
Dispose in a sharps container after performing procedures is recommended to decrease the risk of needlestick injury. (Yes)	648 (82.4)	71 (78.0)	577 (83.0)	0.238
Three doses are required for full protection from Hepatitis B. (Yes)	620 (78.9)	72 (79.1)	548 (78.8)	0.952
Hepatitis C disease can be prevented by vaccine. (No)	342 (43.5)	37 (40.7)	305 (43.9)	0.559
Disease transmission				
Needle stick Injuries may transmit blood-borne diseases like hepatitis B virus (HBV), hepatitis C virus (HCV), and (HIV). (Yes)	727 (92.5)	85 (93.4)	642 (92.4)	0.725
Hepatitis B & C, HIV are blood-borne pathogens that Medical staff are most commonly exposed to when they experience needlestick injury. (Yes)	687 (87.4)	79 (86.8)	608 (87.5)	0.857
In needlestick injury, Hepatitis B carries the greatest risk of transmission. (Yes)	603 (76.7)	71 (78.0)	532 (76.5)	0.754
The percentage transmission of HBV is higher than HIV owing to needle stick injury. (Yes)	517 (65.8)	60 (65.9)	457 (65.8)	0.973
Post exposure measures				
Are you aware of the procedure and guidelines to follow if you sustain a needlestick injury in your workplace? **(Yes)**	637 (81.0)	70 (76.9)	567 (81.6)	0.286
If you have a needlestick injury your immediate action will be to wash your hand with water only. **(No)**	591 (75.2)	70 (76.9)	521 (75.0)	0.684
If you have a needlestick injury your immediate action will be to wash your hand with soap and water. **(Yes)**	592 (75.3)	72 (79.1)	520 (74.8)	0.371
If you have a needlestick injury your immediate action will be to wash your hand with antiseptic solution. **(No)**	391 (49.7)	44 (48.4)	347 (49.9)	0.777
There is currently no approved post-exposure prophylaxis for HCV. **(Yes)**	340 (43.3)	43 (47.3)	297 (42.7)	0.413
Concerning needle stick injury from HCV infected patient, HCV antibody testing should be performed at 4–6 months. **(Yes)**	460 (58.5)	57 (62.6)	403 (58.0)	0.397
Tetanus vaccine is part of the treatment after experiencing needlestick injury. (No)	180 (22.9)	23 (25.3)	157 (22.6)	0.567

**p value- according to Chi-square test.*

number of them are still working under supervision, and many of them are assigned to simple tasks.

As reported by different studies, most of NSIs were reported by Nurses (8, 9, 32), and the majority of injuries happened in the patient room (28, 32). In our study, intravenous (IV) cannula was the most common device involved in most incidents which are similar to what was reported by several studies. (3, 8, 9, 32).

Recapping the needles after use was reported as a common cause of NSIs in many studies (19, 33, 34). On the contrary, in our study, the handling/passing device during or after use and disposal-related causes (24.2%) were the significant causes, while recapping the needle accounted for only 14% of all incidents.

Underreporting of sharp injuries is a common problem in healthcare facilities worldwide (11, 35). In this study, almost half

TABLE 5 | Responses to the attitude statements.

Items	Frequency (%)				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am worry about having needle stick injury.(+ve)	48 (6.1)	51 (6.5)	147 (18.7)	266 (33.8)	274 (34.9)
Patient care is more important than the safety of HCWs. (–ve)	368 (46.8)	224 (28.5)	108 (13.7)	37 (4.7)	49 (6.2)
All sharps injuries at work should be reported immediately. (+ve)	27 (3.4)	17 (2.2)	32 (4.1)	243 (30.9)	467 (59.4)
I think needle stick injury is preventable. (+ve)	24 (3.1)	46 (5.9)	82 (10.4)	370 (47.1)	264 (33.6)
Sharp objects waste should be disposed of by a professional company not in domestic waste. (+ve)	23 (2.9)	9 (1.1)	19 (2.4)	278 (35.4)	457 (58.1)

+ve, positive statement; –ve, negative statement.

TABLE 6 | Percentages of correct responses to the practice questions related to NSI.

Practice questions related to NSI	Percentage of correct responses			
	Total HCWs	HCWs injured with needle stick	HCWs not injured with needle stick	*p* value*
	N = 786	*N* = 91	*N* = 695	
Do you recap needles with 2 hands before disposal? (NO)	570 (72.5)	58 (63.7)	512 (73.7)	0.046**
Do you bend needles before disposal? (NO)	718 (91.3)	84 (92.3)	634 (91.2)	0.729
Is the safety box/disposal container usually available? (YES)	749 (95.3)	84 (92.3)	665 (95.7)	0.182
Do you always put sharp items into its assigned disposal container? (YES)	763 (97.1)	88 (96.7)	675 (97.1)	0.742
Have you been vaccinated against Hepatitis B? (YES)	700 (89.1)	78 (85.7)	622 (89.5)	0.277
Have you received training on the use of safe devices in the last year? (YES)	415 (52.8)	48 (52.7)	367 (52.8)	0.992

**p value- according to Chi-square test.*
***Statistically significant.*

(47.3%) of these injuries were reported by HCWs to appropriate authorities. This is consistent with that reported from Poland (55%) (36) and UK (51%) (37), but it is lower than that (80%) reported from UAE (38) and India (32). Nearly 6.0% of respondents did not know how to report a NSI in the present study which is comparable to the UK study [8%], whereas 14% HCWs in our study were not aware that they should report a NSI which is again comparable to findings of the UK study (37).

According to post-exposure actions, 76.9% of HCWs who sustained NSIs in this study washed the injury site with soap and water compared to 66% in India (33) and only 22% in Nepal (39). Additionally, we observed only in 38.5% of all incidents the source patients were identified, which was lower than that reported by the local studies, i.e. 73% in both Al Ahsa region (10) and University Hospital in Al Riyadh (6) and 84.4% in Najran (8). However, this difference may be explained by the reason that these above local studies were based on data obtained from hospital records.

The incidence of NSIs was significantly higher among those practicing surgery as their specialty. This finding is consistent with other studies (5, 27, 40, 41). Also, we found a significantly higher incidence of NSIs among HCWs who worked in secondary healthcare hospitals than tertiary hospitals (16.3 vs. 10.1%). Similarly, the needle stick and sharps injuries rates were 30 and 14% in secondary and tertiary hospitals, respectively in a study conducted in Jazan (42). The difference in the health services, numbers, and types of procedures in addition to the number of admissions may explain the difference in incidence between secondary and tertiary healthcare

hospitals in this study. More studies are needed to explore these differences.

Additionally, physicians, males, and younger HCWs reported more NSIs than others, but these differences were not statistically significant, which coincides with the results of a similar Iranian study (28). However, on the contrary, a study from China shows a significant association between NSIs with gender, age, and job position (43).

In this study, 43.5% knew there is no vaccine for Hepatitis C which is in contrast with the finding (75%) observed by Jankovic et al. (44).

In the current study, 92.5% of HCWs knew that HBV, HCV, and HIV could be transmitted by NSIs, which is consistent with the findings of a Malaysian study (43) but higher than those reported in Bosnia (45) and Delhi (33). In this study, only 65.8% knew that this risk of Hepatitis B transmission is higher than the risk of HIV, which is less than that observed (82%) in the Irish study (46).

Moreover, in the present study, 82.4% were aware of sharps disposal containers recommendation, which is better than that reported (29%) by a study from the USA (47). Most HCWs in this study (81.0%) were aware of the PEP and Universal precaution guidelines, which is better than that (61%) reported in a local study from Sarourah (21) but it is lower than the observations seen in Indian (48) and Malaysian (44) studies. Only 43.3% of HCWs in this study were aware that there is no PEP for HCV and 58.5% knew the timing of HCV antibody testing. This low knowledge regarding HCV post prophylaxis is also seen in other studies (32, 49).

In a recent study conducted among dental assistants in Jeddah, it was found that disease transmission decreased the risk of NSIs, and this association was statistically significant (22). However, in this study, we find there are no statistically significant differences in knowledge between HCWs who had and who did not have NSI. Our finding is consistent with that reported by Abuduxike et al. in the Cyprus study (50).

Our study shows only two-thirds of the participants had a positive attitude toward worrying about having NSI at work. This is lower than that reported by a Sudan study where 83% of HCWs were worried about these injuries (32). Similar to a local study among HCWs who work in primary health centers in the Jazan region (19), this study finds most HCWs agree that the needle and sharp objects waste should be disposed of by a professional company.

In our study, the majority show a negative attitude toward patient care is important than HCWs safety which is consistent with the attitude of Sudanese HCWs (31). A study conducted in China (41) had reported that HCW's behaviors and attitudes were significantly related to NSIs at work, whereas the Cyprus Study (50) found no significant relationship between the attitude of HCWs and the experience of NSI. Although there are recommendations against recapping the needles after use (51), this practice is still prevalent among HCWs. Several studies from different countries have reported that as the leading cause of NSIs. This risky practice was reported by 66.3% HCWs in India (33) and 46% in Cyprus (50). However, only 5.8% in Malaysia (45) and 13.4% in Lebanon (29) reported this practice. In our study, 27.5% of participants incorrectly practiced recapping the needles with two hands.

Availability of disposal container is an important matter, 95.3% of HCWs in this study confirm its availability, and almost all of them always use it when disposing of sharp items, which is comparable to other studies (18, 28, 50).

A majority of our study sample (89.1%) had been vaccinated against Hepatitis B, which is consistent with reports from local studies (18)(19). Studies have reported a high rate of Hepatitis B vaccination among HCWs, i.e. 100 % in Iran (28), 91.5% in India (33), 88.4% in Lebanon (29), 77% in Bahrain (52) and ranged between 62 and 80% in the United Arab Emirates (27, 38). This high percentage in our study could be due to the fact that the vaccination is free of charge and the pre-employment checkup exists for all HCWs in KSA.

Our study has a few limitations. The cross-sectional design cannot confirm the causality of the relationship between compared variables. The self-reported response could over or underestimate the result. The study's weakness is that it was conducted in a single city of the Aseer Region of KSA. We hope in the future to have all the required resources to do multicentric /nationwide studies. However, a representative sample including HCWs from all levels of health care is the strength of our study.

CONCLUSIONS

The exposure of healthcare professionals to needle stick injury and its underreporting is still a prevalent issue. In this study, during the past 12 months, the incidence of needle stick injury among healthcare workers was 11.57% and more than half of the injuries went unreported. Future studies need to explore the risk factors of NSIs and to assess the benefit of the preventive measures on reducing the risk. Increasing awareness among HCWs and providing regular training on the safe use of sharp devices is highly recommended. Improving the current reporting systems for NSIs to ensure early use of post-exposure prophylaxis is also recommended. Implementation of safety precautions and safe injection practices and providing engineered safety devices may further help in reducing the risk of NSIs.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

AA conceived the idea of this study, supervised the study, participated in the design of the research instrument, reviewed related literature, and participated in discussing findings and making recommendations on the basis of the findings of the study. NA conceived the idea of this study, participated in

the design of the study, and had the major responsibility of coordinating the data collection. SA and JA-L participated in design of the work, interpretation of data, and writing of the manuscript. MA and SS participated in data collection, study subjects management, and manuscript writing. AAA participated in design of the work, analysis of the data, and interpretation of the results. SM and MA finalized the manuscript for submission. All authors have read and approved the final manuscript.

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The Allocation Method for Personal Protective Equipment in the Emerging Infectious Disease Environment

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The COVID-19 pandemic gives humankind a lesson that the outbreak of an emerging infectious disease (EID) is sudden and uncertain. Accurately mastering its dynamics and putting forward an efficient and fair humanitarian logistics plan for personal protective equipment (PPE) remains difficult. This study examines the decision making for humanitarian logistics to answer the question that how to coordinate fairness and efficiency when facing supply-demand imbalance during humanitarian logistics planning in an EID environment. The main contributions include two aspects: (1) The victims' losses in terms of fairness and efficiency in receiving PPE are jointly explored by evaluating their bearing capacity evolution, and then a novel loss function is built to search for a reasonable compromise between fairness and efficiency. (2) A multi-objective optimization model is built, which is solved using the combined use of goal programming approach and improved branch and bound method. Finally, the practicability of the proposed model is tested by an EID case study. The potential advantages of the proposed model and improved approach are discussed.

Keywords: humanitarian logistics, emerging infectious diseases, personal protective equipment, multi-objective optimization, branch and bound method

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INTRODUCTION

In the past decade, public health emergencies have caused widespread concern around the world, and emerging infectious diseases (EIDs) have become intractable in terms of prevention and control of public health emergencies in all countries (1). The COVID-19 pandemic, broke out worldwide in 2020 and lasted 2 years, is the most prominent example which has led to the numerous infected cases worldwide (2). Evidence from different cases shows that it can spread through close contact with infected persons and contaminated surfaces (3). It is important to note that the personal protective equipment (PPE) is the last barrier to prevent people being infected (4). Therefore, the appropriate humanitarian logistics planning for PPE is of great significance, such as mitigating the potential disease spread risk, weakening the impacts on victims' losses resulting from an undergoing pandemic, and therefore benefiting the public safety and social welfare.

As one of the most impactive public health emergencies, an EID refers to such an infectious disease that has a sudden occurrence in a short time (like a "black swan event"), spreads across a large region and results in a large number of cases (5). It is very likely to cause catastrophic damages to human health and even deprive their life. There are following three

characteristics of an EID. First, once an EID breaks out, it may spread rapidly and widely, so that it not only brings the physical damage to the infected people, but also does harm to those who are uninfected yet but psychologically distressed by the potential risk (6). Therefore, when facing a humanitarian logistics planning problem for PPE, the traditional cost function such as unmet-demand cost cannot represent the whole loss, and a more proper loss function is worth exploring. Second, the dynamics and mutability of EID evolution reduce the accuracy and reliability of gathered data and information (7). Under this premise, exploring the law of EID evolution and quantification of the losses caused by EID are both not easy. More particularly, the quantification of losses caused by EID immediately influences the follow-up PPE allocation decision-making quality. Third, there is an imbalance between PPE demand and supply under an EID scenario (8, 9). PPE is usually insufficient, therefore such an imbalance is often manifested by supply shortage during EID development, which will cause the tradeoffs between the fairness and efficiency issues when designing humanitarian logistics planning for PPE. Moreover, the quantification of losses caused by EID is also closely-related to PPE supply-demand imbalance.

By jointly considering the all three characteristics, two core questions then arise as follows.

1. How Should the Losses Caused by EID be Exactly Quantified by a Proper Approach in a More Scientific way?
2. How Should the Quantification of Losses Caused by EID be Integrated With the Tradeoffs Between the Fairness and Efficiency Issues?

This study seeks to answer these two questions by exploring the victims' losses in terms of fairness and efficiency in receiving PPE and building a novel loss function to evaluate their bearing capacity evolution. In previous studies, fairness and efficiency are considered respectively in an independent way, e.g., represented by two conflicting objectives (10–12). Then, search for a proper compromise between them is difficult due to the non-comparability between any two non-dominated solutions in a Pareto Front. However, our proposed bearing capacity evolution can overcome this drawback and reach a real compromise between fairness and efficiency in humanitarian logistics.

Regarding the modeling and solution, a multi-objective optimization model is built, which is solved by the combined use of the goal programming approach and the improved branch and bound (B&B) method. Although the goal programming approach is frequently employed in the previous studies involving multi-objective optimization issues, how to design the following-up solution procedure to simultaneously pursue efficiency and accuracy is worth exploring, especially when facing a large-scale problem (11, 13). Moreover, integrating the goal programming approach and the improved B&B method is also rare in the previous humanitarian-logistics-related studies.

The remainder of this study is organized as follows. Section 2 conducts a literature review about the decision making on humanitarian logistics for PPE. Section 3 introduces the network structure, the mathematical model, and the solution procedure for humanitarian logistics for PPE. Section 4 presents the numerical results and Section 5 discusses the advantages of the proposed model and solution. Section 6 presents the conclusions and future directions.

LITERATURE REVIEW

Many related studies have been conducted and made different contributions. The main research status is introduced as follows.

Humanitarian Logistics

Humanitarian logistics has become a popular topic in the last two decades, comprehensive reviews about humanitarian logistics have been proposed by Altay and Green (14), Caunhye et al. (15) and Besiou and Van Wassenhove (1). Early research focuses on vehicle routing problems (16, 17) and facility location problems (18). Then, an increasing number of research turns the eyes to the integration of those subproblems, for instance, Zhan et al. (19), Rodríguez-Espíndola et al. (20) and Seraji et al. (21) both discuss the location-allocation problem, while Moreno et al. (22) studies the location-routing-allocation problem related to humanitarian logistics. Duhamel et al. (23) and Shavarani (24) both deal with the location-routing problem to optimize the humanitarian relief distribution decision-making. Eisenhandler and Tzur (11) address the routing-allocation problems to guide the decision-making in collecting food donations from suppliers in the food industry and delivering them to humanitarian relief agencies that serve individuals in need. Most of the aforementioned studies do not consider dynamics such as emergencies evolution and information updates. Not-enough-accurate and even incorrect information may cause catastrophic consequences. Therefore, considering the dynamics in humanitarian logistics has important practical significance. Early studies pay considerable attention to forecasting the evolution law of emergencies, but ignore the follow-up decision making on humanitarian logistics. For example, Sheu (25) focuses on the relief demand management based on an imperfect information environment, but omits relief allocation decision-making. To make up this lack, in another study of Sheu (26), he deduces the "perception-attitude-resilience" evolution relationship of demanders through psychological and cognitive theories to aid the relief goods allocation. Lu et al. (27) present a rolling horizon approach enabling the established model to conform to the evolution law of demand information. Haghi et al. (28) consider the changes in demand to build a model for the distribution of relief supplies and transfer of the wounded. Recent studies combine the dynamics and the follow-up decision-making together to present an integrated event-oriented relief logistics plan, for instance, Zhang et al. (29) examine the emergency resource allocation problem by simultaneously considering three stages including pre-, primary- and secondary-event stage. Cao et al. (30) address a dynamic multi-time-period relief distribution model considering supplies uncertainty, hierarchal decision levels and conflicting objectives. Uichanco (31) develops an integrated stochastic prepositioning model in which the probabilities of demand and supply damage are both dependent on the event outcome.

The distribution of humanitarian supplies in response to EID is also very important, but the research on this issue is

relatively limited. Most research still focuses on the humanitarian logistics of large-scale natural disasters without considering the characteristics of EID (33–35). Only a few studies have considered the dynamics and mutability of EID evolution. Zaric and Brandeau (36) develop a dynamic resource allocation model for epidemic control over multiple time periods to interventions that affect multiple populations. Wang et al. (37) construct a multi-objective stochastic programming model with time-varying demand based on the epidemic diffusion rule, and Genetic algorithm and Monte Carlo simulation are used to solve the problem. He and Liu (38) present a new medical emergency logistics model based on the time-varying forecasting and relief distribution to deal with public health emergencies. Büyüktahtakin et al. (39) build an epidemics-logistics mixed-integer programming model to determine the optimal amount, timing and location of resources to control an infectious disease outbreak. Qin et al. (40) propose an even swaps method based on the prospect theory with hesitant fuzzy linguistic term sets to put forward emergency logistics plans under the COVID-19 pandemic outbreak. However, the dynamics of demand depicted in these studies are related to time or scenario, not to the victims' bearing capacity which is more direct and accurate. Therefore, the present study aims to overcome this drawback and reexamine the dynamics of demand by building the victims' losses function based on their bearing capacity evolution.

Multi-Objective Optimization

Numerous studies formulate humanitarian logistics problem as a multi-objective optimization model. Traditional studies have optimized over efficiency-related and fairness-related criteria. For example, Tzeng et al. (41) propose the time, cost and demand satisfaction as main pursued objectives, Vitoriano et al. (42) consider more highly-relevant criteria, such as reliability, security, priority and ransack probability, Huang et al. (43) add a new metric called efficacy which denotes the extent to which the goals of quick and efficient logistics are met, Tofighi et al. (44) focus on the timely and fair provision of aid and propose a multi-objective model from two novel aspects including egalitarian aspect and utilitarian aspect. In comparison, the recent studies propose multiple criteria from much wider viewpoints. Roughly speaking, the utility (45), risk (46), sustainability-related metrics such as carbon-emissions (30) are main new-added criteria. In some recent research, the criteria are deepened in detail to the operational level. For instance, Zhou et al. (47) tackle two objectives involving minimizing the unmet demand and minimizing the risk of choosing the damaged road for dynamic emergency resource scheduling problems, Cao et al. (13) pursue simultaneously the maximization of the victims' satisfaction and minimization of the deviation on satisfaction in humanitarian relief distribution, Uichanco (31) coordinates two objectives involving minimizing the unmet demand and minimizing the unmet proportion of demand for prepositioning humanitarian relief items, Mohammadi et al. (32) consider three objectives where the first objective minimizes the total logistics costs and the third one minimizes the variation between upper and lower bounds of transportation cost. According to incomplete statistical survey involving the recent three-year studies on humanitarian relief logistics optimization, the timeliness (e.g. minimizing total time) and fairness (e.g. minimizing unmet demand) are still the main concerns, but how to coordinate them and search for a proper compromise is still under discussion.

Regarding the methodologies for multi-objective optimization, the Pareto front is worth exploring by some popular methods, such as ε-constrained method (31, 48), augmented ε-constrained method (10) and fuzzy goal constraint approach (29). When facing large-scale numerical examples, the solution approaches, developing two main streams which include either exact approach and the heuristics, have been widely examined. With respect to exact approach, Dalal and Üster (49) build a robust optimization model to aid emergency relief supply planning and solve the model by Benders decomposition method, Cao et al. (30) employ a hybrid global criterion method by incorporating a primal-dual algorithm, expected value and branch-and-bound approach to solve the multi-period humanitarian relief distribution model, Mohammadi et al. (32) solve the humanitarian facility location and vehicle routing model by using GAMS software and the BARON optimization solver. Regarding heuristics, the evolutionary algorithm (47), genetic algorithm (13, 50), bi-level algorithm (51), colony optimization algorithm (52) and NSGA-II (12) are employed in different multi-objective optimization studies. The common limits of the above studies lie in the non-comparability between any two non-dominated solutions in a Pareto Front. However, our proposed bearing capacity evolution, and the follow-up solution approach integrating the goal programming approach and the improved B&B method can overcome this drawback and reach a real compromise between fairness and efficiency in humanitarian logistics.

HUMANITARIAN LOGISTICS MODEL BASED ON VICTIMS' BEARING CAPACITY EVOLUTION

Problem Description

This study examines a three-layer location-allocation network considering multiple PPEs and multiple vehicles. Three network layers, including reserve centers, distribution centers (DCs), and affected areas, respectively have different roles, capacities, and locations. Reserve centers denote warehouses, with fixed, predetermined locations and capacities, that store multiple PPEs and emergency vehicles. Multiple PPEs shows actual demand in an EID scenario, such as masks, gloves, gown and face shields, which have different importance to victims. Multiple vehicles refer to the diversified transportation modes that combine several kinds of vehicles with different loading weights. DCs gather and integrate the multiple PPEs and multiple vehicles transported from the reserve centers, and then deliver them to the affected areas. Borrowing the idea of Li et al. (53), the locations of DCs are undetermined, and needed to be chosen from several candidate locations which have different capacities for PPEs and vehicles. Decision makers have to select optimal locations for DCs before an EID occurs and allocate PPEs after the EID.

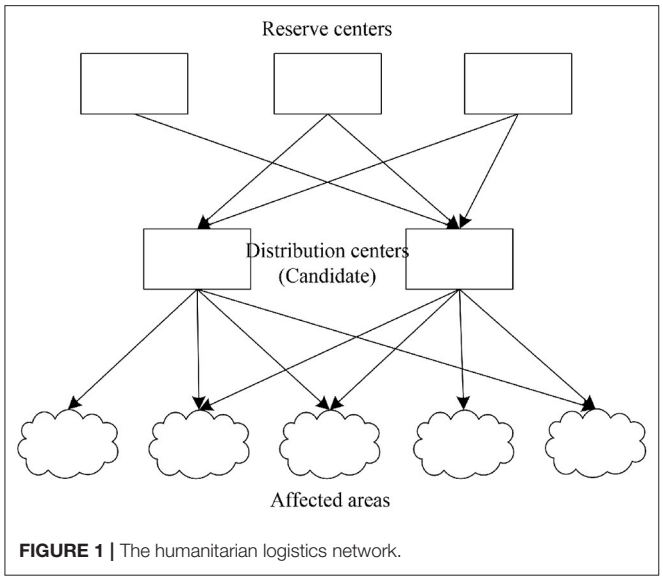

FIGURE 1 | The humanitarian logistics network.

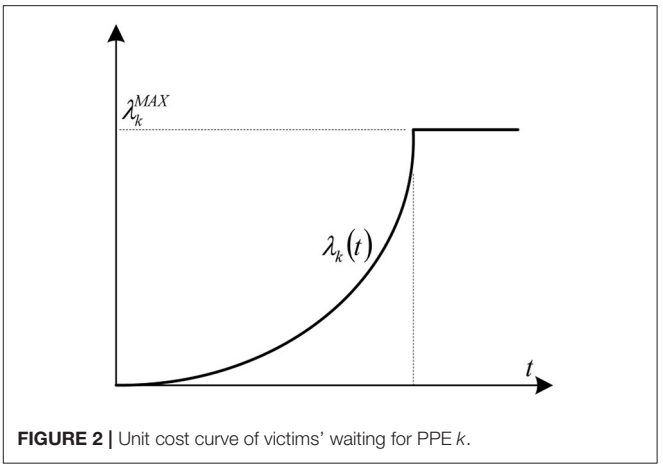

FIGURE 2 | Unit cost curve of victims' waiting for PPE k.

Multiple objectives should be addressed during decision making. **Figure 1** shows the network structure.

The Model

Sets and Parameters

H is set of reserve centers, $h \in H$.
I is set of candidate locations of DCs, $i \in I$.
J is set of affected areas, $j \in J$.
K is set of PPEs, $k \in K$.
M is set of vehicle types, $m \in M$.
N is set of objective functions, $n \in N$.
D_{hij} is the distance from reserve center h to DC i and then to affected area j (m).
C is the maximum coverage range of vehicles in the reserve centers, that is, the longest transportation distance that vehicles can travel (m).
w_k is the weight, reflecting the importance of PPE k to victims.
V_m is the maximum loading weight of vehicle m (kg/vehicle).
U_{hm} is the supply of vehicle m in the reserve center h (vehicles).
W_{hk} is the supply of PPE k in the reserve center h (kg).
P_{im} is the maximum capacity of vehicle m in DC i (vehicles).
Q_{ik} is the maximum capacity of PPE k in DC i (kg).
d_{jk} is the demand quantity of the affected area j for PPE k (kg).
f_m is the transportation cost of vehicle m per unit distance (yuan/m).
e_m is the transportation time of vehicle m per unit distance (s/m).
c_i is the renting cost of DC i (yuan).

Decision Variables

z_i is location variable, indicates whether the candidate location i is used as the DC.
x_{hijm} is routing variable, indicates the number of vehicle m to transport PPE from the reserve center h to the DC i and then to the affected area j (vehicles).
y_{hijkm} is allocation variable, indicates the quantity of PPE k which are delivered by vehicles m from the reserve center h to the DC i and then to the affected area j (kg).

Objective Function G_1: Minimizing Total Losses in Waiting for PPE

In an EID scenario, victims' bearing capacity evolution is actually a process of loss accumulation. Long waiting time leads to increase in victims' losses. In this study, such losses are quantified by costs. Suppose the cost curve of victims waiting for one unit of PPE k is $\lambda_k(t)$, where t is the waiting time. When facing PPE supply shortage, victims' physiological and psychological bearing capacity continuously decreases as time passes. This decline rate is continuously intensifying. Hence, the cost curve increases in a limited time range by an increasing growth rate (see **Figure 2**). In other words, $\lambda_k^{'}(t) > 0$ and $\lambda_k^{''}(t) > 0$. Victims that do not receive any PPE for a long time will receive the maximum cost after a certain time point. At this point onward, correspondingly, the cost curve of victims becomes a horizontal straight line (λ_k^{MAX}).

A loss function (L_{jk}) that uses waiting time as the independent variable is designed as follows, which reflects victims' total losses caused by waiting for PPE k in the affected area j.

$$L_{jk} = \left(d_{jk} - \sum_h \sum_i \sum_m y_{hijkm}\right) \cdot \lambda_k^{MAX} + \sum_h \sum_i \sum_m y_{hijkm} \cdot \lambda_k(t) \quad (1)$$

where

$$t = e_m \cdot D_{hij}. \quad (2)$$

This loss function contains two parts. The first part indicates victims' losses caused by unmet demands (influences the realization of the fairness objective), and can be viewed as victims' losses caused by infinite delay of PPE. The second part denotes victims' losses caused by delayed supply (influences the realization of the efficiency objective), and can also be viewed as

victim's losses caused by finite delay of PPE. Therefore, this loss function measures both the fairness and efficiency, and is in fact, a compromise between these two conflicting objectives.

After building the loss function, the objective function G_1 can be formulated as follows.

$$G_1 = min \sum_j \sum_k L_{jk} \cdot w_k. \quad (3)$$

Objective Function G_2: Minimizing Total Logistics Costs

$$G_2 = min \left(\sum_i c_i \cdot z_i + \sum_h \sum_i \sum_j \sum_m D_{hij} \cdot f_m \cdot x_{hijm} \right). \quad (4)$$

This objective function also contains two parts. The first part is the renting cost of DCs, whereas the second is the transportation costs of PPEs.

Constraints

$$x_{hijm} = \begin{cases} \geq 0, D_{hij} \leq C \\ = 0, D_{hij} > C \end{cases}, \forall h, i, j, m. \quad (5)$$

$$\sum_i \sum_j x_{hijm} \leq U_{hm}, \forall h, m. \quad (6)$$

$$\sum_i \sum_j \sum_m y_{hijkm} \leq W_{hk}, \forall h, k. \quad (7)$$

$$\sum_h \sum_j x_{hijm} \leq P_{im} \cdot z_i, \forall i, m. \quad (8)$$

$$\sum_h \sum_j \sum_m y_{hijkm} \leq Q_{ik} \cdot z_i, \forall i, k. \quad (9)$$

$$\sum_k y_{hijkm} \leq V_m \cdot x_{hijm}, \forall h, i, j, m. \quad (10)$$

$$\sum_h \sum_i \sum_m y_{hijkm} \leq d_{jk}, \forall j, k. \quad (11)$$

$$z_i = 0 \text{ or } 1, \forall i. \quad (12)$$

$$x_{hijm} \text{ is non–negative integer}, \forall h, i, j, m. \quad (13)$$

$$y_{hijkm} \geq 0, \forall h, i, j, k, m. \quad (14)$$

Constraint (5) involves vehicle coverage, which indicates that each vehicle is only responsible for the delivery of PPEs to the affected area within a permitted distance. This constraint not only ensures the timeliness but also the quality and safety of PPEs. In an EID scenario, long-distance transportation is often unreliable because of the implementation of lockdown policies. Constraints (6) and (7) concern the reserve capacity of reserve centers that represent the maximum supply of vehicles and PPEs in reserve centers. Constraints (8) and (9) concern the maximum capacity of DCs for routing vehicles and allocating PPEs respectively. In addition, only chosen DCs are ensured to have flows of vehicles and PPEs. Constraint (10) is the maximum load capacity of vehicles for filling with PPEs. Constraint (11) indicates that the quantity of delivered PPEs is no more than the demand of victims, because excessive delivery is a considerable waste given the premise of shortage of PPEs. Finally, constraints (12)–(14) define the value ranges of decision variables.

Solution Procedure

The proposed model is obviously a multi-objective optimization model and a complicated mixed-integer programming model if being applied to a large-scale numerical example. To simultaneously deal with these two within a reasonable runtime and with high accuracy is difficult in real-world practice. Under this consideration, this study puts forward a solution procedure by integrating goal programming approach and an improved B&B method.

In a humanitarian logistics optimization problem, the timely and effective delivery is vital. Cost minimization is often regarded as a less important goal. Therefore, two objective functions have clear priorities in terms of importance: G_1 is far superior to G_2. For such multi-objective programming problems, goal programming is an effective approach. Thus, the multi-objective programming model is transformed to a goal programming model, such as:

$$min \left(\lambda_1 \cdot \theta_1^+ + \lambda_2 \cdot \theta_2^+ \right) \quad (15)$$

where λ_1 and λ_2 are priorities of the two objective functions. According to above analysis, $\lambda_1 >> \lambda_2$. θ_1^+ and θ_2^+ are positive deviation variables, indicating that the original objective functions are larger than the quantity of ideal levels R_1 and R_2. Accordingly, negative deviation variables θ_1^- and θ_2^- exist, reflecting that the original objective functions are smaller than the quantity of ideal levels. However, given that the two objectives pursue minimization, only the positive deviation variables have to be minimized.

Apart from the constraints of the original model, other constraints include the following:

$$G_n + \theta_n^- - \theta_n^+ = R_n, \forall n \quad (16)$$

$$\theta_n^- \cdot \theta_n^+ = 0, \forall n \quad (17)$$

$$\theta_n^- \geq 0, \theta_n^+ \geq 0, \forall n \quad (18)$$

Equation (16) shows the relationship between the original objective function and the ideal level. Equation (17) is the expression of logical relations between the positive and negative deviation variables. When the objective function exceeds the ideal level, the positive deviation variables are larger than 0 and the negative deviation variables are certainly 0. By contrast, when the objective function does not exceed the ideal level, the negative deviation variables are larger than 0 and the positive deviation variables are certainly 0. If the objective function is only equal to the ideal level, then both the positive and negative deviation variables are 0. Equation (18) defines the value ranges of the positive and negative deviation variables.

After converted into goal programming, the original multi-objective optimization model becomes a large-scale mixed-integer programming model with a single objective. The B&B method is used as a solution by decomposing the mixed-integer programming model into a linear programming model and subsequently solving the linear programming model repeatedly. B&B, proposed by Land Doig and Dakin in the 1960s, is an algorithm design paradigm for discrete and combinatorial optimization problems, as well as mathematical optimization (54). However, a traditional B&B method cannot efficiently avoid exponential expansion of B&B tree when using tree search. This study uses the Xpress-MP software (developed by Dash Optimization), which uses an improved B&B method to avoid exponential node growth. A series of advanced algorithms used by Xpress-MP, such as pre-solving, cutting planes, branching variable selection, node preprocessing, and heuristics, can overcome the disadvantages of the traditional B&B method. Key procedures of improved B&B method are as follows. First, solve the LP relaxation, and save the basis of the optimal solution. Second, fix location variables to 0 if the corresponding routing and allocation variables are close to 0, and to 1 if they have relatively large values. Third, solve the resulting branched MIP problem. Fourth, if an integer feasible solution was found, save the value of the best solution. Five, restore the original problem by resetting all variables to their original bounds, and load the saved basis. Six, solve the original MIP problem, using the heuristic solution as cutoff value. Branches without roles in searching the best solution are cut; thus, the tree size will not expand quickly. This method has been proved suitable to solve large-scale complicated mixed-integer programming problems (55, 56).

EXAMPLE OF DEMONSTRATION

Example Description

A hypothetical EID occurs in the south region of Wenzhou, a southeastern city in China. Five areas are affected, namely, Rui'an, Pingyang, Cangnan, Wencheng, and Taishun. Demands for PPEs such as masks and protective clothing are very large (see **Table 1**), with weights 0.6 and 0.4, respectively. Officials gather vehicles (light, medium, and heavy vehicles) in reserve centers in Shiqu, Yongjia, and Yueqing to deliver PPEs to affected areas. **Table 2** lists the quantity of PPEs and vehicles in reserve centers. Two candidate locations of DCs (DC1 and DC2) are present. **Table 3** shows the capacities of these two DCs, and their renting costs are RMB 800,000 and 600,000, respectively. To ensure timeliness of PPE allocation, officials determine that the maximum transportation radius of vehicles is 150 km. **Table 4** shows the other parameter settings. Additionally, the following is the cost function of waiting for PPEs:

$$\lambda_k(t) = \begin{cases} \frac{t^2}{7315661}, 0 \le t \le 604800 \\ 50000, t > 604800 \end{cases}.$$

TABLE 1 | Demands in affected areas (1,000 kg).

Affected areas	Masks	Protective clothing
Rui'an	146	0
Pingyang	150	0
Cangnan	165	0.16
Wencheng	150	11.4
Taishun	320	3.04

TABLE 2 | Supplies in reserve centers (1,000 kg; vehicles).

	Masks	Protective clothing	Light vehicles	Medium vehicles	Heavy vehicles
Shiqu	500	6	30	15	10
Yongjia	150	2	10	5	2
Yueqing	300	4	20	10	5

TABLE 3 | Capacities of DCs (1,000 kg; vehicles).

	Masks	Protective clothing	Light vehicles	Medium vehicles	Heavy vehicles
DC1	800	10	50	25	12
DC2	600	8	40	20	10

TABLE 4 | Other parameters.

	Light vehicles	Medium vehicles	Heavy vehicles
Load capacity of vehicles (kg/vehicle)	5,000	10,000	20,000
Unit transportation cost (yuan/m)	0.1	0.2	0.3
Unit transportation time (s/m)	0.06	0.07	0.09

Optimal Plans for Humanitarian Logistics

The proposed model is solved by using the Xpress-MP 8.13 on a computer with 3.4 GHz CPU and 8 GB RAM. First, the single objective model of each objective function is solved independently, and the best values are used as the ideal levels of the two objectives. $R_1 = 1.26358e + 8$ and $R_2 = 0$ are obtained and then both inserted into the goal programming model on the premise of $\lambda_1 >> \lambda_2$, resulting in $\theta_1^+ = 0$ and $\theta_2^+ = 3.1975e + 6$. This means that the minimum victims' losses caused by waiting for PPEs amount to RMB 0.126 billion, which fully reaches the ideal level. This also represents the compromise between fairness and timeliness during the humanitarian aid reaches an optimal level. Second, we regard the best values of two single-objective models as the lower bounds of two objectives, and the worst values [respectively resulting in $2.8222e + 10$ solved by $\max \sum_j \sum_k L_{jk} \cdot w_k$, and resulting in $3.7105e + 6$ solved by $\max \left(\sum_i c_i \cdot z_i + \sum_h \sum_i \sum_j \sum_m D_{hij} \cdot f_m \cdot x_{hijm} \right)$] of two single-objective models as the upper bounds of two

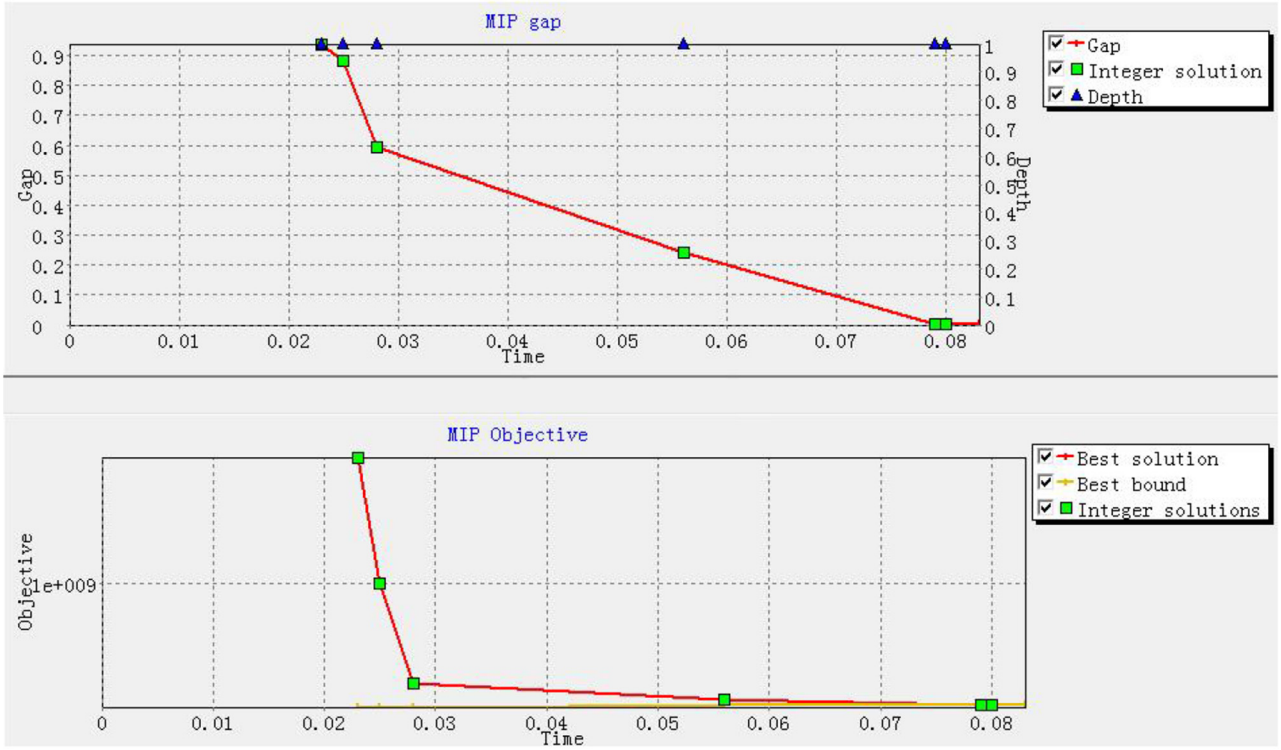

FIGURE 3 | Gap between best solution and best bound.

objectives. Then, using a specified formula such as (current value − lower bound)/(upper bound − lower bound), the percentage deviations of two objectives are respectively obtained as 0% and 86.17%. Although the second objective is not close to its ideal level, the absolute deviation (i.e. RMB 3.1975 million) is also acceptable when standing on the viewpoint of the humanitarians to pay the logistics costs of PPEs. Third, as shown in **Figure 3**, the total runtime is < 1 s, which highly meets the demand of timeliness in humanitarian aid. **Figure 3** also depicts the gap between the optimal solution and the optimal bound, that is, the optimal solution reaches the optimal bound, which infers the high accuracy of proposed solution method.

Figure 4 shows specific plans for humanitarian logistics. Vehicles in all reserve centers have been used thoroughly. Both DC1 and DC2 are chosen to meet the demands of affected areas as much as possible. Note that Rui'an and Taishun only receive one vehicle route. According to further observation, Rui'an is slightly affected and does not need too many vehicles. Taishun is heavily affected and far away from DCs. Vehicles appointed to Taishun all come from Shiqu, because the maximum coverage of vehicles restricts long-term transportation. Therefore, two interesting insights are gleaned, as follows: (i) the best solution of PPE allocation is prioritizing heavily affected areas than slightly affected areas to realize the fairness consideration; (ii) the best solution ensures timeliness of PPE allocation through the maximum coverage range of vehicles.

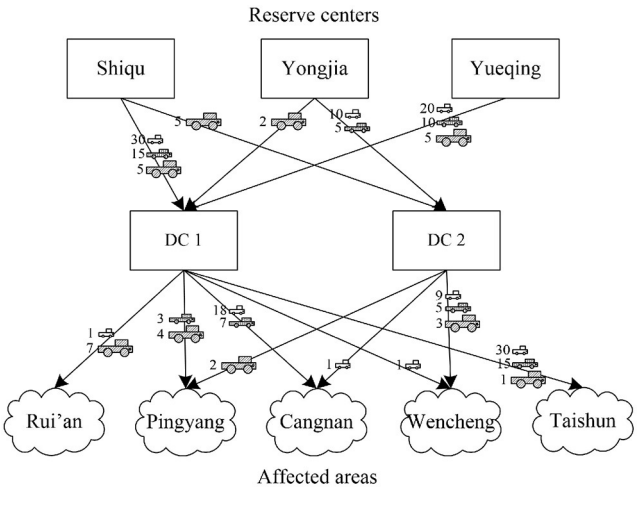

FIGURE 4 | Optimal plans for humanitarian logistics.

DISCUSSION

Tradeoffs Between the Two Objectives

To verify the rationality of the best solution of the model, we analyze the changes of minimum logistics costs (second objective function) by increasing the ideal level of total losses (first objective function), which are depicted in **Figure 5**.

Obviously, each dot in **Figure 5** represents a tradeoff between two conflicting objectives, and the fitted curve linking all the dots forms the Pareto Front. From a traditional viewpoint, it is hard to say which one is better between any two dots in the Pareto Front. However, the minimum logistics cost decreases mildly when the ideal level of total losses increases. Even the ideal level of total losses increases by 100 times (that is, the minimum total losses are RMB 12.6 billion), the minimum logistics costs only decrease by 1.67 times (RMB 1.91 million). This implies that the increase of total losses cannot significantly decrease logistics cost. In other words, saving a certain amount of logistics costs will cause a dramatic increase of victims' losses, which is not acceptable because social welfare must be superior to economic burdens in humanitarian-aid practice. Nevertheless, the tradeoff between the two objective functions are reasonable in the abovementioned numerical results.

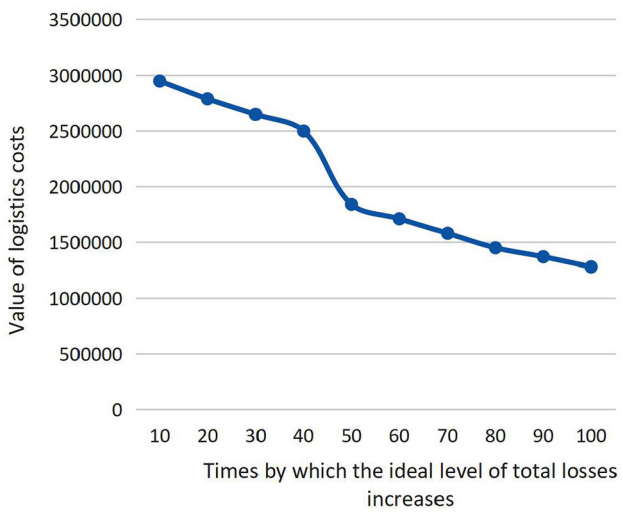

FIGURE 5 | Tradeoffs between the two objectives.

The Merit of the Improved B&B Method

The merit of the improved B&B method mainly lies in three aspects.

First, the improved B&B method avoids the exponential growth of the B&B tree. The B&B tree is mostly not large, even if the most complicated B&B tree (which emerges when the ideal level of total losses increases by 100 times) is acceptable (see **Figure 6**). The reason is that many advanced technologies are employed as the core components in the Xpress-MP, such as pre-solving, cutting planes, branching variable selection, node preprocessing, and heuristics. These technologies continuously act on the formation and evolution of the B&B tree and significantly influence the solution time.

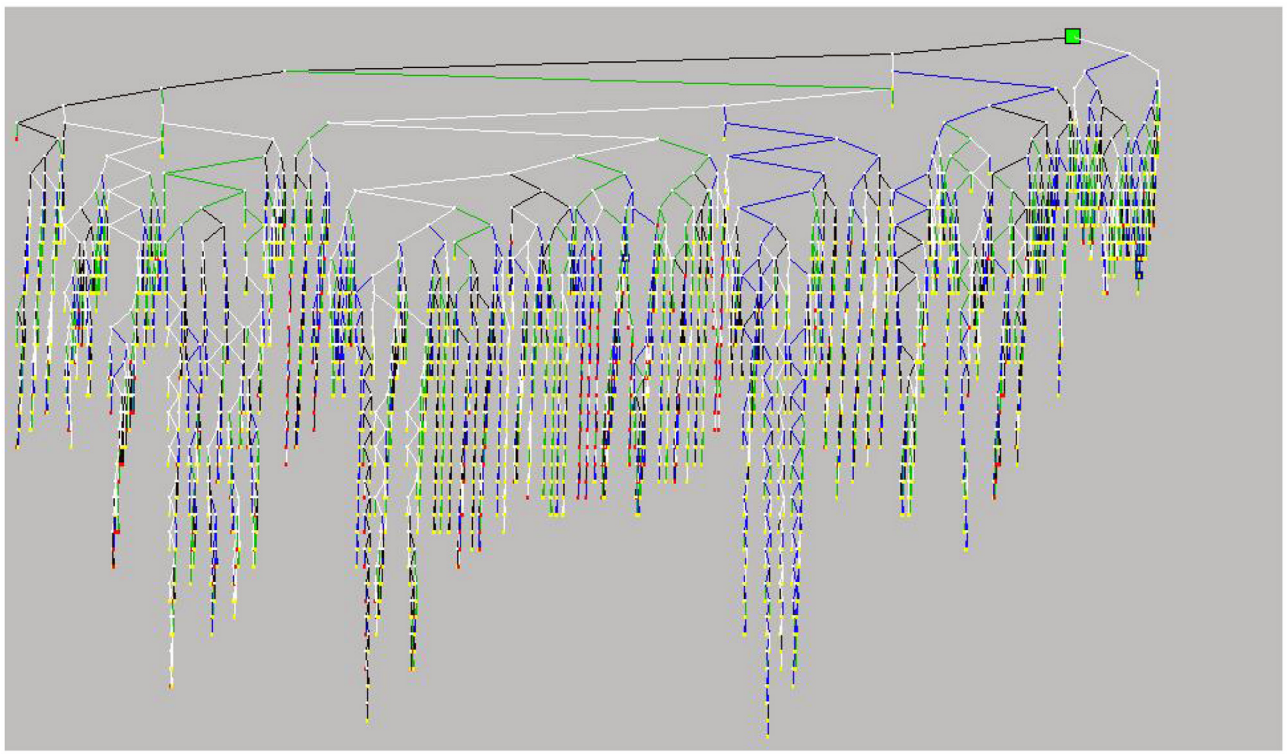

FIGURE 6 | Most complicated B&B tree in this study.

TABLE 5 | Comparisons between traditional and improved B&B.

	Constraints	Variables	Non-zero elements	Best solutionstatus	Best solution error	Runtime (s)
Traditional B&B	385	259	1397	Global opt.	0	12
Improved B&B	109	191	805	Global opt.	0	0.1
	↘71.7%	↘26.3%	↘42.4%	→	→	↘99.2%

FIGURE 7 | The steadiness of method under different parameter settings.

Second, the solution efficiency is given a big boost by the improved B&B method. We compare it with the traditional B&B method to respectively deal with the numerical case on the premise of the same settings (i.e. $R_1 = 1.26358e + 8$, $R_2 = 0$, and $\lambda_1 >> \lambda_2$). Benefiting from pre-solving and other advanced technologies, the improved B&B leads to much smaller-scale constraints, variables, and non-zero elements, and the resulting much less runtime than the traditional B&B. It is worth noting that, this significant improvement of solution efficiency is not on the premise of sacrificing the solution accuracy. The solution accuracy still stays unchanged (see **Table 5**).

Third, the result robustness is proved good by the improved B&B method. Recall that in **Figure 5**, the curve of Pareto Front results from the gradual increase of the ideal level of total losses. Therefore, it is proper to regard the ideal level of total losses as a key parameter. Then, we conduct a sensitivity analysis with respect to the ideal level of total losses to show its effect on solution error and runtime. As shown in **Figure 7**, when the ideal level of total losses gradually increases from its original value to 100-times expansion, the best solution error and runtime are both very close to zero, and their changing curves both keep flat with slight fluctuation. More precisely, the best solution error ranges only from 0 to 0.2%, whereas the runtime ranges only from 0 to 20 s. This implies that the improved B&B method can ensure the result robustness regardless of which tradeoff reached by the total losses and logistics cost. This is very important for humanitarian logistics practice. The steady and high-quality performance of not only accuracy but also efficiency of the improved B&B method to solve the numerical case agrees with the requirements on humanitarian logistics.

CONCLUSIONS

EID is an unforeseeable public health emergency, therefore tackling the dynamics issue and putting forward reasonable and efficient plans for humanitarian logistics is an important research topic. This study examines the decision-making problem for locating the DCs and allocating PPEs to victims based on victims' bearing capacity evolution. In a three-layer network composed of reserve centers, DCs, and affected areas, the location of DCs and allocation of PPEs are simultaneously optimized. Logistics time and demand satisfaction level are incorporated to build a loss function on the victims' side. Moreover, a multi-objective optimization model is formulated and applied to a case study. The following are the conclusions and insights.

First, the optimal level of the compromise between fairness and timeliness is reached, because the optimal result of first objective fully reaches the ideal level. The loss function plays an important role on leading to this result, which can help the decision maker put forward a reasonable, optimal humanitarian logistics plan in practice.

Second, minimizing victims' total losses is superior to minimizing logistics costs. The decrease of the ideal level of victims' total losses cannot significantly improve the best value of logistics costs. This finding conforms to the characteristics of humanitarian logistics. Minimizing victims' total losses, to some extent, representing pursuing the social welfare, must be superior to economic burdens.

Third, the combined use of the goal programming approach and the improved B&B method has significant merit which includes avoiding the exponential growth of the B&B tree,

improving the solution efficiency, and ensuring the good result robustness. In other words, the proposed solution approach can simultaneously pursue efficiency and accuracy when facing a large-scale problem, which meets the requirements of quick response in practice.

However, this study still has several limitations. The real-world decision making involves other more practical factors. Further research can add the stochastic components to re-building the loss function and re-formulating the model. Considering a more complicated humanitarian logistics network and the three-dimensional transportation modes based on multiple transportation platforms are also an improved way. Nonetheless, we hope this study can provide an efficient and fair decision-making tool to deal with the humanitarian logistics planning for PPEs, and relatively make up the gaps existed in the present decision-making framework.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

AUTHOR CONTRIBUTIONS

S-lZ: conceptualization, resources, data curation, validation, methodology, formal analysis, project administration, writing—original draft, and visualization. XG: conceptualization, investigation, project administration, and writing—review and editing. YY and Y-CC: conceptualization, investigation, and writing—review and editing. All authors contributed to the article and approved the submitted version.

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Barriers and facilitators of rehabilitation nursing care for patients with disability in the rehabilitation hospital: A qualitative study

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Nurses play a key role in providing rehabilitation care. In this regard, identifying the factors that affect their practice can be useful in planning to improve the quality of rehabilitation nursing care. This study aims to explore the experience of nurses and members of the rehabilitation team about barriers and facilitators of rehabilitation nursing care of patients with disability in the rehabilitation hospital. This qualitative study was conducted in the main public rehabilitation hospital in Tehran, Iran. Eighteen persons including 12 nurses in clinical and managerial positions, an occupational therapist, a physical medicine specialist, a patient, and an informal caregiver participated in this study. Participants were selected based on purposeful sampling. Data were collected through 18 in-depth semi-structured interviews and analyzed based on qualitative content analysis principles. Three themes were derived from the data analysis, which represented Barriers and facilitators related to nurses (specialized knowledge and skills, psychological status, mentoring, professional communication), barriers and facilitators related to the work environment (nurses' performance evaluation, nursing workforce, comprehensive care facilities, workplace design, specialized unit), barriers and facilitators related to patients and caregivers (patient's participation in nursing care, patient adaptation, efficiency of formal caregivers). The experiences of the rehabilitation team shows that not only nurses, but also the environment, patients, and caregivers can affect the provision of care and change the quality of care. Identifying these factors can help managers, researchers, and clinical nurses to facilitate and improve rehabilitation nursing care by modifying the influencing factors.

KEYWORDS

rehabilitation nursing, inpatient rehabilitation, people with disability, quality of care, nursing practice, rehabilitation team

Introduction

Rehabilitation is one of the fundamental services in health care that is provided for a wide range of diseases and health problems at acute, sub-acute, and long-term phases (1). The aim of rehabilitation is to promote, achieve and maintain maximum performance through training and empowerment of people with disabilities to manage their health status and adapt to their conditions (2, 3). The rehabilitation process is based on teamwork. Members of the rehabilitation team, including physicians, nurses, physiotherapists, occupational therapists, and psychotherapists are involved in this process (4, 5). Among the members of the rehabilitation team, nurses play a key role in the rehabilitation process and have several responsibilities in providing rehabilitation care (6). Nursing care prepares patients for the rehabilitation process, leads to the continuation of rehabilitation, achieves desired rehabilitation outcomes, and improves patients' quality of life (7, 8). Due to the inability of patients to perform activities of daily living, nurses help them to meet basic needs (7, 9). In addition to meeting physical needs, nurses support patients in psychological, spiritual, and social dimensions (10, 11). Providing comprehensive rehabilitation nursing care in all dimensions requires some prerequisites. In addition to the nurse's competence in providing care, contextual factors such as environmental characteristics, care equipment, and leadership affect the nurse's ability to provide comprehensive care (12–15). In 2014, Clarke identified some of the factors affecting nursing care by reviewing the literature on stroke rehabilitation. Some of these identified factors such as the clarity of nurses' roles, the interdisciplinary work, and evidence-based practice facilitated nursing care (16). Also, problems such as nursing shortage, focus on routine practice, parallel or separate teamwork, and hierarchical relationships between nurses and therapists prevented the provision of rehabilitation nursing care (16). All these factors affect the provision of holistic nursing care and the safety and quality of care. In addition, considering the importance of nursing care role in the rehabilitation process, barriers and facilitators can affect the achievement of rehabilitation outcomes. They also affect the health status and quality of life of people with disabilities (4, 13, 16, 17). Barriers can reduce nurses' performance due to mental fatigue, dissatisfaction, and burnout (18–21). Despite the importance of recognizing these challenges, few studies have been conducted to identify the factors affecting rehabilitation nursing care. Among these studies, quantitative research is unable to comprehensively explain the affecting factors. Qualitative studies have focused solely on a specific area such as stroke rehabilitation. In addition, most of them have focused on examining the viewpoints of nurses and the experiences of other members of the rehabilitation team in working with rehabilitation nurses have been less considered (13–16). Therefore, this qualitative study was conducted to explore the rich experiences of all members of the rehabilitation team on barriers and facilitators of rehabilitation nursing care for patients with disability in the rehabilitation hospital.

Materials and methods

Design

Deep understanding of different people's experiences about human phenomena such as rehabilitation nursing care can be achieved through qualitative research. Content analysis is one of the most widely used techniques in qualitative research, especially in the field of nursing, which aims to provide knowledge and understanding of the phenomenon studied. Since the aim of this study was to understand the experiences of nurses and other members of the rehabilitation team about barriers and facilitators of rehabilitation nursing care, this qualitative study was carried out with a content analysis approach (22–24).

Participants

The study population consisted of the members of the rehabilitation team in Rofaydeh Rehabilitation hospital in Tehran. Inclusion criteria include a bachelor's degree or higher and 6 months of work experience in a rehabilitation hospital for nurses; experience working with rehabilitation nurses for rehabilitation team members; experience of hospitalization in Rofaydeh rehabilitation hospital for patients and caregivers. Participants were included in the study based on purposeful sampling. the first participant was selected by the research team based on the participant's experience and willingness. Maximum variation in Sampling was performed to obtain a wide range of experiences. Eighteen persons including 12 nurses (eight clinical nurses, two head nurses and one educational supervisor, and one clinical supervisor), an occupational therapist, a physical medicine and rehabilitation specialist, a nurse assistant, a patient with multiple sclerosis with a history of three periods of hospitalization and a caregiver of a patient with stroke participated in this study.

Data gathering

Data were collected through 18 semi-structured in-depth interviews. Before the meeting, coordination was made about the time and place according to the participants' willingness. Before starting the interview, the necessary explanations about the research were provided and informed written consent was obtained. Based on the interview guide prepared by the research team, interviews started and continued with questions tailored to the role of each participant, for example, clinical nurses

were asked that "Please tell me what factors affect the care you provide to patients?" Rehabilitation team members were asked "what factors affect nurses' care provision based on your experience working with nurses?". The following questions were based on participant responses and the questions were referred differently. At the end of each interview, the interviewer was asked to provide additional information by asking, "Do you want to add anything else?". The interview continued for as long as the participant wanted and lasted an average of 45–60 min.

Data analysis

In this study, the data were analyzed using conventional content analysis based on the five stages of Graneheim and Lundman. In the first step, In the first stage, the recorded interviews were transcribed verbatim. The interviews were read several times to understand the whole sense of the interview. The text of the interview was read and divided into meaning units and were abstracted and labeled with a code. During coding and labeling meaning units, the main context and whole sense were considered. The codes were compared based on differences and similarities and sorted into categories. The tentative categories were discussed by the research team and revised. Finally, the underlying meaning, that is the latent content of the categories was formulated into themes (23). Interviews continued until no new categories or relevant themes emerged and the categories evolved in terms of conceptualization (24).

Trustworthiness and ethical consideration

In order to ensure the trustworthiness of the data based on Lincoln and Guba's evaluation criteria, credibility, dependability or accountability, transferability and confirmability were addressed. In this regard, the researcher was present in the research environment for more than a year to collect qualitative data and tried to gather valid information through prolong engagement in conducting interviews. Participants with maximum diversity were selected in terms of education, work experience, gender, and job position. Through the process of member check, the initial coding of interviews was examined by participants to verify the accuracy of the codes. Also, in order to conduct peer review, three faculty members familiar with qualitative research examined the codes and categories and agreed on interpretations. Clear and distinct descriptions of culture and context, selection and characteristics of participants, data collection, and analysis process were presented (22, 23, 25).

This research is part of a larger study. The present study has been approved by the Ethics Committee of the University of Rehabilitation Sciences and Social Health (Code of ethics: IR.USWR.REC.1400.069) In this study, the researcher adhered to ethical considerations such as confidentiality of participants' names, permission to record interviews, obtaining informed written consent to participate in the study, and the discretion of participants to withdraw from the study at each stage of the study.

Results

Participants characteristics

Eighteen persons including 12 nurses, an occupational therapist, a physical medicine and rehabilitation specialist, a nurse assistant, a patient with multiple sclerosis with a history of three periods of hospitalization, and a caregiver of a patient with stroke participated in this study. The nurses participating in the study included 8 clinical nurses, two head nurses, one educational supervisor, and one clinical supervisor. Among the nurses participating in this study, eight worked as clinical nurses, two heads of nursing, one clinical supervisor, and one educational supervisor at Rofaydeh Rehabilitation Hospital. The educational degree of nurses was from undergraduate to doctoral level. five nurses were master's students or graduates of nursing rehabilitation with an average of 2 years of work experience.

Three themes were derived from the data analysis, which represented Barriers and facilitators related to nurses (specialized knowledge and skills, psychological status, mentoring, professional communication), barriers and facilitators related to the work environment (nurses' performance evaluation, nursing workforce, comprehensive care facilities, workplace design, specialized unit), barriers and facilitators related to patients and caregivers (patient's participation in nursing care, patient adaptation, efficiency of formal caregivers).

Barriers and facilitators related to nurses

This theme suggests that some nurses' issues such as specialized knowledge and skills, psychological status, mentoring, and professional communication can affect the provision of rehabilitation nursing care.

Specialized knowledge and skills

This category stated that due to the lack of a comprehensive and special course in the field of rehabilitation nursing in the undergraduate nursing curriculum, nurses do not acquire specialized knowledge and skills in this field and face challenges while working in a rehabilitation hospital. The number of nurses with a master's degree in rehabilitation nursing is limited and these nurses often have little experience working in a rehabilitation hospital. Rehabilitation nursing care is specialized

care, and a lack of specialized knowledge and skills prevents the provision of comprehensive and specialized care. A nurse who is a master's student of rehabilitation nursing (p3) stated that:

> "At the undergraduate level, I learned a little bit about rehabilitation, but now that I'm studying rehabilitation, my perspective has changed… for example, I noticed that my colleagues didn't educate patients about home modification when they saw that I was training patients about it, they became curious, and I explained it to them".

In relation to the lack of specialized knowledge of novice nurses, (P6) mentioned this:

> "I have a bachelor's degree in nursing, when I came to this hospital, I knew nothing about rehabilitation, caring for people with disabilities was difficult for me because I only knew how to care for patients with general problems such as diabetes or heart diseases".

The hospital's educational supervisor (p12) stated:

> "One of our problems is the small number of nurses with rehabilitation expertise, some of whom are still students... To manage this problem, one of the prerequisites for employment in this hospital is to study the principles of rehabilitation, but it is not enough, because The field of rehabilitation is extensive, and we need to train them constantly to develop their knowledge and improve their skills".

Psychological status

Long-term hospitalization, slow progression and long recovery process of disabled patients, lack of psychological and emotional readiness of nurses to work in rehabilitation units, and difficulty of care are factors that impose a psychological burden on nurses. These psychological stresses affect nurses' performance and prevent them from comprehensively presenting their roles and responsibilities. (P6) in this regard stated:

> "a nurse who works in the rehabilitation hospital is under pressure... It's hard to see people with these conditions, Patients' condition affects our work…They always talk to us about their problems and it's too hard to listen to them Because their disease is often incurable, and we can only help them adapt... If something happens to them, even after discharge, we become very sad... they are like our family".

The psychological burden of care has made nurses feel that they need support, but the emotional and psychological status of nurses is usually ignored. In these conditions, psychological stress increases day by day and reduces their performance. (P7) described:

> "To continue working, nurses need to be emotionally strengthened.... One of our colleagues holds motivational classes for patients to strengthen their psychological condition, we also need to attend these kinds of classes…".

Mentoring

The number of nurses with rehabilitation expertise is limited and most of the nurses working in the rehabilitation hospital are general nurses. In this situation, rehabilitation nurses and experienced nurses as a mentor can help and guide their colleagues to provide better care. The presence of experienced nurses in each work shift can help to manage the problems of patients in specific situations. (P4), who has long work experience in a rehabilitation hospital, has explained:

> "When someone has the high experience, they know how to act in different situations, and a less experienced colleague can get help if needed".

p6, who has less experience in working in the rehabilitation hospital, has stated:

> "For example, there are some things that we may ignore, but the guidance of our experienced colleague or head nurse helps us to consider more details, and this affects our quality of care a lot, not just doing routine nursing work.... I learned a lot about rehabilitation this way".

In addition, some nurses have other responsibilities, such as specialized wound care, holding motivational classes for patients, or providing educational content and education in charge. The presence of nurses who have been trained and experienced in a particular field such as wound care can help other nurses in providing specialized care. (P1) who is in charge of education in one of the units stated:

> "I am in charge of education in this unit. I help my colleagues provide the best educational content for their patients...If they have questions about educating patients or need more educational resources, I will provide them".

Regarding the importance of having wound care specialist nurses in facilitating care, (P6) described:

> "Some nurses in this hospital are experts in wound care, they teach us how to dress different kinds of wounds, even when they are not in the hospital, we call them, and they guide us. In this situation, we can easily and correctly dress any wound".

Professional communication

Communication of rehabilitation team members with each other is one of the most important requirements of the rehabilitation process. Nurses 'communication with other members of the rehabilitation team helps to be aware of patients' progress in rehabilitation. Also, if any physical or psychological problem occurs in the rehabilitation process, therapists notify nurses and nurses can consider it in providing care. The occupational therapist participating in the study (p17) stated:

> "Sometimes patients have a hypotensive episode in the occupational unit, so we call and notify nurses, and when the patient returns to the unit, the nurses assess the patient's hemodynamic condition and take care of him/her, or when the patient complains of shoulder pain, we inform nurses to manage pain by using a sling or something else".

Communication among nurses is an important factor affecting care. The development of communication leads to the integration of the care process and the provision of comprehensive and safe care. One of the participating nurses (P1) stated:

> "We have a cyberspace group if special care like a new orthosis is prescribed to a patient, the head nurse informs us in the group, and everyone knows to consider it... The head nurse usually attends teamwork meetings and informs us of the results in person or online. In general, teamwork meetings are useful because we will be aware of the decisions of the rehabilitation team and the condition of patients so if patients need special care or medical intervention we will follow up".

Developing communication between patients and nurses leads to better awareness of different physical, psychological, social, and spiritual aspects of patients and providing individualized nursing care. In this regard, the patient participating in the study (p14) has stated:

> "In this hospital, we and nurses have a good relationship. We're really like a family so it's easier for us to tell them our problems, they understand us better and treat us according to our situation... I think everyone works better when the communication space is productive and friendly".

Barriers and facilitators related to the work environment

This theme suggests that factors such as nurses' performance evaluation, nursing workforce, comprehensive care facilities, workplace design, and the specialized unit can facilitate or hinder the delivery of care.

Nurses' performance evaluation

The performance of Nurses is constantly evaluated by supervisors and head nurses. These evaluations focus only on defects while nurses expect that positive aspects of their performance be considered as well. This method of evaluation reduces the motivation of nurses to provide care, causing them to only perform their duties and not try to improve the quality of care. (P4) noted that:

> "Each month, supervisors randomly select and review the records of several patients, nursing reports are carefully checked, and head nurses are informed about our mistakes. The focus is only on errors However, If the nurse has written a perfect and complete report, it will not be taken into consideration… Sometimes I wonder why I spend so much time writing a good report in detail, they don't care…".

Nurses expect different aspects of their care to be seen and receive positive feedback. P5 noted:

> "You know, it doesn't matter if someone is responsible, for example, I always check that patients do rehabilitation exercises that the physiotherapist gives them and use their night splints, I supervise patient caregivers to brush patients' teeth, despite all the positive work, I was never encouraged, but if there is the slightest mistake in the nursing report, I will be blamed immediately…".

Identifying and highlighting the positive points of nurses' performance can encourage them to provide better care. (P4) noted:

> "We expect our positive points of performance to be identified and when that doesn't happen, the importance of providing better care is diminished gradually and we will no longer be willing to provide the best care!".

Nursing workforce

One of the barriers to providing care is the nursing shortage that causes compressed work schedules. Nurses have to work more, and they don't have enough time to rest after work shifts. Continuous work and fatigue reduce their ability to provide high-quality care. One of the nurses (P5) pointed out:

> "We work overtime while we don't want it… Our working conditions are tough, and overtime makes us tired too much, we always feel tired because we can't get enough rest, we will no longer be able to think about comprehensive care".

In addition, most shifts are 18 h or 12 h to compensate for nursing shortage. One of the nurses (P4) described:

> "18-h shifts are too long, most of my shifts are 18 h, I come to the hospital from 13:00 and until 8:00 tomorrow and I only have 1 day to rest afterward. This not only increases the chances of errors but also prevents us from thinking about different aspects of rehabilitation.".

This problem also causes nurses to take care of more patients. Therefore, in addition to a compressed work schedule and long work shifts, the workload is also higher than the standard. This leads to less time to take care of each patient and focus on minimum requirements. One head nurse who is in charge of planning the work schedule (P9), stated:

> "Our unit has 19 beds. According to the standards of the Ministry of Health, we have three fewer nurses, so the working hours of our staff are increased, and Each nurse should take care of 10 patients and will not have enough time to meet all patients' needs or even talk to them".

Comprehensive care facilities

Patients with disabilities usually have comorbidities so, need some diagnostic tests or medical consults, that need to be done accordingly. Delays in treatment can make it difficult to provide care and will be challenging for nurses. Besides, Disabled patients are susceptible to acute events such as falling, seizure, or aspiration. In the absence of adequate facilities in these emergent conditions, nurses would be exhausted and cannot provide comprehensive care to their patients. The clinical supervisor participating in the study (P13) stated that:

> "We don't have CT scan or MRI in this center, and when a patient needs these tests, he/she should be transferred to another hospital, which can be dangerous for the patient and increase the workload of nurses. During the transfer, one nurse must take care of that patient so his/her colleague must take care of all patients in the unit".

The process of transferring the critically ill patient to other hospitals is very long. This long process prevents nurses from providing adequate and equal care for all patients. The nurse, who is a graduate of intensive care nursing (p5), noted:

> "We don't have an intensive care unit, when a patient gets severely ill, for example, suffering from respiratory distress, we have to focus on him/her …the patient's transfer is time-consuming...In this situation, we can't supervise the rehabilitation program of other patients, we need to prioritize care and provide only the acute and necessary care.".

Workplace design

Some parts of the hospital environment are not suitable for patients with disability. problems such as the long corridors make it difficult to access and monitor the patients properly. Most rooms have three beds, and the number of beds does not fit the room space. In these rooms, nurses have difficulty providing care because the risk of infection transmission is high, and it is impossible to protect patients' privacy and talk to them privately. Noisy and crowded rooms distract the patient during training and reduce the effectiveness and quality of education. Inappropriate design of rooms also makes it difficult to provide care such as dressing changes or intermittent catheterization. Caregiver of the patient participated (p15) in the study described:

> "Sometimes when nurses want to talk to my mother privately, they take her to another place, like the hospital yard, because their room has three beds… Sometimes, because the rooms are crowded, we may not understand some parts of their education and ask them to repeat it, It's hard and time-consuming. Nurses get tired".

An inappropriate environment in critical situations creates more challenges. A participant who had the experience of participating in cardiovascular resuscitation. (P8) stated:

> "Imagine that in this small room we want to bring an emergency trolley near the patient, there's no space for ourselves to resuscitate the patient... In this situation, in which every second is important, we should move everything around to find enough space for resuscitation".

Specialized unit

Only patients with similar problems are admitted to specialized units. Therefore, nurses better identify patients' needs, education becomes more specialized, and the safety and quality of care increase. One participant who works in the multiple sclerosis rehabilitation unit and previously worked in non-specialized units (P1) stated:

> "In our unit, only patients with MS are admitted... Nurses exactly know what problems and needs patients may have and they (nurses) know how to identify them… Medication errors decreased because patients have similar problems. It is easier to educate them…For example, we know how to treat patients with MS who have certain moods.".

In these units, similar problems of patients with certain diseases have been identified and protocols have been developed to manage them. These protocols help nurses to be aware

of special risks. Therefore, they can anticipate certain risks such as falling, aspiration, or seizure and prevent them. In addition, when these happen, nurses can provide acute care more quickly and accurately. P10 who works in the stroke unit noted:

> "In our units, some of our patients are susceptible to seizure, a protocol has been developed for seizure management, so our nurses know how to take care of a convulsing patient...., patients with stroke are also prone to shoulder subluxation and pain, so we assess this problem in all patients and train their caregivers to prevent subluxation... patient safety improves because we take care according to a specific protocol".

Barriers and facilitators related to patients and caregivers

This theme indicates that the patient's cooperation with the nurse facilitates the provision of care and the inefficiency of caregivers in performing their duties is an obstacle in the provision of rehabilitation nursing care.

Patient's participation in nursing care

Rehabilitation nursing care requires patient participation in rehabilitation exercises, repetition of trained skills, and adherence to treatment. If the patient is not cooperating, the nurse should spend more time repeating rehabilitation and training interventions and not make progress in learning new skills. Also, patient cooperation in observing the principles of safety and health facilitates the provision of safe and quality care. The patient participant noted:

> "Well, some patients do not cooperate with the nurses, for example, the nurse asks the patient to take his medication on time, but the patient does not pay attention and the nurse has to go to the room several times and remind the patient to take his medication."

Considering the importance of patient participation in providing safe care, the caregiver participating in this study stated:

> "Sometimes patients don't listen to nurses and do dangerous things. For example, nurses emphasize that they should get help from the caregiver to get out of bed and not to go out on their own, but not to pay attention."

One of the participating nurses also stated:

> "When patients cooperate with us, our work gets better, for example, when I teach the patient how to do CIC and he participates and learns to do it independently, I can teach him more and he will become independent sooner."

Patient adaptation

Patients admitted to rehabilitation services shortly after injury or illness may not yet be able to adapt. In these situations, denial of physical problems or illness causes them to reject the exercises and training provided by nurses. Failure to accept the condition and functional limitations may put patients at risk and make it difficult for the nurse to take care of them. Some patients are stubborn with nurses at this stage and do not pay attention to nurses' care recommendations. The participating nurse working in the brain and spinal cord injury unit (P4) stated:

> "It is difficult for the patient to cope with what happened to him, especially the patient who suffers from a spinal cord injury due to an accident and the patient is stubborn in the first days, does not want to listen to the training. We need to spend a lot of time talking to them to be satisfied to take care of ourselves."

These patients also suffer from psychological problems that make them less receptive to rehabilitation nursing care. A nurse working in the multiple sclerosis unit (P1) noted:

> "When a patient is diagnosed with MS and hospitalized for treatment and rehabilitation during the attack phase, he or she does not pay attention to the recommended diet or behave aggressively..."

Efficiency of formal caregivers

Many patients employ formal caregivers, and this has increased during the COVID-19 pandemic. Although these caregivers are introduced to patients by the hospital, their eligibility for patient care is not assessed. Most of them do not have enough knowledge or experience to care for patients with disability. Therefore, instead of using this time to provide comprehensive care for patients, nurses should spend a lot of time training caregivers and monitoring their work. (P9) described:

> "One of our biggest challenges at this hospital is private caregivers (formal caregivers). Instead of spending time caring for the patient, we need to educate the private caregivers while these trainings should have been given to them before … We must constantly monitor their work to prevent them from making mistakes".

In addition to being incompetent for patient care, they do not cooperate well with nurses. This leads to an increase in the workload of nurses and exhausts them. (P3) stated in this regard:

> "It's the duty of the caregiver to help patient to do their exercise but they evade from their responsibilities.... Patients should be taken to rehabilitation units on time, but they don't care… we are too busy to check them all the time, it is annoying that we should remind them everything....".

Although the incompetence of official caregivers creates many problems for nurses, the relevant authorities are not aware of the importance of their role and do not monitor the performance of formal caregivers. One of the participating head nurses (p10) stated:

> "Lack of cooperation of caregivers is a burden on nurses, the others do not care. For example, one of our officials said that we don't care who wants to take care of the patient...., while the caregivers and their performance are very important".

Discussion

The aim of this study was to investigate Barriers and facilitators of rehabilitation nursing care for patients with disability in the rehabilitation hospital. The findings indicated that some of these factors are related to nurses, patients, and caregivers and some are related to the work environment. Specialized knowledge and skills, psychological status, mentoring, and professional communication are barriers and facilitators factors. The need for specialized knowledge and skills to provide rehabilitation nursing care can be a barrier to providing nursing care. Because of the shortage of nurses with rehabilitation expertise, general nurses with undergraduate education or nurses with other specialties provide care in the rehabilitation hospital. These nurses have not received adequate rehabilitation training and have no special skills in providing rehabilitation care. Previous studies have consistently shown that one of the challenges of rehabilitation nursing care is inadequate training of nurses and a lack of specialized knowledge in the field of rehabilitation (16, 26). The knowledge and skills of nurses affect their performance in providing care, their relationship with patients, and the rehabilitation process (27). In the absence of sufficient knowledge and non-specialized skills, rehabilitation care is not fully provided, participation of nurses in the rehabilitation process is limited, achieving optimal results becomes difficult, and the risk of injury increases (16, 26, 28). According to the findings of this study, in such situations where the number of nurses with rehabilitation expertise is limited, guidance from rehabilitation nurse specialists, nurses with other specialties such as wound care, or experienced nurses are facilitators of rehabilitation care. In accordance with these results, evidence in stroke rehabilitation shows that assisting clinical nurses by advanced professional nurses plays a key role in better understanding comprehensive care and leads to improved care (15).

As a facilitating factor related to nurses, the professional communication among nurses, nurses with other members of the rehabilitation team and nurses with the patients and their caregivers lead to a better understanding of the patient's condition and rehabilitation process. As a result, this improves the performance of all members of the rehabilitation team especially nurses. In line with these findings, previous studies have also shown that communication and teamwork of nurses with each other, as well as other rehabilitation team members, are important facilitators in providing care, increasing the quality and safety of care, and reducing missed nursing care (4, 14, 16, 29).

The findings also indicate that working in rehabilitation units imposes psychological stress on nurses. Because of the close and long relationship between nurses and patients with disability, nurses are faced with patients' problems, and this puts nurses under pressure. The results of other studies also indicate that working in rehabilitation units is very challenging and has a great psychological burden on the members of the rehabilitation team because they are in contact with patients who have experienced unpleasant events, some suffer from pain and they have various physical, psychological, familial, or social obstacles in the path of rehabilitation. In such situations, rehabilitation nurses experience very high psychological stress which leads to emotional exhaustion (21, 30–32). These work-related psychological problems affect the quality of care and, if continued, cause burnout of nurses, which negatively affects the provision of care (33).

The results of this study also indicate that nurses' performance evaluation, nursing workforce, comprehensive care facilities, workplace design, and specialized unit are barriers and facilitators related to the work environment. Based on the findings, the lack of an accurate method of evaluating nurses' performance, focusing solely on weaknesses and deficiencies, and ignoring the positive points of nurses' performance have made them unmotivated in providing care. This can cause nurses to only meet minimum standards and not try to improve care. Evidence also suggests that a lack of encouragement for nurses causes a lack of motivation, affects their performance, and causes less attention to their responsibilities (34). This also leads to reduced responsibility, neglecting patient needs, lack of follow-up, and repeated missed nursing care (35). This situation along with high psychological pressure and heavy workload can cause burnout in nurses (33, 34).

Shortage of the nursing workforce as a barrier increases the working hours and the workload of nurses. In general, caring for patients with disabilities is heavy and difficult and rehabilitation nurses manage disability and associated diseases, meet basic needs, help to perform activities of daily living, and promote the

mental health and social status of patients (7, 8, 16). Providing care in this wide range is harder despite the shortage of nursing staff and this prevents comprehensive rehabilitation nursing care. In addition, a high workload can reduce the quality of care and patient outcomes and increase the occurrence of undesirable events such as falls and infections (16, 18, 36).

In addition, due to the lack of comprehensive facilities and resident physicians, nurses face challenges in providing care when acute problems occur. Therefore, the long process of transferring patients for diagnostic tests or intensive care facilities attracts most of the nurses' attention to critical patients and reduces attention to other patients. It is not uncommon for disabled patients to have acute care needs and may need to be transferred to an acute care facility. Therefore, rehabilitation units should be close to acute care facilities and rapid and uninterrupted transfers must be available (37, 38). It is also advisable to equip rehabilitation hospitals with some acute care facilities, such as CT scan imaging so that some problems can be managed without transferring patients to other centers. All these factors affect patient care and can improve the quality of care and outcomes (37–39).

The workplace design for providing care has also created challenges for nurses. Problems such as lack of space prevent nurses from providing education in a calm environment, protecting the privacy and private dialogue with patients, observing hygiene principles and infection control, and acute care. In confirming these results, evidence suggests that the environment affects nurses' performance and can improve the efficiency, effectiveness, and safety of care (12). Other studies also show that environmental barriers affect the relationship between nurse and patient. Single bedrooms can somewhat resolve privacy and infection control, and the patient's distraction in providing education (12, 40). Participants in this study also stated that the design of units has given them less access to patients' rooms. Problems such as long ways to access patients can negatively affect nurses' readiness to provide care and cause dissatisfaction (20).

The results of this study show that some characteristics of the care environment such as specialized units facilitate professional care. In this situation, nursing care and patient education are provided in a specialized manner, patients' problems are well identified, and managed, and safer care is provided. Previous studies also show that the expertise of nurses, specialized nursing care, specific rehabilitation interventions, and provision of rehabilitation care in specialized units lead to better care and achieving more favorable outcomes for patients (38, 41).

Barriers and facilitators related to patients and caregivers were patient participation in nursing care, patient adaptation, and efficiency of official caregivers. Findings indicated that patient participation in rehabilitation nursing care facilitates care delivery. Evidence also indicated that patient participation is one of the most important and fundamental factors and prerequisites for nursing care and the rehabilitation process (42–44). Patients' participation in nursing care facilitates the provision of care, improves nurses' performance, and achieves desired outcomes for patients (42, 43, 45–48). Findings from the literature review show that one of the ways to increase patient participation is to improve nurse-patient communication (43, 49, 50). The professional relationship between nurse and patient is another facilitating factor of rehabilitation nursing care in this study. Therefore, paying attention to improving professional communication can improve synergy by facilitating patient participation to facilitate the provision of rehabilitation care.

The findings of this study indicated that patients' adaptation to their situation facilitates the provision of rehabilitation nursing care. Sister Callista Roy, a nursing theorist, has proposed an adaptation model through which nurses assist patients in achieving adaptation, in other words, nurses facilitate patient adaptation (51–53). However, the authors of this study did not find evidence as to whether the patient's adaptation to their condition facilitates the provision of nursing care.

Another barrier to care is the inefficiency of formal caregivers. The incompetence of formal caregivers forces the nurse to train and prepare them for care and constantly supervise their work. Evidence also suggests that the unpreparedness of caregivers is one of the barriers to rehabilitation care (38). Other studies indicate that there is no specific framework for training and supporting caregivers, causing nurses to spend time to training and preparing them for care to compensate for this shortage. This increases their workload and prevents them from providing rehabilitation care (12, 39–41).

Regarding our results and previous evidence, we state that managers, researchers, and clinical nurses can play an important role in strengthening the facilitator and removing barriers. Nursing managers can improve nurses' professional knowledge, skills, and professional communication by holding training courses with different topics such as rehabilitation principles, communication, and teamwork skills. Proper workplace design for provision of rehabilitation care, equipping and specializing the care units and standard workforce allocation are other tasks that can be done by managers to facilitate rehabilitation care. Clinical nurses' efforts to gain more knowledge and skills and improve communication and collaboration with other members of the rehabilitation team can help them provide better care. Nursing researchers can design and implement interventions in future research to improve nurses' psychological status, increase participation, patient adaptation and efficiency of formal caregivers.

Conclusion

The results of this study indicated that there are several factors in facilitating or inhibiting the provision of rehabilitation

nursing care, some of which are related to nurses, patients and caregivers, and the work environment. Barriers can negatively affect the quality and safety of care, prevent comprehensive care, increase missed nursing care, and cause exhaustion and burnout in nurses. Facilitating factors also promote professional care and provide comprehensive care. Considering the impact of barriers and facilitators on the quality and safety of care, recognizing barriers and facilitators, and planning to eliminate or strengthen them are very important. The results of this study remind us that achieving this goal depends on improving nurses' situation, paying attention to patients and their caregivers, and resolving work environment shortcomings. this finding can help managers, researchers, and clinical nurses to modify these factors to improve rehabilitation nursing care. Considering this study was conducted in the inpatient rehabilitation hospital, it is suggested that future studies be performed in different settings.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by IR.USWR.REC.1400.069. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SSh conducted interviews and qualitative analysis. All authors designed the study, drafted the manuscript, reviewed the data, read, and approved the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Knowledge, attitudes and practices of healthcare professionals toward the novel coronavirus during the early stage of COVID-19 in a lower-and-middle income country, Bangladesh

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Healthcare workers (HCWs) are at an increased risk of COVID-19 infection because of their direct exposure to suspected and confirmed coronavirus patients in healthcare facilities. This condition is even more acute in low-and lower-middle-income countries (LMICs). Given the poor healthcare settings of Bangladesh, it is challenging to halt the spread of infection without proper knowledge, attitudes, and good behavioral practices (KAPs). Therefore, this study conducted a cross-sectional study from May 5 to 31, 2020, with 203 healthcare professionals to determine the knowledge, attitudes, and practices (KAP) toward COVID-19. Participants were doctors, nurses, dentists, and allied health professionals. A self-administered questionnaire including several KAP-related items aligned with the World Health Organization (WHO) guidelines was distributed over various online platforms to collect data. Bivariate and multivariable logistic regression analyses were conducted to determine the factors influencing KAP levels. The majority of participants were male (52.22%). The prevalence of high knowledge levels, positive attitudes, and good practices were 51.23, 45.81, and 49.75%, respectively. Social media was the most common source for seeking coronavirus information. Workers at private institutions were less likely (OR = 0.56, 95% CI = 0.30–0.95, $p < 0.05$) to be knowledgeable than workers at public institutions. Doctors had more positive attitudes than other healthcare professionals. Older participants showed high rates of good behavioral practices (OR = 1.05, 95% CI = 1.06–1.32, $p < 0.05$) than younger ones. Workers at private institutions had a better practice level toward COVID-19 (OR = 2.11, 95% CI = 1.17–3.83) than those at public

institutions. These results point to the necessity for proper training programs for medical professionals that help them gain confidence to deliver the correct treatment to their patients and the need to implement preventative steps during pandemics.

KEYWORDS

KAP, COVID-19, SARS-CoV-2, healthcare workers, lower-and-middle income country, Bangladesh

Introduction

The novel coronavirus disease 2019, known as COVID-19, brought an unprecedented risk to public health worldwide. On January 30, 2020, the World Health Organization (WHO) declared COVID-19 a global public health emergency and urged all countries to take coordinated action to halt the spread of the virus (1). Globally, healthcare workers (HCWs) have been playing frontline roles in fighting the COVID-19 pandemic. However, the lack of resources and unavailability of vaccines prevented HCWs from tackling the virus successfully. Governments worldwide have implemented non-pharmaceutical measures, including stopping economic activity, restricting the movement of people, and maintaining social distancing to combat the spread of the infection (2). Despite these measures, the world has witnessed more than 500 million cases and more than six million death as of July 1, 2022 (3).

On March 8, 2020, Bangladesh reported its first case of novel coronavirus and consequently, first death from COVID-19 confirmed on March 18, 2020 (4). As of July 1, 2022, Bangladesh reported COVID-19 cases surpassed 1.9 million, and deaths exceeded 29,000 (5). In an immediate response to halt COVID-19, the Bangladesh government took several steps, including reducing international flights, checking and quarantining incoming travelers for 14 days, declaring the closing of educational institutions, implementing a nationwide lockdown, regulating inter-district movements, suspended commercial activities except for essential services, and ceased social gatherings (2, 6, 7). Further, several organizations voluntarily disseminated extensive public service announcements (PSAs) on COVID-19, stressing the need of public health measures including handwashing, mask use, and social isolation (8). Being one of the world's most populous nations, Bangladesh still experienced significant difficulties keeping track of people's knowledge, attitudes, and behaviors regarding the newly emerged and potentially devastating COVID-19 pandemic (9).

HCWs are at an increased risk of infection because of their direct exposure to suspected and confirmed coronavirus patients in healthcare facilities. This condition is even more acute in low and lower-middle-income countries (LMICs), where health service capacity is poor, and population density is high (10). It has been reported that the increased demand for healthcare services combined with a shortage of qualified medical professionals led to a high rate of COVID-19 infection among HCWs (11). Further, because of long working hours caused by the lack of personnel, HCWs often fail to ensure proper safety, leading to infection (12). A meta-analysis reported that the prevalence rate of HCWs infected with SARS-CoV-2 was 10.1%, including 4.2% in China, 9% in Italy, and 17.8% in the USA (13). In Bangladesh, the mortality rate of HCWs was relatively low (0.05 per 100,000 population); however, these data don't accurately portray the actual scenario since testing capacity and research data were inadequate (14). Studies revealed that HCWs' lack of knowledge and misconceptions may have led to delays in diagnosis and poor infection prevention practices (11, 15). Experience gained from the previous Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 revealed that inadequate knowledge, negative attitudes, and poor behavioral practices (KAPs) regarding infectious diseases impeded containment and inhibited further transmission (16). Thus, HCWs need to be up-to-date about COVID-19 to protect themselves from infection and prevent the spread of the virus within the same hospital (17).

Earlier studies have reported KAPs regarding COVID-19 among HCWs in different contexts (11, 15, 17–19). A study conducted among 686 HCWs in Ethiopia reported that 73.3% of participants had satisfactory knowledge, 54.8% had a good attitude, and 61.5% practiced COVID-19 preventive measures. These participants' knowledge levels were negatively correlated with attitude and practice scores (20). Another study in Turkey found that 91.66% ($n = 251$) HCWs answered correctly for knowledge-based questions, 85.96% ($n = 251$) for precautionary measures questions, and knowledge scores were positively associated with preventive behavior (21). A study in Nepal found that 76% of HCWs reported adequate knowledge, 54.7% reported positive attitudes, and 78.9% reported behavioral practices; here, knowledge was positively associated with attitudes and practices (19). A global systematic review with 20 studies including 12,072 HCWs reported a 75.8% had good knowledge, 74.6% had positive attitudes, and 79.8% had good practices toward COVID-19 (15). Based on this literature and

the evolving COVID-19 scenario, it is still necessary to identify the coronavirus's KAP among HCWs. Such findings would give more insight into how Bangladesh might avoid the continued spread of the outbreak.

The healthcare sector, particularly in Bangladesh, is of great concern (10, 22). In the early stages of COVID-19, Bangladesh lacked the necessary healthcare infrastructure, a shortage of personal protective equipment (PPE), and testing kits to effectively contain the spread of the disease (23). As a result, HCWs might have been deprived of systematic training regarding COVID-19 precautionary measures. Further, hospital administration turned away patients without protective gear. These feelings of unequal treatment influenced them to hide their symptoms, which complicated the treatment of regular patients (23). Such poor healthcare services, overcrowded environments in the hospital, and lack of isolation facilities are likely to be compounded by insufficient knowledge and poor infection control and practices mechanism of HCWs that lead to further transmission of infection (24). Like other countries, Bangladesh also followed WHO-recommended guidelines and organized training by government health institutes across the country to prevent the spread of disease (25, 26). Despite the availability of resources, significant numbers of HCWs still had limited knowledge, attitudes, and practices toward COVID-19. Given the limited healthcare settings of Bangladesh, it would be challenging to halt the spread of infection without proper knowledge and good behavioral practices. There is a dearth of studies to date that calculate the KAPs toward COVID-19 among HCWs in Bangladesh.

In the present study, we determined the KAPs regarding COVID-19 among HCWs. In Bangladesh, there have been two studies on the KAP of HCWs. One study conducted the KAPs of COVID-19 during the early stage of the pandemic among 393 healthcare workers (27). However, it focused only on PPE as a means of preventive practices and provided little details about other measures such as knowledge and attitudes. Another study employed a relatively large sample of HCWs but was restricted to a single area of Bangladesh and performed just before the second wave of the pandemic when the pandemic had already attained great attention, and several initiatives had been taken to enhance public awareness (14). Considering this research gap, the present study aimed to determine KAPs toward COVID-19 among HCWs using a nationwide sample during the early stage of the pandemic.

Methods

Study design and participants

We conducted a cross-sectional study through online platform. Physicians and other medical staff in Bangladesh who have licenses from the Bangladesh Medical and Dental Council or the Bangladesh Nursing and Midwifery Council were considered for the target participant of this study. The study was conducted between May 5, 2020, and May 31, 2020. The researcher disseminated a semi-structured Google form questionnaire across their own social networks (including private Facebook and WhatsApp groups) to collect data. The survey was undertaken using a convenient sampling strategy. This study was not motivated by a specific hypothesis and was, instead, mostly exploratory. This is why a formal statistical test or power analysis was not used to estimate the minimal sample size in advance. Instead, we calculated after the fact that a sample size of 203 healthcare workers would have allowed us to estimate a two-sided 95% confidence interval with strict precision of 5%, even if only 20% of the study participants could have developed good knowledge, attitude, and good practice toward the COVID-19 pandemic. The study was carried out in accordance with the Declaration of Helsinki and the highest ethical standards were maintained throughout the study. Every participant who took part in the research first gave their electronic permission to take part. Ethical approval for this research was granted by the Institute of Disaster Management at Khulna University of Engineering & Technology, Khulna 9203, Bangladesh.

Measures

The survey measured sociodemographic characteristics, including gender, age, place of residence, current living status, education, healthcare professions type, frontline status, type of healthcare institution, work experience, and daily working hours. Gender was assessed by asking participants whether they male or female. Age was determined as the two group: $\leq$30 or above 30. Place of residence of the respondents were defined as urban or rural. Respondents were asked about their current living status on three options including living with family members, living with non-family members or living alone. Education level of the participants were classified into five groups: college (2 years of post-secondary education), undergrad (4 years of post-secondary education), graduate (undergrad completed but not enrolled in Masters level education), postgraduate (enroll in or completed master's) and advance (MPhill, PhD) (7, 23). Participants professions were further categorized into four groups: doctors who passed a Bachelor of Medicine and Bachelor of Surgery (MBBS) and practiced medicine; nurses who provided technical assistance to doctors as well as those involved in administrative work at hospitals; dentists who completed a Bachelor of Dental Surgery (BDS) degree and practiced dentistry; and allied health professionals such as physiotherapists, occupational therapists, mental health counselors, and physician assistants (23). Frontline status was determined by asking whether they directly involved with any COVID-19 patient care. Type of

healthcare institute was characterized by public vs. private institute. Work experience of the respondents were categorized as <5 years, 5–9 years or >9 years of experience. The daily work hours were determined as <8 h vs. ≥8 h. The KAP assessment was evaluated with WHO guidelines. In addition, participants' sources of COVID-19 related information were evaluated. Options included governmental health agencies, international agencies (e.g., WHO), medical journals, hospital training programs, public and private media, online media, and traditional news sources.

Knowledge assessment

Knowledge regarding COVID-19 was assessed using eight questions, including the type of infection, common symptoms, incubation period, mode of transmission, the likelihood of exposure, and effectiveness of the mask. Respondents were asked to rate their responses as "yes," "no," or "don't know." Correct responses were recorded with a score of 1, and an incorrect or uncertain answers received a score of 0 following (28, 29). The total score for knowledge ranged from 0 to 8. Individual knowledge scores were assessed with scores above the mean as good and otherwise as poor knowledge regarding COVID-19. This threshold between good and poor knowledge enhances finding's interpretability and responds to variations in information sources across groups (30). Internal consistency of the knowledge scale was determined using Cronbach's alpha. This score was 0.78, indicating that the data were internally consistent.

Attitude assessment

Attitudes toward COVID-19 were assessed by asking five questions: fear of COVID-19 infection, worry about social support, disclosure of patient's exposure to the doctor, willingness to treat COVID-19 patients, and feelings of fatigue after the outbreak. Respondents were asked to rate their attitudes toward each question on a 5-point scale from not at all (0) to very high (4). The overall score was the sum of the five questions and ranged from 0 to 20. Individuals who scored higher than the mean were categorized as having a positive attitude, and those who scored lower than the mean were labeled as having a negative attitude. This classification also corresponds with prior research, aids in findings interpretation, and addresses demographic variations (30). Cronbach's alpha was 0.76, indicating a high degree of internal consistency.

Practice assessment

Behavioral preventative measures were assessed with eight items, including maintaining quarantine with family, washing hands, participating in a COVID-19 related training program, using and removal of PPE in the hospital, using of medical mask, and avoiding social gatherings. Each item was answered on a 5-point scale ranging from never (0) to always (4). The total score was the sum of the eight items and ranged from 0 to 32. A score above the mean indicated good practices, and a score below the mean indicated poor practices. Once again, this score was classified into two levels for the same reasons as the knowledge and attitude classifications (30). Cronbach's alpha was 0.79, indicating a high degree of internal consistency.

Statistical analysis

Frequency distributions were used to assess healthcare professionals' KAPs toward COVID-19 transmission. Categorical data were presented as frequencies (%), while continuous data were displayed as means and standard deviations (SD). We used the Shapiro-Wilk test to check the normality of the data. Since our data failed to meet the assumption of a normal distribution, non-parametric tests were used to determine the relationship between mean KAP scores and sociodemographic variables. Univariate analyses for association between KAP levels and sociodemographic variables were performed using Chi-square or Kruskal-Wallis tests when appropriate. Multivariable logistic regression analysis was conducted to determine predictive factors of KAP levels while holding other sociodemographic factors constant. Only significant variables in the univariate analysis were included in the multivariate analysis. The significance of the associations was determined with odds ratios (OR) and 95% confidence intervals (CI). SPSS statistical software (version 26) was used to analyze the data.

Results

Sociodemographic characteristics of the sample

Table 1 summarizes the sociodemographic characteristics of the respondents. About half were female (47.78%, $n = 97$). More than half were 30 years old or younger, and the majority lived in an urban area (95%, $n = 194$). Nearly 85% ($n = 172$) lived with their family members during the pandemic. More than half (52.2%, $n = 106$) received at least a graduate level of education. Regarding profession type, most were doctors ($n = 150$), followed by nurses ($n = 24$), dentists ($n = 22$), and allied health professionals ($n = 7$). Most (75%, $n = 121$) of worked for public hospitals. Approximately 40% ($n = 81$) were frontline workers during the pandemic. More than half (52.22 %, $n = 106$) had <5 years of job experience after earning their graduation. Over 80% ($n = 169$) worked more than 8 h daily.

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TABLE 1 Sociodemographic features of the respondents ($N = 203$).

Variables	*N* (%)
Gender	
Male	106 (52.22)
Female	97 (47.78)
Age (years)	
≤30	113 (55.67)
>30	90 (44.33)
Place of residence	
Urban	194 (95.57)
Rural	9 (4.43)
Living status	
With family members	172 (84.73)
With non-family members	24 (11.82)
Alone	9 (3.45)
Education	
College	6 (2.96)
Undergraduate	15 (7.39)
Graduate	106 (52.22)
Postgraduate	67 (33)
Advanced degree (MPhil, Ph.D.)	9 (4.43)
Healthcare profession	
Doctor	150 (49.50)
Nurse	24 (7.92)
Dentist	22 (7.26)
Allied health	7 (2.31)
Healthcare institution type	
Public	121 (59.61)
Private	82 (40.39)
Frontline worker	
Yes	81 (39.90)
No	122 (60.10)
Years of employment	
<5 years	106 (52.22)
5–9 years	46 (22.66)
>9 years	51 (25.12)
Working hours per day	
<8 h	34 (16.75)
≥8 h	169 (83.25)

Knowledge assessment

Table 2 demonstrates the knowledge assessment of healthcare professionals in Bangladesh during the pandemic. The mean score was 7.44 (±0.66). About 51% ($n = 104$) achieved high knowledge scores. Most (99.01%, $n = 201$) had good knowledge of the type of COVID-19 infection. All participants knew that the common symptoms of COVID-19 disease were fever, cough, sore throat, and shortness of breath.

TABLE 2 Knowledge assessment of healthcare professionals during COVID-19.

Statement	*N* (%)	
	Correct	Incorrect
COVID-19 is a viral infection	201 (99.01)	2 (0.99)
Its common symptoms are fever, cough, sore throat, and shortness of breath	203 (100)	0 (0.00)
Its incubation period is up to 14 days with a mean of 5 days	201 (99.01)	2 (0.99)
It is transmitted through respiratory droplets such as cough and sneezing	202 (99.01)	1 (0.99)
Close contact with a confirmed case is a significant risk factor for COVID-19	203 (100)	0 (0.00)
N-95 mask is effective in reducing the spreading of COVID-19	190 (93.60)	13 (6.40)
People with chronic disease and over 60 years are at most risk of COVID-19	199 (98.03)	4 (1.97)
Antiviral drugs can reduce the symptom of COVID-19	111 (54.68)	92 (45.32)
Knowledge score		
Mean score (±SD)	7.44 (±0.66)	
High	104 (51.23)	
Low	99 (48.77)	

Most knew that the incubation period of the onset of the disease was up to 14 days, with a mean of 5 days, and that the disease was transmitted through respiratory droplets such as during coughing and sneezing. All reported that close contact with a confirmed case is a significant risk factor for transmission. Most (93.60%, $n = 190$) had good knowledge of the effectiveness of N-95 masks in reducing infection. Most (98.03%, $n = 199$) also reported that people with chronic diseases and those over 60 years old were at the most risk. More than half (54.68%, $n = 92$) recognized that antiviral drugs could reduce symptoms of COVID-19.

Attitude assessment

Table 3 presents the attitude assessment of HCWs in Bangladesh during the COVID-19 pandemic. The mean score was 10.27 (±4.54). More than half of respondents (54.19%, $n = 110$) showed negative attitudes toward COVID-19. One-third (38.42%, $n = 78$) were slightly afraid of becoming infected with COVID-19. Around 19% ($n = 39$) reported that they were high levels of worry about social support, while 31.03% ($n = 63$) reported a little worry about social support. Most (36.95%, $n = 75$) agreed that patients should disclose exposures to doctors. Nearly half (45.32%, $n = 92$) were highly willing to

TABLE 3 Attitude assessment of healthcare professionals during COVID-19.

Statement	*N* (%)				
	Not at all	A little bit	Moderate	High	Very high
Afraid of becoming infected with COVID-19	22 (10.84)	78 (38.42)	52 (25.62)	32 (15.76)	19 (9.36)
Being worried about social support	18 (8.87)	63 (31.03)	55 (27.09)	39 (19.21)	28 (13.79)
Patient should disclose their exposure to the doctor	31 (15.27)	17 (8.37)	37 (18.23)	43 (21.18)	75 (36.95)
Willing to treat COVID-19 patients if get an opportunity	20 (9.85)	30 (14.78)	61 (30.05)	47 (23.15)	45 (22.17)
Feelings of fatigue due to overwork during pandemic	33 (16.26)	78 (38.42)	39 (19.21)	32 (15.76)	21 (10.34)
Attitude score					
Mean score (±SD)			10.27 (±4.54)		
Positive			93 (45.81)		
Negative			110 (54.19)		

TABLE 4 Behavioral practice assessment of healthcare professionals during COVID-19.

Statement	*N* (%)				
	Never	Rare	Sometimes	Often	Always
Maintain quarantine with family	26 (12.81)	14 (6.90)	63 (31.03)	34 (16.75)	66 (32.51)
Wash hands more frequently than before	3 (1.48)	2 (0.99)	49 (24.14)	47 (23.15)	102 (50.25)
Participate in a training program for COVID-19	79 (38.92)	24 (11.82)	52 (25.62)	32 (15.76)	16 (7.88)
Participate in an online training program on COVID-19	64 (31.53)	12 (5.91)	65 (32.02)	34 (16.75)	28 (13.79)
Use PPE in hospital	46 (22.66)	10 (4.93)	53 (26.11)	33 (16.26)	61 (30.05)
Remove PPE carefully	5 (2.46)	5 (2.46)	43 (21.18)	31 (15.27)	119 (58.62)
Use a medical mask when go outside	44 (21.67)	8 (3.94)	40 (19.70)	38 (18.72)	73 (35.96)
Avoid social gathering	3 (1.48)	5 (2.46)	44 (21.67)	43 (21.18)	108 (53.20)
Practice score					
Mean score (±SD)			20.03 (±7.05)		
Good			101 (49.75)		
Bad			102 (50.25)		

treat COVID-19 patients if they got the opportunity. Only 9.85% ($n = 20$) stated unwillingness to treat any COVID-19 patients. Around 38% ($n = 78$) reported feeling a little fatigue after the outbreak, while 15% ($n = 32$) reported high fatigue after the outbreak.

Practices assessment

Table 4 shows the behavioral practices of respondents toward COVID-19. The mean score was 20.03 (±7.05). Approximately half of the respondents (49.75%, $n = 102$) showed good behavioral practices toward COVID-19. One-third (32.52%, $n = 66$) always maintained quarantine with their family. More than half (50.25%, $n = 102$) washed their hands more often than before. Only 7.88% ($n = 16$) reported participating in training programs on COVID-19, while 13.79% ($n = 28$) reported participating in online training programs. Although only 30% ($n = 61$) of respondents reported frequent use of PPE in hospitals, more than half (59%, $n = 119$) reported always removing PPE carefully. Nearly two-thirds (58.62%, $n = 119$) reported that they always used a medical mask, while more than half of respondents (53.20%, $n = 108$) reported avoiding social gatherings when going outside.

Information sources

Figure 1 illustrates the information sources used by HCWs for COVID-19 information. The majority reported getting information from social media (86.21%). Around 73% of respondents used television for COVID-19 information. About 69% relied on the government press releases for information, while 64% received information from the WHO. More than half used medical journals (57.64%) or newspapers (51.23%) for relevant information. Only 37% used hospital training programs for COVID-19 information.

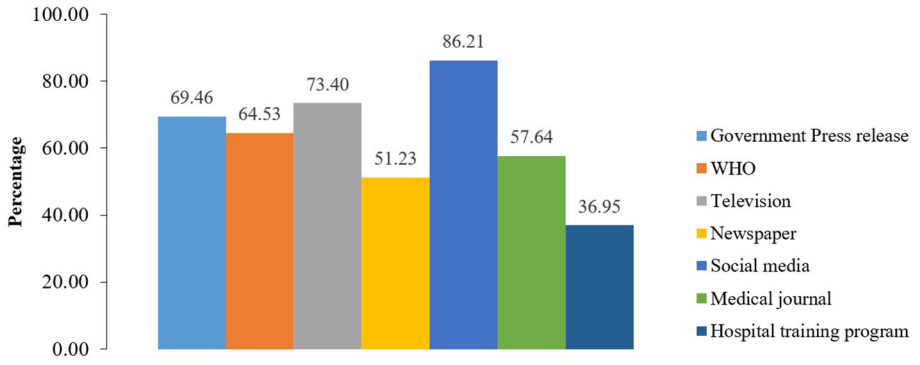

FIGURE 1
Sources of information on COVID-19 disease among healthcare workers.

Factors influencing the KAPs of HCWs during COVID-19

Table 5 shows the factors influencing the knowledge levels of healthcare professionals during COVID-19. The type of working institution was the only significant factor; respondents working in private institutions were less likely to be knowledgeable than workers in public institutions (OR = 0.56 95% CI = 0.30–0.95, $p < 0.05$).

Table 6 shows the factors influencing the attitude levels of healthcare professionals during COVID-19. Results showed that type of healthcare profession was the only significant factor: doctors were more likely to have positive attitudes than other working professions.

Table 7 presents the factors influencing the behavioral practices of healthcare professionals during COVID-19. Results showed that age and type of working institution were significant. Participants over 30 years old were more likely to show good behavioral practice than younger participants (OR = 1.05, 95% CI = 1.06–1.32, $p < 0.05$). Participants in private institutions also had high likelihoods of good practices (OR = 2.11, 95% CI = 1.17–3.83).

Discussion

Summary of the main findings

Globally, healthcare workers are at an increased risk of COVID-19 infection because of their direct exposure to suspected and confirmed coronavirus patients (31). In some cases, healthcare workers (HCWs) were also sources of community transmission. Evidence suggests that overcrowding, lack of proper safety equipment, and absence of isolation facilities are associated with the transmission of disease among HCWs (32). This scenario is likely compounded when HCWs lack awareness of infection and prevention practices. Previous studies show that adequate knowledge, positive attitudes, and good behavioral practices help reduce the risk of infection (33). To the best of our knowledge, this is the first study of its kind in Bangladesh that assesses the KAPs level of HCWs toward COVID-19. Our study found that more than half of HCWs had high levels of knowledge, nearly half showed positive attitudes, and half showed good behavioral practices toward COVID-19.

Regarding our findings on knowledge levels, this parallels other research, such as a previous study with 304 healthcare workers in Pakistan, where half of HCWs had high levels of knowledge regarding COVID-19 (34). Another study in Addis Ababa, Ethiopia, found half of hospital and community pharmacists had high levels of knowledge regarding COVID-19 (35). Our sample finding was slightly lower than other studies. One possible explanation is that the pandemic had already achieved tremendous prominence at the time of this study, and many steps had been made to raise awareness levels among individuals at the time of these studies, so they may have already reached this high level of knowledge on COVID-19. Further, our study reported that most HCWs relied on social media for COVID-19 information, which could have affected their decision-making ability; social media has long been acknowledged to spread false health information (36, 37). Our findings reveal that most respondents correctly answered most of the knowledge-related questions. These findings were in accord with the previously published literature (34). Still, nearly half of our respondents gave incorrect answers on whether antiviral drugs could reduce the symptoms of COVID-19. This finding underscores the necessity for health authorities to continue encouraging HCWs to obtain information from trustworthy sources and engage in training that stress COVID-19's less common presentation and treatment (18).

Less than half of the HCWs showed positive attitudes toward COVID-19. This finding parallels those observed in Pakistan,

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TABLE 5 Factors influencing knowledge levels regarding COVID-19 among healthcare professionals.

Variables	Knowledge (%)		χ^2 (p-value)	OR (95% CI)	p-Value
	High	Low			
Gender					
Male	52 (50)	54 (54.55)	0.42 (>0.05)		
Female	52 (50)	45 (45.45)			
Age (years)					
≤30	59 (56.73)	54 (54.55)	28.38 (>0.05)		
>30	45 (43.26)	45 (45.45)			
Place of residence					
Urban	102 (98.08)	92 (92.93)	3.17 (<0.05)*	Ref.	
Rural	2 (1.92)	7 (7.07)		0.23 (0.04–1.22)	>0.05
Living status					
With family members	88 (84.62)	84 (84.85)	1.42 (>0.05)		
With non-family members	11 (10.58)	13 (13.13)			
Alone	5 (4.81)	2 (2.02)			
Education					
College	2 (1.92)	4 (4.04)	9.03 (<0.05)*	Ref.	
Undergraduate	3 (2.88)	12 (12.12)		0.63 (0.05–7.2)	>0.05
Graduate	59 (56.73)	47 (47.47)		1.41 (0.17–11.3)	>0.05
Postgraduate	37 (35.58)	30 (30.30)		0.32 (0.07–1.40)	>0.05
Advanced degree	3 (2.88)	6 (6.06)		0.40 (0.09–1.79)	>0.05
Healthcare profession					
Doctor	85 (81.73)	65 (65.66)	7.22 (<0.05)*	Ref.	
Nurse	8 (7.69)	16 (16.16)		0.23 (0.05–1.52)	>0.05
Dentist	9 (8.65)	13 (13.13)		0.43 (0.05–3.34)	>0.05
Allied health	2 (1.92)	5 (5.05)		0.45 (0.06–2.97)	>0.05
Working/study institute					
Public	69 (66.35)	52 (52.53)	4.04 (<0.05)*	Ref.	
Private	35 (33.65)	47 (47.47)		0.56 (0.30–0.95)	<0.05*
Frontline role					
Yes	42 (40.38)	39 (39.39)	0.02 (>0.05)		
No	62 (59.62)	60 (60.61)			
Years of employment					
<5 years	60 (57.69)	46 (46.46)	2.68 (>0.05)		
5–9 years	20 (19.23)	26 (26.26)			
>9 years	24 (23.08)	27 (27.27)			
Working hours					
<8 h/day	19 (18.27)	15 (15.15)	0.35 (>0.05)		
≥8 h/day	85 (81.73)	84 (84.85)			

*Significant at the 0.05 level (2-tailed).

where only 44% of HCWs reported positive attitudes toward COVID-19 (38). Similarly, some previous studies revealed lower levels of a positive attitude toward infectious diseases (39). In our research, most HCWs were moderate to highly worried about social support and afraid of infecting their family members. This fear could induce negative attitudes toward COVID-19 risk. Earlier studies found that most HCWs were worried of infecting their family members and relatives (40, 41). A study found a similar result where 88% of respondents feared infecting their family, friends, and society (19). Our low proportion of positive attitudes toward COVID-19 might be due to differences in country settings, as Bangladesh has a poor healthcare system that worsened COVID-19 control strategies. The low capacity of the healthcare system in Bangladesh also intensified the fear

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TABLE 6 Factors influencing the attitudes toward COVID-19 among healthcare professionals.

Variables	Attitude (%)		χ^2 (p-value)	OR (95% CI)	p-Value
	Positive	Negative			
Gender					
Male	49 (52.69)	56 (51.38)	0.01 (>0.05)		
Female	44 (47.31)	53 (48.62)			
Age (years)					
≤30	54 (58.06)	58 (53.21)	27.84 (>0.05)		
>30	39 (41.94)	51 (46.79)			
Place of residence					
Urban	89 (95.70)	104 (95.41)	0.01 (<0.05)*	Ref.	
Rural	4 (4.30)	5 (4.59)		1.10 (0.28–4.32)	>0.05
Living status					
With family members	83 (89.25)	88 (80.73)	3.11 (<0.05)*	Ref.	
With non-family members	7 (7.53)	17 (15.60)		0.31 (0.03–2.89)	>0.05
Alone	3 (3.23)	4 (3.67)		0.68 (0.06–7.35)	>0.05
Education					
College	4 (4.30)	2 (1.83)	2.76 (>0.05)		
Undergraduate	9 (9.68)	6 (5.50)			
Graduate	45 (48.39)	60 (55.05)			
Postgraduate	31 (33.33)	36 (33.03)			
Advanced degree	4 (4.30)	5 (4.59)			
Healthcare profession					
Doctor	62 (66.67)	87 (79.82)	12.39 (<0.01)**	Ref.	
Nurse	15 (16.13)	9 (8.26)		0.02 (0.00–0.13)	<0.001***
Dentist	9 (9.68)	13 (11.93)		0.02 (0.00–0.15)	<0.001***
Allied health	7 (7.53)	0 (0.00)		0.02 (0.00–0.14)	<0.001***
Working/study institute					
Public	51 (54.84)	70 (64.22)	1.60 (>0.05)		
Private	42 (45.16)	39 (35.78)			
Frontline role					
Yes	39 (41.94)	42 (38.53)	0.29 (>0.05)		
No	54 (58.06)	67 (61.47)			
Years of employment					
<5 years	51 (54.84)	54 (49.54)	1.19 (>0.05)		
5–9 years	22 (23.66)	24 (22.02)			
>9 years	20 (21.51)	31 (28.44)			
Working hours					
<8 h/day	16 (17.20)	18 (16.51)	0.02 (>0.05)		
≥8 h/day	77 (82.80)	91 (83.49)			

***Significant at the 0.001 level (2-tailed).
**Significant at the 0.01 level (2-tailed).
*Significant at the 0.05 level (2-tailed).

of infection among HCWs. Doctor-patient ratios in Bangladesh are 5.81 per capita, the second-lowest in South Asia (42). There is not a single critical care bed per 10,000 people in Bangladesh (43). Such an inadequate resources put additional strains on HCWs who were already working in a stressed environment (42). There were also incidents of COVID-19 patients running away from hospitals due to fear of being isolated from their families (44), which may have put additional pressure on HCWs. HCWs endured societal shame, hatred, addressed as virus carriers, and other types of social discrimination during the early phases of the COVID-19 epidemic (45) that likely contributed to negative attitudes toward COVID-19.

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TABLE 7 Factors influencing behavioral practices regarding COVID-19 among healthcare professionals.

Variables	Practice (%)		χ^2 (p-value)	OR (95% CI)	p-Value
	Good	Bad			
Gender					
Male	49 (48.51)	57 (55.88)	1.10 (>0.05)		
Female	52 (51.49)	45 (44.12)			
Age (years)					
≤30	57 (56.44)	57 (55.88)	43.78 (<0.05)*	Ref.	
>30	44 (43.56)	45 (44.12)		1.05 (1.06–1.32)	<0.05*
Place of residence					
Urban	94 (93.07)	100 (98.04)	2.95 (<0.05)*	Ref.	>0.05
Rural	7 (6.93)	2 (1.96)		3.57 (0.68–18.60)	
Living status					
With family members	92 (91.09)	80 (78.43)	7.07 (<0.05)*	Ref.	
With non-family members	8 (7.92)	16 (15.69)		0.14 (0.01–0.98)	>0.05
Alone	1 (0.99)	6 (5.88)		0.38 (0.03–3.96)	>0.05
Education					
College	4 (3.96)	2 (1.96)	1.05 (>0.05)		
Undergraduate	7 (6.93)	8 (7.84)			
Graduate	51 (50.50)	55 (53.92)			
Postgraduate	34 (33.66)	33 (32.35)			
Advanced degree	5 (4.95)	4 (3.92)			
Healthcare profession					
Doctor	75 (74.26)	75 (73.53)	1.62 (>0.05)		
Nurse	11 (10.89)	13 (12.75)			
Dentist	10 (9.90)	12 (11.76)			
Allied health	5 (4.95)	2 (1.96)			
Working/study institute					
Public	51 (50.50)	70 (68.63)	6.93 (<0.01)**	Ref.	<0.01**
Private	50 (49.50)	32 (31.37)		2.11 (1.17–3.83)	
Frontline role					
Yes	44 (43.56)	37 (36.27)	1.12 (>0.05)		
No	57 (56.44)	65 (63.73)			
Years of employment					
<5 years	57 (56.44)	49 (48.04)	1.55 (>0.05)		
5–9 years	20 (19.80)	26 (25.49)			
>9 years	24 (23.76)	27 (26.47)			
Working hours					
<8 h/day	15 (14.85)	19 (18.63)	0.51 (>0.05)		
≥8 h/day	86 (85.15)	83 (81.37)			

** Significant at the 0.01 level (2-tailed).
* Significant at the 0.05 level (2-tailed).

Nearly half of the participants showed good precautionary behaviors toward COVID-19. A similar finding in Pakistan reported that 58.9% of HCWs had good practices toward COVID-19 (34). Another study in Bangladesh in early 2021 reported that 62% of HCWs had good preventive practices (14). Our study finding was much lower than some studies, where 78.9% were reported in Nepal (19), 88.7% were reported in Pakistan (17), and 89.7% were reported in China (33). This might be attributed to the lack of good knowledge among HCWs about COVID-19. Having adequate knowledge of the COVID-19 infection could help to adopt good preventive practices. Earlier studies also showed that respondents with good

knowledge levels exhibited optimistic attitudes and proactive practices toward COVID-19 (46, 47). More specifically, several malpractices such as not maintaining proper quarantine after work, using face masks more than once, not wearing PPE and N-95 mask regularly while contacting patients, and lack of appropriate training on COVID-19 precautionary practices could be contributed to poor preventive practices during COVID-19 (14). Among various preventive practices in our study, the most frequent were removing PPE carefully regularly (58.62%), followed by avoiding social gatherings (53.20%) and washing hands more frequently than before (50.25%). This finding contrasts with a recent study that found that 80% of HCWs avoided social gatherings during COVID-19. This may be because the HCWs were occupied with COVID-19 patients, which limited their ability to remove PPE frequently. In addition, frontline health care workers in LMICs, particularly in Bangladesh, were required to work in congested workplaces and with inadequate infection prevention and control mechanisms, making it impossible to avoid gathering regularly (24). Jawed et al. (34) also found handwashing to be the most popular practice, and 70% of respondents followed proper hand hygiene, which was higher than in our study. This discrepancy may be because of inadequate water infrastructure and poor infection and prevention control practices (IPC) in hospital settings. A national survey conducted in 2014 in Bangladesh reported that only 2% of HCWs were compliant with the recommended hand hygiene practice due to lack of inadequate infrastructure and poor IPC training (48). Similar problems have been faced by many healthcare facilities in LMICs; for example, one study found that 50% of healthcare facilities in LMICs lacked piped water and 39% lacked handwashing soap (49). Unfortunately, only 30%−35% of respondents of our study maintained quarantine with family, and used a mask while going outside. This might be due to the HCW's fear of infecting their family members and relatives. Further, nearly 23% of HCWs reported that they never used PPE at the hospital during pandemic period. This case occurred during the early stages of the pandemic in Bangladesh, when healthcare workers were unaware of the outbreak. In addition, 40% of the HCWs in our study were from private institutions where COVID-19 patients were not initially treated during the outbreak. This is the result of a shortage of personal protective equipment (PPE) and its questionable quality, which makes it difficult for health care workers (HCWs) to continue their duties during the early stages of the COVID-19 outbreak in Bangladesh (2). Both public and private hospitals in Bangladesh were failed to provide PPE to frontline healthcare workers (50). Such a scenario might have led to substandard PPE use among healthcare workers. It is alarming that few of our participants attended training programs on precautionary practices during COVID-19. Earlier studies indicated that training programs organized by hospitals had an important influence on the prevention of infectious disease outbreaks (51, 52). It is crucial to provide healthcare professionals with the resources they need to develop and use evidence-based knowledge, which could be achieved through proper training (53).

The major sources of information regarding the COVID-19 disease were social media, followed by television, governmental press releases, the WHO website, medical journals, newspapers, and hospital training programs. This finding is in line with a previous study measuring public knowledge of COVID-19 transmission in Pakistan, which found that social media was the top source for seeking coronavirus information, followed by television (54). Another study reported that the HCWs in Ho Chi Minh City used social media as the top source for coronavirus information (55). In contrast, a study in Pakistan found that television, radio, and newspaper were the prevailing sources of coronavirus information among HCWs (34). The reason for using social media as the most common source during COVID-19 could be its easy access and user-friendly features. The Bangladesh government, being aware of the critical need for timely and accurate risk communication during the pandemic, emphasized e-government and social media as means of disseminating information to the public, which could also have contributed to HCW's reliance on social media (2).

Our study confirmed that age, working institution, and healthcare profession were predictive of KAP levels among HCWs in Bangladesh. HCWs in private institutions showed lower knowledge levels than those in public institutions. Similar findings were observed in a recent study in Eastern Ethiopia, where HCWs of public health facilities reported sufficient knowledge levels about COVID-19 (20). The reasons for low knowledge level among private hospital HCWs might be the lack of proper training and inadequate supply of PPE during the early stage of the pandemic. As a result of uncertainty about PPE availability in health care institutions, HCWs in private medical facilities were required to purchase their PPEs. In addition, HCWs in private hospitals were less interested in COVID-19 although they were in direct contact with COVID-19 positive patients (56).

Respondents' type of healthcare profession was another significant factor influencing attitude levels toward COVID-19. Our study found that respondentss who worked as doctors had better attitudes than other professionals. A similar finding was observed in Saudi Arabia, where physicians had a more favorable attitude toward COVID-19 than nurses (57). Another study in Pakistan reported higher attitude scores among physicians than pharmacists and nurses (58). Further, a study in Pakistan found that good knowledge levels were determinants of good attitude levels among community HCWs (38). This might be due to knowledge differences among professionals: the more knowledge, the more positive attitude toward the disease. A good level of knowledge is necessary for creating preventative beliefs, generating good attitudes, and fostering positive behaviors toward disease (59). Doctors also had to work directly with COVID-19 patients and therefore required

higher knowledge levels than other professionals. A recent study confirmed that physicians had the highest knowledge scores regarding COVID-19 (57).

Our findings also showed that respondents over 30 had better practices toward COVID-19. Similar results were reported in Eastern Ethiopia, where older HCWs tended to be more cautious than their younger counterparts (20). A systematic review and meta-analysis also indicated that older HCWs had better COVID-19 practices (15). This might be because older HCWs perceived themselves as riskier than younger ones (20). Further, older healthcare workers might have experienced previous pandemics like SARS, H1N1, and MERS and were already alerted to the need for self-protection, cleanliness, and quarantine, so they exhibited better practices toward COVID-19 (60).

In our study, HCWs in private hospitals showed better practices than those in public hospitals. Our findings contradict a previous study that showed HCWs in public hospitals had better preventive behavior scores (21). Perhaps this difference is due to private hospitals in Bangladesh initially refusing to treat patients with COVID-19, giving their HCWs a better chance to strictly adhere to preventative practices. In contrast, public hospitals in Bangladesh had an overcrowded environment that made it challenging to practice acceptable preventive practices (50).

Limitations

This study has some limitations that should be acknowledged. We included a modest sample size, so our results may not be generalizable to all HCWs in the country. A further drawback is that the questionnaire was developed in a rapid response to the emerging pandemic before the virus spread widely throughout the country. The reliability of our findings depended on the accuracy and recall of the participants. In addition, the sample may have been biased toward certain respondents who could access the internet. This study was undertaken during the early phases of the COVID-19 outbreak in Bangladesh, and it lacked longitudinal follow-up data. Finally, given the cross-sectional nature of this study, we cannot confidently say the observed associations represented cause-and-effect relationships.

Conclusion

The current study determined the knowledge, attitude, and practice (KAP) levels among HCWs in Bangladesh toward the coronavirus during the early stage of the pandemic. We found more than half of HCWs had a high level of knowledge, nearly half showed positive attitudes, and half reported good behavioral practices. Age, working institution, and type of healthcare profession were determinants of KAPs levels. This study demonstrated a need for an immediate upgradation of the KAP level of HCWs in Bangladesh. It remains crucial to monitor preventative practices and respond accordingly during the pandemic. More in-depth studies are needed to explore the best strategies for combating COVID-19. Finally, a proper training program with incentives for healthcare practitioners could help them build their confidence to provide the right care to their patients and spread awareness among the public about the risks posed by the illness and the need for preventive measures.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the research ethical clearance board of the Institute of Disaster Management, Khulna University of Engineering & Technology, Khulna, Bangladesh. The patients/participants provided their written informed consent to participate in this study.

Author contributions

MP: conceptualization, data curation, methodology, formal analysis, writing—original draft, review and editing. MH: conceptualization, data curation, investigation, writing—review and editing. RS: conceptualization, data curation, writing—review and editing. AD, AP, RK, and SS: writing—review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Human trafficking and the growing malady of disinformation

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Disinformation has endangered the most vulnerable communities within our world. The anti-trafficking movement in particular has been adversely impacted by disinformation tactics advanced through the QAnon campaign. QAnon's extremist messaging exacerbates gendered, racist, and xenophobic manifestations of trafficking victimization as well as problematic responses to trafficking that underpin historic structural inequities built into the United States' response to trafficking. We describe an overview of mechanisms used by the QAnon campaign to spread disinformation and illustrate how these mechanisms adversely affect the anti-trafficking movement. Given the critical role of healthcare providers in both the identification and connection to care for trafficked persons, as well as their susceptibility to disinformation, we provide several recommendations for the health sector to leverage their educational and advocacy power to combat trafficking disinformation while addressing the root causes of human trafficking.

KEYWORDS

human trafficking, QAnon, infodemic, misinformation and disinformation, anti-trafficking activism, labor exploitation and human trafficking

Introduction

Inaccurate information not only creates confusion but also endangers the most vulnerable communities globally. Complicating this threat is the role of social media, which has expedited and expanded the spread of information. The World Health Organization has recognized this as a public health issue and defined our current global state as an infodemic, or "too much information including false and misleading information" (1). Misinformation refers to fake or misleading information that is disseminated unintentionally. Disinformation refers to fake or misleading information that is intentionally disseminated (2).

Unfortunately, the anti-trafficking movement is no stranger to the role of misinformation and disinformation. Historical misconceptions have long underpinned public perception of human trafficking and continue to influence our policies, headlines, and biases. Inaccurate information exacerbates the disproportionate attention and resources dedicated to addressing the most sensational and "media-worthy" cases of human trafficking but overlook the spectrum of trafficking exploitation

within the global landscape (3). Experts describe the deleterious impact this has on survivors of trafficking and increases marginalization of and lack of resources for migrant workers and those engaged in commercial sex 3. One particularly egregious example of this phenomenon are the conspiracy myths that lie at the foundation of the disinformation propagated by the QAnon campaign. Our goal within this manuscript is to (1) describe the large-scale mechanisms used by the QAnon campaign to spread disinformation, (2) illustrate how these mechanisms adversely affect the anti-trafficking movement on a population level, and (3) provide systems-level recommendations for the health sector to combat disinformation while addressing root causes of trafficking.

The rise of QAnon

The QAnon campaign began in 2017 when an anonymous writer—under the name "Q"—began posting a series of coded messages on the website 4chan that implicated the involvement of "deep state" democrats, celebrities, media personnel, and political officials in a worldwide satanic domestic minor sex trafficking ring (4, 5). This then progressed to multiple anonymous imageboard sites by the names of 4chan, 8chan, and 8kun also weaponizing these messages to recruit following for conspiracy theories (6). Studies have found that accessibility of the internet, availability of social media, and abundant disinformation sources all catalyzed the grown of the QAnon campaign to an unprecedented threat level (7). With the unveiling of Jeffrey Epstein's involvement in the commercial sex industry, these conspiracy theories began infiltrating mainstream social media as well as public discourse. It migrated and integrated into larger online platforms such as YouTube and Reddit. Once efforts began mobilizing off-line, these theories were picked up via news coverage, which then broadened the message even further (8). Today, "QAnon has transformed from a bizarre conspiracy theory circulating only in the dark corners of cyberspace to a mainstream phenomenon advocated by politicians and media figure alike" (6, 9–11). Mobilization of this campaign has launched hundreds of #SaveTheChildren rallies across the United States (4). By late 2020, nearly 50% of Americans have heard QAnon conspiracy theories with surveys showing almost 14% of polled Americans identify themselves as "QAnon believers" (5, 12).

Themes of disinformation

QAnon's large-scale beliefs are rooted in extremism identifying one absolute enemy, typically individuals with elite power, driving domestic minor sex trafficking (13). As is the case for most extremist theories, radicalization "discourages the navigation of differing perspectives required in a pluralistic society, and the dehumanizing effects of conspiracy which are important for supporting radicalization" (14). In the case of QAnons's campaign within the context of the anti-trafficking movement, their sensationalized theories around domestic minor sex trafficking propagate a simplified representation of exploitation that distracts energy and resources from the multi-systemic causes that ultimately give rise to human trafficking.

QAnon mobilizes gendered, racist, and xenophobic manifestations of trafficking victimization as well as problematic heroism responses to trafficking. "The 'white slave' panic in Europe and the United States at the turn of the twentieth century" was driven by "those who fomented the white slavery scare of the time" and "sought to expose precisely the mobile yet highly organized net of the underworld lurking below the surface of society" (15). This is replicated in QAnon's panic regarding "the procurement, by force, deceit, or drugs, of a white woman or girl against her will, for prostitution" (15). The ways in which QAnon profiles victims of human trafficking simultaneously strengthens the conflation of human trafficking with exclusively sex trafficking despite other forms of trafficking exploitation having been found more prevalent globally. This systemic devaluing of trafficked individuals ignored by QAnon's profiling—people of color, immigrants, people who identify as gender non-binary—underpins historic structural inequities that have been built into the United States' response to human trafficking (16). At the core of both, we see "racialized and gendered roles of feminine helplessness and protection by traditional (i.e., masculine) institutions" (14).

QAnon's public messaging carries adverse implications for survivors and the anti-trafficking movement. Resources invested in inaccurate information divert resources and effort from supporting victims and survivors (17). In fact, QAnon's campaign could threaten the bipartisan support extended to this issue, driving potentially ineffective and dangerous policies based upon inaccurate information. By invalidating the narratives of people with lived experience and drowning out the voices of survivor-advocates, victims themselves may be less likely to self-report (17). Service providers will also be impacted through QAnon's efforts that perpetuate systemic biases and ultimately reinforce inequitable funding cycles, screening efforts, and care coordination.

Mechanisms of disinformation

False storytelling

Embedded within QAnon's online and offline disinformation are narratives of stolen innocence and virtue that position trafficked persons into victims with feminine identities centered around purity, innocence, and motherhood (18). They sensationalize embodiment of storytelling that is accepted and propagated by media coverage (19). This narrative of a heroic spectator with the potential to save the pure victim from

the omnipotent evil clutches of human trafficking normalize problematic dynamics: "traditional power relationships, the construction of trafficking as a cudgel against the other, and the co-optation of discourse by institutional power" (14). In fact, QAnon-related images have been shown to markedly over-represent preteen white children when compared to the evidence on child trafficking demographics and also draw significantly upon graphic imagery that relies on the motif of distressed children (20).

Story-telling is particularly useful for disinformation because narratives are positioned to not only convey information but also serve as political instruments for spreading disinformation concerning human trafficking. First, if a story is of high quality, the events and lessons of the story are often perceived by audiences to provide a sound message and speak to a higher point. The power behind these stories then lies within their capacity to remind us of other compelling stories and in turn blurs the line between history vs. memory (14). Second, stories can draw upon larger social structures such as the sincerity of a storyteller or norms around performance that influence social acceptance of the narrative itself into our collective identity (19, 21). These characteristics of narratives that aim to (1) facilitate connections between people as well as ideas and (2) generate meaning from scattered pieces of information can be leveraged to spread disinformation about human trafficking (19, 21). This second point is particularly true within the context of the QAnon campaign given the finding that people are more likely to joining radicalized groups if they feel uncertain, fearful, or powerless within the context of their own lives (22). For audiences who are bombarded by a flood of information and without bandwidth to evaluate this information it seems that the various shortcuts and connections presented by distorted human trafficking narratives are used to process information (23).

Co-opting

Extremist groups, such as the QAnon movement, also have the tendency to latch onto issues of national concern to promote their disinformation efforts, drawing attention to their conspiracies by repackaging reactionary views into messaging "save the children" and "stopping the traffickers" (14, 24). In fact, analysis of claimed motivations put forth by the #SaveTheChildren rallies "highlights the utility of moral-high ground arguments as a useful trope for advancing other motivations, often individual or political… An overarching commitment to "ending" trafficking or "saving" children thus emerged as a uniting theme, bringing together differing communities with different underlying or secondary motivations for joining the movement" (25). In fact, social media content analysis of QAnon users are notable for holding simplistic mental models regarding the battle between "good" vs. "evil" (26, 27).

With that said, through co-opting mechanisms, QAnon invalidates the lived and professional contributions made by survivors of labor and sex trafficking. It tokenizes and sensationalizes real trauma while simultaneously appropriating the anti-trafficking movement for political incentives (28). Disinformation spread in this manner additionally presents changes for anti-trafficking educators who must respond to these efforts without providing conspiracies a larger platform and more legitimacy (14, 29). Unfortunately, there is a wealth of evidence in rumor psychology to support that increased exposure afforded to disinformation, even if successful in discrediting, can mean inaccurate beliefs "still tend to persist, but in a weakened state" (29). In other words, so long as the QAnon beliefs or conspiracies are commented upon, they have the potential to gain traction and be integrated within the audience's mental models regarding human trafficking as well as our sociopolitical climate (30).

Echo chambers and filter bubbles

Echo chambers and filter bubbles within the internet as well as social media can further concentrate the spread of disinformation. Echo chambers are communities of individuals who are consistently exposed to conforming opinions (31). Filter bubbles or ideological frames are states of intellectual isolation that result from personalized searches when website algorithms can selectively predict what information an individual user prefers, based on previous computer click-behavior or search histories (31). Regarding the phenomenon of both, a prior line of literature has demonstrated that the role of increased exposure to inaccurate, unsubstantiated information is associated with increased tendency of users to believe the content (32). Echo chambers, for example, are thought to be applied by information users to "process information through a shared system of meaning and trigger collective framing of narratives that are often biased toward self-confirmation" (33). Analysis of over 800,000 tweets regarding QAnon from the summer of 2018 found that the majority of users were disseminating rather than producing information, which created and sustained online echo chambers (26).

These findings demonstrate how people connected to QAnon supporters or beliefs are more likely to find and share content that supports similar perceived narratives of human trafficking and disregard any conflicting information (33). In fact, a prior randomized experiment by Kim and Cao (34) demonstrated how messaging and conspiracy can breed "a spiral of distrust; that is, exposure to the content leads to belief in conspiracies that causes heightened distrust, and the heightened distrust, in turn, makes people more susceptible to the influence of the content, which further increases distrust." This social reinforcement strengthens polarization, support, and dissemination of these conspiracy theories. Although they are likely to assimilate more slowly into audience's perception of

human trafficking, they are positively correlated with longevity of the belief and degree of sharing (33).

Recommendations for the health sector

Healthcare providers are key actors in the anti-trafficking response for both identification of trafficked persons as well as connections to care. With that said, providers are also exposed and susceptible to the disinformation tactics employed within the current sociopolitical landscape. There are several ways health systems and professionals can leverage their educational and advocacy power to combat trafficking disinformation and invest in addressing the root causes of human trafficking (35).

First, it is vital that those with lived experience, from a diversity of demographics, shape health sector efforts on trafficking. Clinician educators should avoid sources that incorporate sensationalized language within discourse regarding human trafficking (e.g., avoid imagery of victim in restraints). Information alleging complex conspiracy theories without supporting evidence should be avoided. Medical educators must also be cautioned against using information disseminated by organizations that (1) promote racial, ethnic, or religious stereotypes and (2) claim to "rescue" trafficked "victims." Health professionals should be trained on the diversity of people who experience trafficking, especially counter-stereotypical examples of trafficking, in order to combat structural and institutional biases that impact identification and intervention efforts for this population. Further, rather than "screening for trafficking," providers can educate their patients about their rights as workers and connect them to resources because many victims may not self-identify (35).

Health systems should develop policies that identify and respond to individuals who have experienced any form of human trafficking, inclusive of labor and sex trafficking. They can disseminate accurate information about trafficking exploitation and worker rights to counter disinformation. Health professionals and health systems can advocate for policies that address social determinants of health that are also systemic vulnerabilities to human trafficking such as access to housing, social, legal, and/or employment support. Health systems should also advocate for an end to discriminatory practices against immigrants and communities of color.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Author contributions

JP: investigation, methodology, writing—original draft, and writing—review and editing. HS: conceptualization, investigation, methodology, resources, supervision, validation, and writing—review and editing. TE: conceptualization, resources, supervision, validation, and writing—review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Monkeypox and occupational exposure: Potential risk toward healthcare workers and recommended actions

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Monkeypox, occupational exposure, healthcare workers (HCWs), healthcare (MeSH), occupational hazard

Monkeypox virus (MPXV) is the microorganism responsible for causing the zoonotic disease known as Monkeypox (MPX). It is a double-stranded DNA virus belonging to the Orthopoxvirus genus of the Poxviridae family (1). Other important viruses of this family include the variola virus which causes the smallpox disease and the vaccinia virus which is utilized to manufacture the smallpox vaccine. The first case of human MPX was seen in 1970 in a pediatric patient in the Democratic Republic of Congo (DPR). Since then, the disease was limited to the African continent with only a few sporadic outbreaks outside of endemic regions. However, during the recent multi-country outbreak of MPX, more than 89 countries have been affected, and the majority of them are reporting MPX cases for the first time (2, 3).

Although human-to-human transmission of the disease has become more evident in the recent outbreak, the risk of occupational exposure, particularly in healthcare settings, should be carefully addressed. A recent review highlighted that there is a low risk of exposure to MPX in non-endemic healthcare settings; however, the level of evidence remains limited (4). A dreaded picture was seen during the COVID-19 pandemic when more than 115,000 healthcare workers (HCWs) lost their life due to this fatal disease (5). Important to say, HCWs constituted a significant proportion of all COVID-19 patients. Similarly, in the present MPX outbreak, the nosocomial transmission of MXPV can occur, potentially leading to the deaths of HCWs, which can, subsequently, turn this disease into an occupational hazard.

Concerns regarding MPX transmission in medical settings arose from reports of person-to-person transmission during this multi-country outbreak and the long-standing evidence of smallpox transmission in hospitals (6–9). On 17th August 2022, a total of 35,275 confirmed cases of MPX have been reported, out of which 3923 HCWs were suspected of MPX and 386 tested positive for MPXV (10). However, the majority of these HCWs were infected in the community rather than hospital settings with 98.3% falling under the MSM (men who have sex with men) community. For instance, in a case reported in North London on 11th June 2022, a 35-year-old, HIV-positive, male,

sexual HCW presented with fever, lymph node swelling, myalgia, and throat pain (11). Subsequently, he developed a painful blister on his nose which gradually increased in size. He tested positive for MPXV and was treated with Tecovirimat (antiviral agent licensed by the European medicine agency) for 10 days, after which he was discharged.

Further investigations are still ongoing to determine the possible routes of transmission of Monkeypox among other three HCWs who were reported at the same time but had no history of sexual contact. With the progressive increase in the number of MPX cases worldwide, HCWs are now at increased risk for contracting the disease. When caring for a patient who has MPX, the proper and consistent use of personal protective equipment (PPE) is extremely important in protecting, and preventing the transfer of MPXV to HCWs. Importantly, HCWs are not limited to physicians and nurses; however, they rather include emergency medical technicians, nursing assistants, technicians, therapists, phlebotomists, pharmacists, students, trainees, and contractual workers who are not employed by the healthcare facility, and those not directly involved in patient care. In addition, HCWs involve those who are exposed to infectious pathogens that can be transmitted in different sectors within healthcare settings, such as laundry, security, engineering and facilities management, administrative, billing, and volunteer personnel. Unaddressed mistakes (i.e., self-contamination following the removal of contaminated PPE) could pose a significant risk of transmission to HCWs.

In the study of Fleischauer et al. (12), nearly 75% of exposed HCWs reported at least one unprotected exposure to a confirmed MPX patient. According to postexposure surveillance, none of the HCWs reported any symptoms which were in line with the case definition for MPX infection (12).

However, HCWs should be aware of the signs and symptoms of MPX while entering a contaminated patient room or a treatment center, and they should wear the recommended PPE. If any of these symptoms occur, they should contact health services for further evaluation and should not report to work (or should leave work, if signs or symptoms develop while at work). Then, authorized officials and public health authorities should decide how to monitor exposed HCWs. In general, the monitoring strategy used usually reflects the risk of transmission, with more active-monitoring techniques being used for exposures in higher-risk settings. In most cases, self-monitoring techniques are adequate for exposures with low transmission risks. If authorized officials and public health authorities decide that a self-monitoring technique is appropriate, even greater risk exposures might be covered. The sort of monitoring to be employed is ultimately determined by the individual's level of exposure risk, their dependability in reporting potential symptoms, the number of people who need monitoring, the amount of time since exposure, and whether or not they have received postexposure prophylaxis (PEP) (13–15).

According to the Centers for Disease Control and Prevention (CDC), asymptomatic HCWs who have been exposed to MPXV do not need to be isolated and prohibited from working, but they should be screened for symptoms during the 21 days following their last exposure. If symptoms appear, HCWs should be treated. If a diagnosis that calls for a work restriction is made, even after MPX infection has been ruled out, there may still be limits advised (e.g., varicella). Throughout the 21-day observational period, if HCWs develop a rash, they should remain off work until the rash is examined and confirmatory testing is carried out to either confirm or exclude a diagnosis of MPX (13–15).

A new 5-day isolation phase should be initiated if a new symptom appears without any rash at any point throughout the 21-day monitoring period, and the HCWs should be restricted from working. Even if the 5-day period lasts longer than the original 21-day monitoring period, HCWs should be restricted from work for 5 days after the onset of any new symptom if there is no rash. HCWs may return to work with approval from their workplace officials after the 5 days have elapsed without the onset of any new symptoms and a complete skin examination confirms no skin abnormalities. Until all lesions have crusted, those crusts have dissolved, and a new layer of healthy skin has grown underneath, HCWs with a confirmed MPX infection should stay off work. The exact time interval for which an HCWs can resume work will ultimately be decided by public health authorities (13–15). The rising signals on MPX leading to a global public health concern along with COVID-19. We will gain more clarity on the magnitude of the current outbreak as case finding intensifies. Protecting HCWs and ensuring that we learn from recent epidemics and share available resources early, and quickly will be the key to containing the transmission.

Author contributions

RS: write the initial draft. AM, PS, AA, and BP: review the literature and edit the manuscript. All authors agree for the final manuscript.

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Nursing personnel management during COVID-19 pandemic: An exemption trend in view of health reasons

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Background: In the COVID-19 pandemic, the healthcare system faced unprecedented challenges with increased number of patients and limited resources. Managing nursing resource was a major challenge for hospital administration. They had to be on the frontline, but their safety was of paramount importance.

Aim: This study aims to analyze the measures taken for the management and effective engagement of nursing personnel for deployment in the COVID area of the hospital and the exemption trend based on their health status.

Methodology: A retrospective cross-sectional descriptive study was carried out to analyze the requests of nursing staff received for exemption of duty in COVID patient care areas. These requests were categorized and examined by the medical board constituted for this purpose. Microsoft Excel was used to interpret the results.

Results: The study evaluated the health reasons of nursing officers on the basis of which exemption was given for deployment of nursing officers in COVID areas. They were mostly medical reasons (91.1%) and few personal reasons (8.77%). The majority suffered from diseases affecting two or more than two specialties. Out of 376 applications, 223 were exempted, 81 were not exempted, 13 were given short-term exemption, and 26 were shifted to administrative assignments. Thirty-three staff members were referred to an appropriate forum.

KEYWORDS

COVID-19, nursing personnel management, medical conditions and vulnerable staff, clear guidelines, effective engagement

Introduction

The COVID-19 pandemic took over the world like an unrelenting storm testing the resilience of healthcare systems everywhere. Healthcare systems were faced with unexpected influx of patients requiring treatment within limited resources. Healthcare providers at the front line faced numerous challenges. Different guidelines were laid

down to equip COVID facilities with staff, essential equipment, and medicines. The nursing staff and other healthcare providers were under extraordinary pressure and played a pivotal role in providing patient care services 24 × 7 during the pandemic. At the same time, management of the nursing manpower emerged as one of the major challenges the world over. Various International and national guidelines were laid down to address the huge demand of nursing staff trained in managing communicable diseases and infection prevention.

The situation was no different in our 2,210 bedded tertiary care institute and research center. Although there was an unprecedented demand for nursing staff and every possible resource had to be utilized, it was equally important that the health and wellbeing of committed care providers were adequately safe guarded. "No country, hospital, or clinic can keep its patients safe unless it keeps its health workers safe" was a statement issued by the WHO in a news release. In our institute, this was done by providing PPE, provision of testing for COVID-19, training for infection prevention and control, and psychological care by counseling to mention a few. A lot more measures were suggested to protect the old and vulnerable members in our communities, but apparently, similar emphasis was not given in the case of healthcare workers including nurses. There is not much literature available on protocols in place for vulnerable healthcare workers and their deployment in COVID patient care areas. In the absence of any clarity, hospitals and organizations devised their own protocols to safeguard vulnerable staff (1). In our country, a national level advisory was issued by the Ministry of Health and Family Welfare, Government of India for pregnant/lactating mothers and immunocompromised healthcare workers to inform their medical condition to hospital authorities for posting only in non-COVID areas (2, 3). This was a move meant to minimize risk to staff while ensuring effective management of patient care services and was followed in our institute.

This study aims to analyze the measures taken for the management and effective engagement of nursing personnel for deployment in the COVID area of the hospital and the exemption trend based on their health status.

Materials and methods

A retrospective cross-sectional descriptive study was carried out to analyze the requests received for exemption of duty. The guidelines issued by the Ministry of Health and Family Welfare were circulated to concerned officials for dissemination. Applications/requests received from the nursing staff for exemption of duty in COVID areas were examined. A medical board was constituted to examine the requests seeking exemption on medical grounds based on the issued guidelines. The requests were categorized. The proceedings of the medical board and all related office orders were studied. Requests that did not fall under the purview of the board were referred to an appropriate forum. Microsoft Excel was used to interpret the results.

Ethical clearance

The institute ethical committee (intramural) approved the study with protocol in their meeting held on 22 March.2022, with reference no: IEC-INT/2022/study-29.

Results

The institute caters to more than 100,000 IPD patients, and as expected of a tertiary center, patient care services to both COVID and non-COVID cases (new and follow up) have to be provided. During the pandemic, the allocation of nursing staff in COVID patient care areas was done according to nursing norms, area requirements, government guidelines, and in consultation with nursing manpower management committee. The number of duty shifts of nursing staff was increased from 3 to 4 because of difficulties associated with wearing of PPE. The number of off-duties was increased to enable staff to handle stress and burn out along with rotational deployment in COVID care areas. The physical OPD was scaled down drastically during pandemic peak and elective surgeries were stopped to enable the diversion of staff for COVID care.

A total of 376 requests were received from the nursing cadre staff for exemption from COVID area duties in a period of 6 months, i.e., 1 August 2020 to 31 January 2021. The reasons for these requests were examined by the medical board which consisted of specialists from Department of Medicine, Endocrinology, Orthopedics, Urology, Psychiatry and Hospital Administration along with the provision of co-opting any other expert as and when required. Out of the 376 nursing officers, 323 were women and 53 were men.

The age wise grouping in Figure 1, shows that maximum number of Nursing officers who applied for exemption were in the age range of 25–34 years (36.4%), followed by 35–44 years (31.9%), 45–54 years (26.3%) and least in the age group <25 (2.9 %) and >55 (2.3%). The requests were examined and divided into two categories, namely, medical conditions (91.9%) and personal issues (8.77%), as seen in Figure 2. Most of the applicants were found to have diseases involving dual speciality ($N = 88$), followed by diseases involving pulmonary function ($N = 49$), internal medicine ($N = 31$), orthopedics, etc. Antenatal (21) and lactating (29) staff members were also included under medical conditions (Figure 3).

As can be seen in Figure 4, out of the 376 applications, 223 nursing officers were exempted by the medical board and 13 were given a short-term exemption. Twenty six applicants

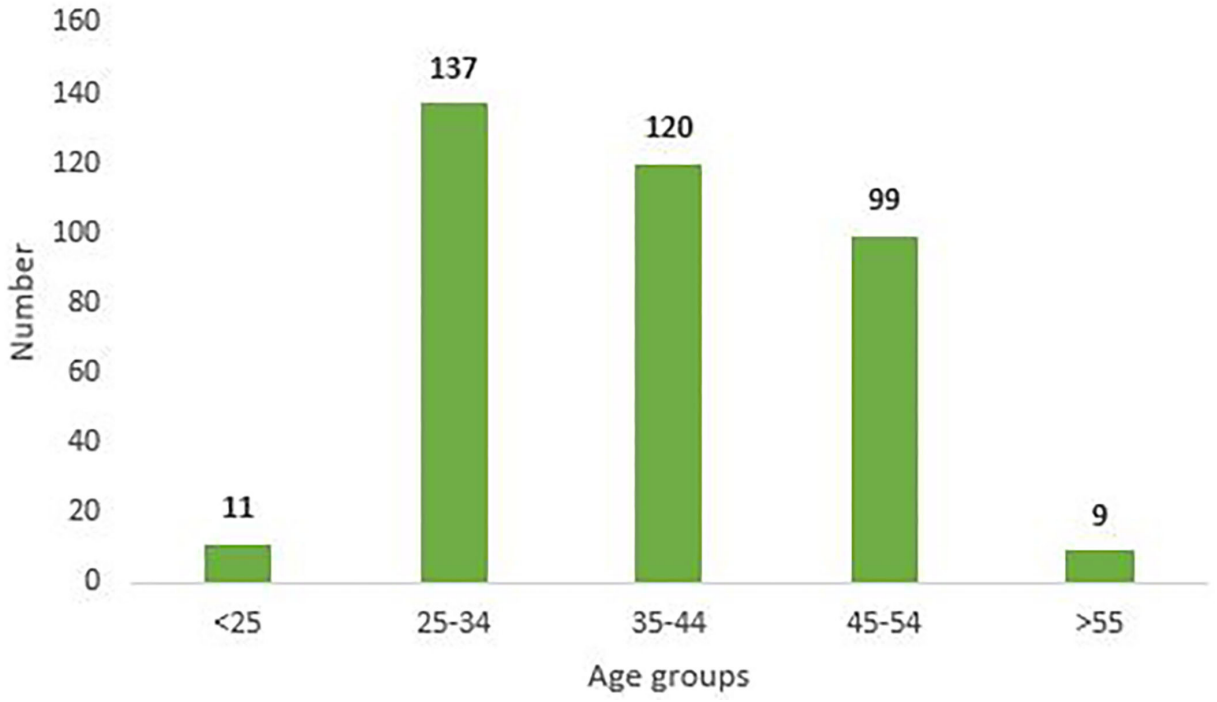

FIGURE 1
Age Wise distribution of requests for duty exemption in COVID care areas.

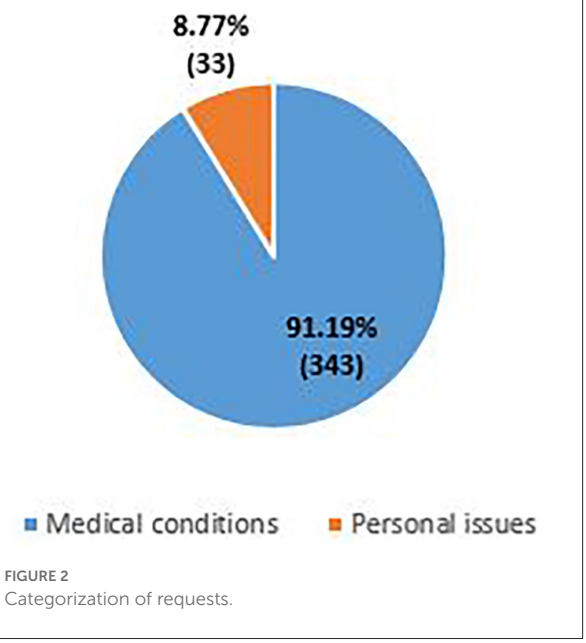

FIGURE 2
Categorization of requests.

stated reasons not amounting to serious medical or health issues but were exempted from core ward assignment, which included 6 h of continuous duty wearing PPE in the isolation ward, and were rather deployed for administrative duties in COVID areas. Eighty one applicants were not exempted and out of them, 32 were advised to get their medical issues re-evaluated from the respective departments of the institute. Thirty-three applicants were referred to the committee for the management and deployment of nursing staff as their reasons for seeking exemption did not fall under the purview of the medical board.

Discussion

The institute took all measures effectively in a timely manner to ensure the health and safety of its healthcare providers including nursing staff. Records displayed frequent training and continuous monitoring of infection control measures taken by the nursing officers while performing duties in COVID areas, which reduced the risk of transmitting infection (4). As per the guidelines issued by the Ministry of Health and Family Welfare, GoI, all healthcare personnel who were suffering from chronic illness or having immunocompromised health status or any other high-risk conditions were exempted from duty in COVID care areas.

This study evaluated the reasons stated for exemption by the nursing staff. The medical board constituted by the institute examined the requests, followed the standard national as well as international guidelines, and exempted all nursing officers who had a potential risk of infection due to certain medical

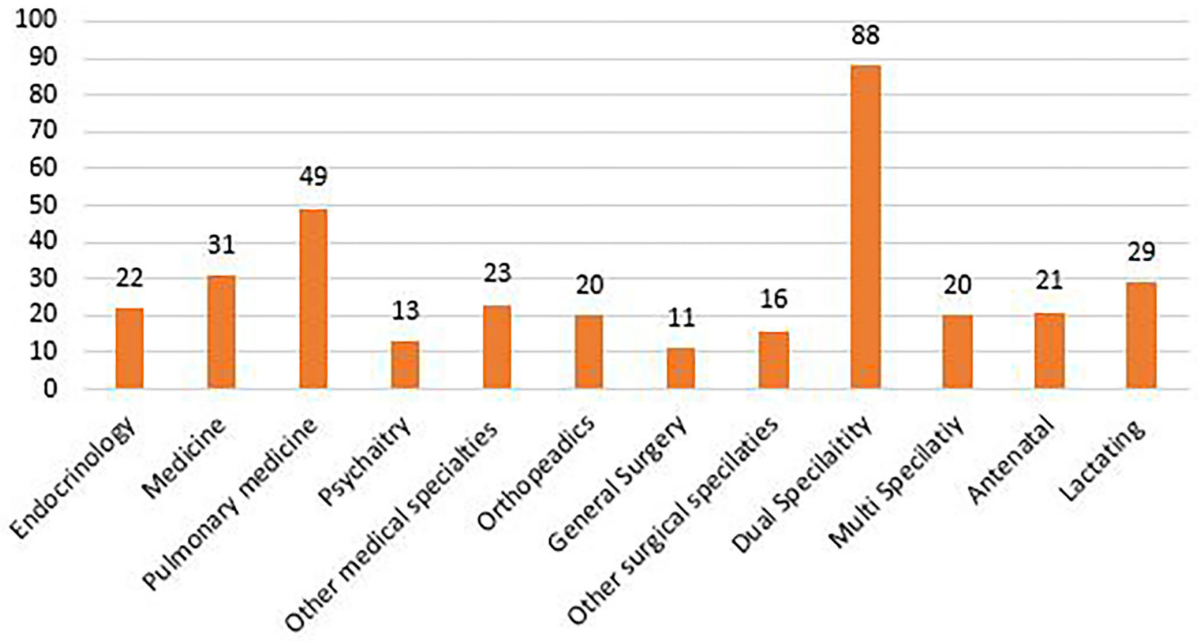

FIGURE 3
Categorization of exemption requests based on medical/surgical specialities.

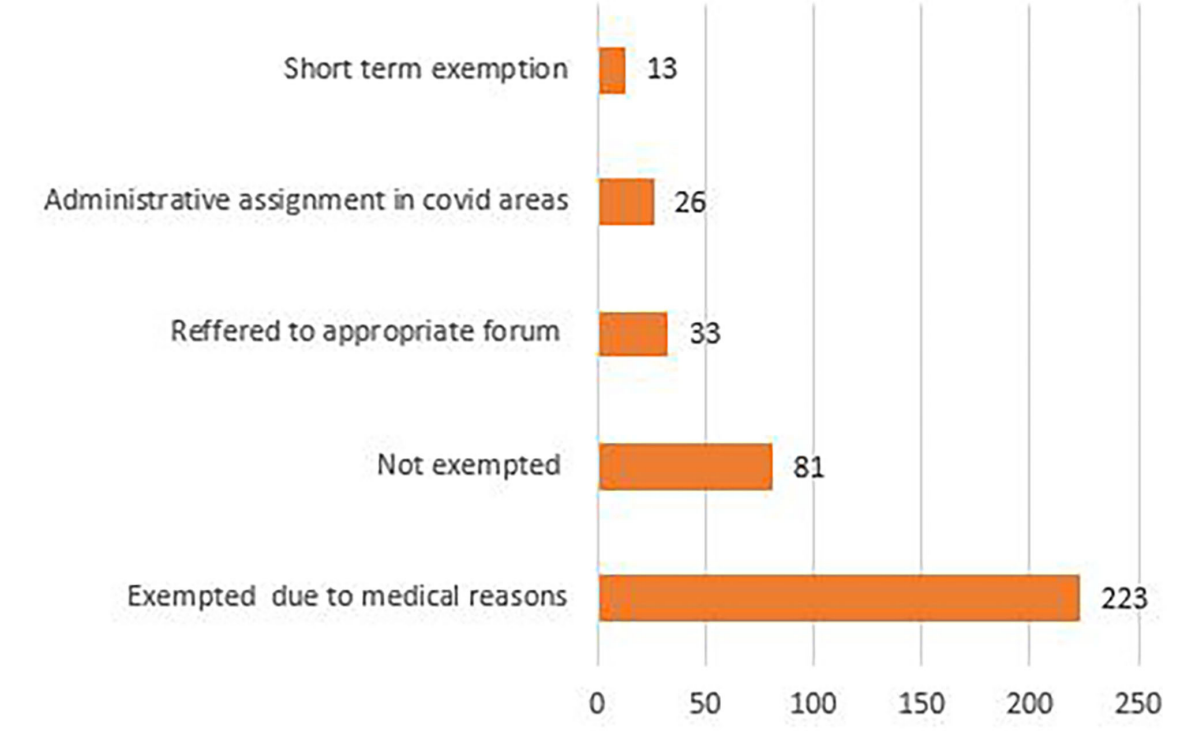

FIGURE 4
Decision on exemption request under medical grounds.

conditions from direct COVID patient care. Studies mention that many healthcare workers have conditions that elevate the risk for severe infection or death if they become infected with COVID-19, so organizations will need to decide whether such workers, including physicians, should be redeployed away from highest risk sites. It is not possible to entirely eliminate risks, but prudent adjustments may be warranted (5). Another study states that at the same time, evidence is mounting that preexisting conditions such as cardiovascular disease, diabetes, hypertension, and obesity, as well as older age, are associated with higher risk of hospitalization, admission to an intensive care unit, and death among those with COVID-19 (6, 7).

The study also revealed that highest number of requests for exemption was received from nursing officers in the age group of 25–34 years. This may be attributed to reproductive age group period, as 40 staff members in this group requested exemption either because of pregnancy or they were in the lactation phase, and a good number of them were exempted. Another reason could be anxiety associated with deployment in infectious disease areas (COVID wards) in this age group as compared to the more experienced staff above 34 years of age, and the same is mentioned in other studies (8, 9). In order to overcome the anxiety aspect, multidisciplinary support can be provided through psychological counselors *via* hot line teams & virtual clinics. Adequate availability of PPE must be ensured. Places to relax post duty, basic hygiene needs and nutritious food must also be arranged (10, 11). Most of the requests were received from staff with medical issues related to dual specialities. Sixty percent of the total applicants were exempted, while the others were given temporary exemption especially in the case of lactating mothers. The exempted staff members were deployed in non-COVID patient care areas so optimal utilization of resources could be done. The personal issues consisted mainly of ailing family member with no support system and fear of passing on the infection as the nursing staff members were also the primary care giver at their homes. Although counseling was done to some extent in these cases, the requests were redirected to senior nursing management to provide support and arrange for counseling to resolve the personal issues.

It was difficult to relate these findings to other institutions/hospitals as the literature on this topic is scarce.

Conclusion

In these unprecedented times, frontline workers are the army deployed the world over to tackle the enemy, but their protection and safety are paramount while treating patients. Numerous mechanisms were developed to ensure the protection of staff members both in terms of physical and mental health. Equally important is ensuring the safety of immunocompromised staff and their engagement in non-COVID areas to ensure optimal and rational staff deployment in both COVID and non-COVID patient care settings. The overall health of healthcare providers is a vital chain link for effective and efficient management of pandemics, and there have to be clear guidelines for vulnerable nursing staff regarding their deployment in direct patient care.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

SS, ND, AK, and SB contributed to conceptualization and design of the study. SKS contributed in data analysis. SS wrote the first draft of the study. ND, AK, NP, and SB revised and approved the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

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Supplementary material

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A cross-sectional survey exploring the attitude, knowledge, and use of anesthesia teams toward evidence-based practice in Riyadh Saudi Arabia

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Background: Evidence-based practice (EBP) plays a crucial role in improving the quality of healthcare services by ensuring the delivery of the highest and safest level of patient care since EBP helps in justifying treatment choices to patients. Studies that examine the levels of EBP knowledge, attitudes toward EBP, and use of the use of EBP within anesthetic teams' practice are lacking, hence it is necessary to explore this.

Aim: To evaluate anesthesia teams' levels of knowledge, attitude toward and use of the evidence-based practice in a local hospital in Saudi Arabia.

Method: In one hospital, a cross-sectional survey was conducted using a convenience sampling technique using a validated questionnaire instrument called the Evidence-Based Practice EBP Questionnaire. The questionnaire was distributed through an online method to 173 participants. Descriptive and inferential statistics Tests were utilized to analyse the retrieved data using the SPSS program.

Results: One hundred and forty questionnaires were completed and returned, yielding a response rate of 80.9%. Overall, anesthesia teams showed a high positive attitude toward EBP but low levels of knowledge and use of EBP. Participants with higher levels of education and/or work experience exhibited significantly higher levels of knowledge and use of EBP than those who had lower education levels and/or work experience. Also, higher levels of education and/or work experience exhibited a significant positive association toward a higher level of knowledge and use of EBP. However, attitude levels toward EBP

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did not exhibit either significant or associated. Physicians showed significantly higher knowledge and use of EBP than non-physicians. Lack of knowledge and lack of time due to workload were the leading barriers encountered by anesthesia teams ATs.

Conclusion: Education level, work experience and job position affect the knowledge, attitude, and use of EBP. Continuous education and minimizing barriers are recommended to enhance the knowledge, attitude, and use of EBP among anesthesia teams in Saudi Arabia.

KEYWORDS

evidence based practice, attitudes, use, knowledge, anesthesia teams, Healthcare Professionals

Background

In the past, Healthcare Professionals (HCP) based their medical judgments on daily practice, expert sources, or textbooks, and not on scientific evidence-based studies (1). However, in the early 21st century, the picture changed totally due to the huge increase in the quantity of clinical research evidence available (2). Annually about 2.5 million papers are published (3). However, the increase in the quantity of clinical research evidence does not automatically translate into improved patient treatment and care (4). Moreover, rapid changes in the methods of treatments and technologies within the last two decades have made it difficult for HCP to ensure that the available evidence has sufficiently high validity to be implemented into their clinical practice (5). Therefore, EBP exists to play the main role in providing the practitioner with the essential skills to be able to distinguish whether the available evidence is trustworthy (6).

Evidence-based practice is outlined as the process of decision-making by integrating the finest scientific research evidence with clinical experience and the patient's preferences and values (7). The principle of EBP comprises five phases: it starts with formulating a clinical question, searching for the best evidence that answers the question formulated, critically appraising the evidence retrieved to assess its validity and reliability, and implementing the findings with HCPs' expertise and patients' preferences, and finally, evaluating the entire process with the findings of patients' outcomes (8). EBP aims to deliver the most efficient healthcare service where HCPs' decisions are made according to the evaluation of the best evidence rather than depending on traditional treatments (9). Hence, EBP is considered crucial to delivering safe practice with high-quality care to enhance patient outcomes (10).

In the past three decades, EBP has become a global concern for HCPs and administrative staff as well as researchers and policymakers, since it is found to be effective in reducing costs without affecting the quality of care (11). Most healthcare organizations globally have found that EBP offers remarkable outcomes in terms of reducing mortality, morbidity, and medical errors while improving cost-effectiveness (12). Healthcare institutions globally could reduce their expenses by 30% if patients received evidence-based care (13). The World Health Organization (WHO) revealed that employing EBP in daily practice can save a minimum of £4.5 million annually in each hospital (14). In the United Kingdom (UK), EBP reduced around 63% of the total cost of a surgical procedure for carpal tunnel syndrome, which is among the most common surgical procedures performed (15), while in the US, EBP has increased the recovery rate by 30% and saved about 35% of the total cost of treatment for oncology patients suffering from lung cancer, which is the second most common disease diagnosed in the United State (US) (16–18). Accordingly, both national and international healthcare organizations have highlighted the significance of evidence-based care to ensure that patients receive appropriate, high-quality care (19).

Unfortunately, although EBP has proved its effectiveness in different clinical organizations, HCPs' uptake is below optimum levels (14). The gap between the amount of research evidence that exists and the application of such evidence in clinical practice is huge (19). In anesthesia, 30% of clinical decisions taken by ATs have been found to be either unnecessary or potentially harmful to patients (20). For instance, 40% of anesthetists are found to perform the cricoid pressure technique while intubating patients undergoing either emergency or cesarean section procedures, although this technique has been shown to cause esophageal rupture (21). Also, around 80% of medication error events are avoidable if the anesthesia practitioner applied actual evidence-based care (22).

Practitioners have reported encountering several obstacles with the use of EBP in clinical practice (23). Many studies have found that insufficient knowledge about EBP, lack of time due to workload, level of academic qualifications and level of work experience were the main barriers to the use of EBP during clinical practice (24–28). Healthcare organizations also found

that HCPs' attitude toward EBP plays a fundamental role in the use of EBP principles in clinical practice (29). This is critical, since applying evidence to clinical practice can take a decade, which could delay the provision of a high-quality healthcare service (30).

To date, limited studies have explored the knowledge, attitudes, and use of EBP among Anesthesia Teams (AT) worldwide. Unfortunately, no studies have investigated these aspects among ATs in Saudi Arabia (SA). Thus, the presence of this gap highlights the need to establish at least a baseline measurement to provide a clear picture to establish strategies to address any future problems that may appear. The study findings would thus underline the knowledge, attitude, and use of EBP among ATs in their respective practices. This could also lead to further research into potential methods for implementing EBP in SA. Hence, the current study aimed to explore the level of knowledge, attitude, and use of evidence-based practice among anesthesia teams in a single hospital in SA. Also, an assessment was performed to investigate the contributing factors that affect the level of knowledge, attitude, and use of EBP within anesthesia teams' professional practice.

Methods

Study design

This was a descriptive quantitative cross-sectional survey design. The questionnaire link was sent to the participants' emails *via* an accredited and secured web page platform (SurveyMonkey) to anesthesia staff.

Target population

The target population was 173 (all anaesthesiologists and anesthesia technologists/technicians who are officially registered in the Saudi Commission for Health Specialities and currently working in Prince Sultan Military Medical City Riyadh Saudi Arabia). A gatekeeper who has access to the contacts of the registered anesthesia staff was utilized to identify the eligible population. Since the data collection period was for 4 weeks between January and February 2020. An auto-reminder was sent asking participants to complete the questionnaire 2 weeks after sending the first link to improve the response rate.

Sampling

This study used a non-probability convenience sampling method since it reaches all eligible participants who are available and accessible to participants. Importantly, a power calculation was utilized to calculate the needed sample size, to ensure that the sample of the current study would be representative of all anesthesia practitioners in the targeted hospital. The G*power programme (version 3.1.9.2) was utilized with a significant value of $p \leq 0.05$, power of 0.95 and medium effect size of 0.3. This calculation revealed that a sample size of 138 participants was required.

Data collection

Data were collected by using the Evidence-Based Practice Questionnaire (EBPQ) tool which is considered a valid and reliable self-reported questionnaire (31). The EBPQ comprises closed-ended questions within three subscales: knowledge about, attitude toward, and use of EBP.

Each item of the EBPQ takes the form of a seven-point Likert scale ranging from (1 to 7), and the participants were asked to choose where they found themselves between these seven points. For the knowledge subscale, a score of (1) indicated "Poor," whereas a score of (7) indicated "Best," while for the use subscale, a score of (1) indicated "Never" whereas a score of (7) indicated "Frequently."

However, in the attitude subscale, the participants were asked to indicate where they found themselves between two opposite statements (for instance, "I resent having my clinical practice questioned" to "I welcome questions on my practice"): a score of number (1) means the statement is negative and a score of (7) means the statement is positive. The respondents were asked to indicate their level for each subscale, where (1) indicated the lowest score and (7) indicated the highest. Subsequently, the average score was calculated to determine the level of each subscale. Higher scores indicated higher use of knowledge about and a more positive attitude toward EBP.

In the fourth section, six demographic questions were added to the questionnaire such as gender, age, specialization, job position, academic qualifications, and work experience. Therefore, the questionnaire had four sections with a total of 30 questions. A pilot study was conducted with eight qualified anesthesia professionals (four anaesthesiologists and four technologists) who are not from the targeted population. Piloting was performed to ensure face validity prior to sending the questionnaire to the target population.

Data analysis

Both descriptive and inferential statistical approaches were utilized to analyse the data collected for this study. These statistical methods were applied using the Statistical Package for Social Sciences (SPSS) program (version 25). Frequency, percentage, mean, and Standard Deviation (SD) were used for the descriptive statistics, and these were presented in tables and charts to simplify explaining the participants' data. Normality

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test was used, and the data showed that the data were normally distributed; therefore, parametric statistical tests were used for the study's results. Thereafter, inferential statistical tests were used. Both *t*-test and one-way Analysis of Variance (ANOVA) were utilized. Pearson's Correlation test was used to examine whether associations existed between the participants' responses and the variables.

In this study, the cut-off level was determined as follows: mean scores from 1 to 3 were considered low, whereas a score of 4 was considered moderate and 5–7 was considered high.

Ethical considerations

Ethical approval was obtained from the targeted hospital, in SA, giving the researcher permission to conduct the study in the anesthesia department. Participants have received an information sheet that contains the aim and objectives of the study. Implied consent was the method for obtaining informed consent for this study, and this was clearly stated and explained to the participants in the information sheet. When the participant presses the "submit" button and the questionnaire has been sent, this acts as informed consent. Also, no names or numbers were requested in the questionnaire to ensure the anonymity and confidentiality of the participants.

Ethical approval project code: 1233, 31 Jul Series 2019.

Results

Response rate

Out of 173 questionnaires sent, a total of 140 questionnaires were completed presenting a response rate of 80.9%. Of 140 questionnaires, 64 (45.7%) of participants were between 20 and 30 years old, 54 (38.6%) were aged between 31 and 40 years, and 22 (15.7%) were aged 41 or above. The majority of respondents 49 (35%) held diplomas, while 44 (31.5%) held bachelor's degrees, 27 (19.2%) held PhD degrees and finally, 20 (14.3%) held master's degrees. Regarding specialization, most of the respondents were technologists 93 (66.4%), while 47 (33.6%) were anesthetists (Table 1).

Furthermore, more than half of the respondents 78 (55.7%) had between 6 months and 10 years of experience, while 45 (32.1%) had between 11 and 20 years, and only 17 (12.2%) had 21 or more years of experience. As for the job position variable, the majority of participants were in senior positions 34 (24.2%), followed by 33 (23.6%) who were in junior positions, while 26 (18.6%) were senior in charge, 20 (14.3%) were specialists, 16 (11.4%) were consultants and 11 (7.9%) were residents. The majority of respondents were male (85.7%), while 20 (14.2%) were female, and PhD and master's holders were all Anesthetists (Table 1).

TABLE 1 Sample distribution according to demographic characteristics ($n = 140$).

Variables	Variable category	Frequency	%
Gender	Male	120	85.7%
	Female	20	14.3%
Age	20–30 years	64	45.7%
	31–40 years	54	38.6%
	41 or more	22	15.7%
Academic qualification	PhD.	27	19.2%
	Master's degree	20	14.3%
	Bachelor's degree	44	31.5%
	Diploma	49	35%
Specialization	Anesthetist	47	33.6%
	Technologist	93	66.4%
Work experience	6 months−10 Years	78	55.7%
	11–20 Years	45	32.1%
	21 years or above	17	12.2%
Job position	Consultant	16	11.4%
	Specialist	20	14.3%
	Resident	11	7.9%
	Senior In-Charge	26	18.6%
	Senior	34	24.2%
	Junior	33	23.6%

Knowledge of EBP

Overall, ATs revealed a low level of knowledge about EBP, with a mean score of (3.77) out of 7. In this context, participants show a moderate level of knowledge toward sharing and disseminating new ideas about care with colleagues, with a mean score of (4.92; 4.52) respectively. However, ATs' research skills and ability to critically analyse the evidence against set standards were the lowest among the questionnaire items, with an average score of (2.83; 2.91) respectively (Table 2).

Attitude toward EBP

ATs exhibited a high positive attitude toward EBP, with a mean score of (5.16) out of 7. The participants show a high positive attitude toward the importance of EBP to clinical practice, with a mean score of (6.79). However, ATs show a negative attitude level in "workload is too great for me to keep up to date with new evidence," with a mean score of (3.48) (Table 2).

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TABLE 2 Knowledge, attitude, and use subscales scores ($n = 140$).

Item	Score (mean ± SD)	Ranking
Knowledge subscale		
Sharing of ideas and information with colleagues	(4.92 ± 1.39)	1
Dissemination of new ideas about care for colleagues	(4.80 ± 1.32)	2
IT skills	(4.52 ± 1.50)	3
Ability to review your own practice	(4.07 ± 1.56)	4
Ability to identify gaps in your professional practice	(4.02 ± 1.55)	5
Monitoring and reviewing practice skills	(3.93 ± 1.45)	6
Awareness of major information types and sources	(3.82 ± 1.54)	7
Ability to apply information to individual cases	(3.73 ± 1.76)	8
Converting your information needs into a research question	(3.61 ± 1.54)	9
Knowledge of how to retrieve evidence	(3.53 ± 1.81)	10
Ability to determine how useful (clinically applicable) the material is	(3.11 ± 1.83)	11
Ability to determine how valid (close to the truth) the material is	(3.04 ± 1.80)	12
Ability to analyse critically evidence against set standards	(2.91 ± 1.81)	13
Research skills	(2.83 ± 1.82)	14
Attitudes subscale		
(−) Evidence-based practice is a waste of time	(6.79 ± 1.33)	1
(+) Evidence-based practice is fundamental to professional practice		
(−) I resent having my clinical practice questioned	(5.64 ± 1.51)	2
(+) I welcome questions about my practice		
(−) I stick to tried and trusted methods rather than changing to anything new	(4.74 ± 2.0)	3
(+) My practice has changed because of evidence I have found		
(−) My workload is too great for me to keep up to date with all the new evidence	(3.48 ± 2.09)	4
(+) New evidence is so important that I make the time in my work schedule		
Use subscale		
Shared this information with colleagues.	(5.11 ± 1.38)	1
Evaluated the outcomes of your practice.	(3.63 ± 2.01)	2
Integrated the evidence you have found with your expertise.	(3.51 ± 1.65)	3
Formulated a clearly answerable question as the beginning of the process toward filling this gap.	(3.27 ± 1.57)	4
Tracked down the relevant evidence once you have formulated the question.	(3.20 ± 1.60)	5
Critically appraised, against set criteria, any literature you have discovered.	(2.92 ± 1.69)	6

Use of EBP

ATs exhibited a low level of use of EBP, with a mean score of (3.60) out of 7. In this context, ATs show a high use level in sharing information with colleagues, with a mean score of (5.11). However, ATs show poorness in critically appraise literature, with a mean score of (2.92) (Table 2).

Statistically significant results

Within demographic characteristics, anesthetists have higher levels of knowledge, attitude, and use of EBP than technologists. However, only the knowledge and use levels reveal statistically significant differences between anesthetists and technologists (both at $p = 0.001$). For attitude level, no statistically significant results were found between anesthetists and technologists ($p = 0.092$). Likewise, the results show that levels of knowledge and use of EBP significantly increased as work experience increased among ATs (both at $p = 0.001$). However, although the attitude level increased with work experience among ATs, the result did not reveal a statistically significant difference ($p = 0.249$). This indicates that there is convergence in ATs' level of attitude toward EBP depending on the work experience variable. Regarding academic qualifications, the ATs' levels of knowledge, attitude, and use of EBP increased as academic qualifications increased. However, only knowledge and use levels exhibited statistically significant differences (both at $p = 0.001$). Within the results, the study results show that levels of knowledge, attitude and use of EBP increased as job positions increased. Further, the results show that there were statistically significant differences between levels of knowledge

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TABLE 3 Statistical differences and correlations for knowledge, attitude, and practice or use levels according to demographic characteristics ($n = 140$).

Characteristics	Questionnaire mean score ± SD		
	Knowledge	Attitudes	Use
Gender			
Male	3.98 ± 1.36	5.04 ± 0.99	3.83 ± 1.40
Female	3.90 ± 1.01	4.89 ± 1.11	3.63 ± 1.26
p-value	0.819	0.571	0.546
Age			
20–30 years	3.72 ± 1.43	4.62 ± 1.13	3.56 ± 1.46
31–40 years	3.96 ± 0.97	4.83 ± 1.04	4.02 ± 1.13
41 or more	4.10 ± 1.07	5.24 ± 0.87	4.28 ± 1.41
p-value	0.278	0.351	0.059
Academic qualification			
PhD	4.82 ± 0.78	5.25 ± 0.89	4.65 ± 1.04
Master's degree	4.75 ± 0.86	5.10 ± 0.77	4.49 ± 1.10
Bachelor's degree	4.08 ± 1.13	4.91 ± 1.20	3.73 ± 1.05
Diploma	3.08 ± 1.34	4.66 ± 1.24	3.02 ± 1.43
p-value	0.001*	0.137	0.001*
Specialization			
Anesthetist	4.24 ± 0.94	5.13 ± 0.86	4.47 ± 1.15
Technologist	3.30 ± 1.39	4.80 ± 1.18	3.46 ± 1.36
p-value	0.001*	0.092	0.001*
Work experience			
6 months—10 years	3.60 ± 1.37	4.76 ± 0.96	3.30 ± 1.27
11–20 years	4.19 ± 1.04	4.91 ± 1.20	4.08 ± 1.30
21 years or more	5.04 ± 1.05	5.28 ± 0.84	4.56 ± 1.35
p-value	0.001*	0.249	0.001*
Job position			
Consultant	4.87 ± 1.19	5.30 ± 0.75	4.86 ± 0.98
Specialist	4.43 ± 1.20	5.21 ± 0.90	4.27 ± 1.01
Resident	4.35 ± 0.83	5.02 ± 1.38	4.14 ± 0.99
Senior In-charge	4.15 ± 0.47	4.99 ± 1.23	3.87 ± 1.59
Senior	4.07 ± 1.27	4.66 ± 0.68	3.73 ± 1.14
Junior	2.76 ± 1.29	4.60 ± 0.98	2.86 ± 1.16
p-value	0.001*	0.221	0.001*

(SD) Standard Deviation, (*) statistically significant $P < 0.05$ level.

and use among ATs (both at $p = 0.001$). However, for attitude level, there were no significant difference $p = 0.221$ (Table 3).

Associations according to demographic characteristics

Results reveal that there were no associations between attitude levels and any of the demographic variables. However, there were positive, statistically significant associations between the level of knowledge about EBP among ATs and academic qualification ($R = 0.503$) and work experience ($R = 0.363$). These findings indicate that ATs' knowledge increased with the increment of academic qualification and/or work experience. Also, there were positive, statistically significant associations between the levels of use of EBP among ATs and academic qualifications ($R = 0.483$), work experience ($R = 0.199$) and job position ($R = 0.409$), indicating that ATs' use of EBP increases in line with each of these variables. Regarding gender, age and specialization, the results show no significant association (Table 4).

Association between the attitude and use subscales toward the knowledge subscale

Results exhibit that there was a significant positive association between the levels of attitude and knowledge toward EBP among ATs ($R = 0.372$, $p = 0.036$), which indicates that the ATs' attitude toward EBP increased with the increment of knowledge level. Similarly, there was a significant positive association between the level of use of EBP among ATs and the level of knowledge ($R = 0.641$, $p = 0.023$), showing that the ATs' use of EBP increased with the increment of knowledge level (Table 5).

Discussion

The study aimed to investigate the level of ATs' knowledge, attitude, and use of EBP in a large local hospital in SA. The current study revealed that amongst the three subscales, attitude achieved the highest score, followed by knowledge, while the lowest score was for the use of EBP. The current study's findings suggest that ATs overall have a low level of knowledge about EBP. This result was similar to the findings of previous studies (24, 26, 32, 33). However, it contradicts the findings of previous studies (25, 34, 35).

Within the knowledge subscale, the highest items scored by ATs related to sharing and dissemination of evidence to colleagues, whereas the lowest scoring items were in "research skills," "ability to critically appraise literature," and "ability to determine how valid the material is" and "ability to determine how useful the material is." This is interesting since the highest and lowest scoring items were also similarly ranked in previous studies (24–26). The similarities in the results reported by the latter studies indicate that the lack of knowledge could be attributed to the weakness of the teaching approaches in terms of providing sufficient teaching modules to explain the principles of EBP during academic studies. This was clear in the current study's significant difference in the level of knowledge as academic qualifications increased. In this study, participants with diplomas showed the lowest score, while those with PhD degrees had the highest level of knowledge about EBP.

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TABLE 4 Associations of knowledge, attitude and use levels according to demographic characteristics ($n = 140$).

Dimensions and associations (R)		Demographic characteristics					
		Gender	Age	Academic qualification	Specialization	Work experience	Job position
Attitudes	*R*	0.048	0.027	0.017	0.014	0.056	0.071
	p-value	0.074	0.061	0.082	0.093	0.067	0.094
Knowledge	*R*	0.019	0.040	0.503**	0.020	0.363**	0.043
	p-value	0.081	0.091	0.028	0.061	0.001	0.058
Use	*R*	0.051	0.035	0.483**	0.029	0.199**	0.409**
	p-value	0.097	0.088	0.001	0.062	0.024	0.001

(R) Pearson's correlation, (**) statistically significant correlation.

This could be because the diploma curriculum for anesthesia practitioners in SA does not contain any research modules to teach students how to read and evaluate research findings (36). The current study also found a significant positive association between level of knowledge and academic qualification, meaning that higher qualifications were related to higher knowledge. This is congruent with the previous studies (33, 35). Importantly, although the latter two studies reported different overall results regarding the level of knowledge about EBP, these studies showed similar results regarding the association between qualifications and level of knowledge. The findings of this study also revealed that work experience exhibited a significant positive association with a high level of knowledge. The increase was comparable with the findings of previous studies (24–26, 32).

Attitude toward EBP was highly positive amongst ATs in this study. This was comparable to previous studies (37–40). This highly positive attitude could be because the targeted hospital undergoes annual evaluation by the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) and the Joint Commission (JCI), and these organizations play a main role in enhancing the use of EBP. This high positive attitude indicates that ATs have good use of- the significance of EBP in delivering the highest quality of healthcare. On the other hand, the lowest attitude level reported by ATs was toward the statement "My workload is too great for me to keep up to date with all the new evidence," which could be considered as a barrier not only to the level of attitude but also toward the use of EBP at the bedside. The presence of this barrier is critical, since attitudinal barriers toward EBP can be more difficult to overcome than knowledge barriers, and thus could affect the application of retrieved evidence in actual practice (41). The current study found a statistically significant positive association between the attitude and knowledge subscales, meaning that attitude level increases as knowledge level increases.

Results from the current study revealed that ATs have low levels of use of EBP. This finding concurred with previous studies (28, 42, 43). However, it contrasted with previous studies (26, 27). This might be because the former three studies and the present study reported a lack of knowledge about EBP. In this study, a significant positive association between the use and knowledge subscales, meaning that level of use of EBP increases with the increase of knowledge. This is interesting since this can be the main influence toward the low use level. Additionally, the current study's results found that the use of EBP among ATs showed a significant increase as their academic qualification increased.

TABLE 5 Associations between the attitude and use subscales and the knowledge subscale.

Subscales		Knowledge subscale
Attitude	r	0.372**
	p-value	0.036
Use	r	0.641**
	p-value	0.023

(r) Pearson's correlation, (**) statistically significant correlation.

The current study also found that work experience influences the level of use of EBP. The use of EBP increased significantly with higher work experience. This was comparable to the previous studies (28, 42, 43). However, it contradicted the previous studies (26, 27). It could be because HCPs with more than 10 years of experience become more confident in using EBP in clinical practice, whereas those with <10 years of experience have limited practical knowledge (44). Moreover, the current study found a significant increase in the practice of EBP as the seniority of job positions increases. This result was comparable with the findings of previous studies (28, 43). In fact, the tasks, and duties of anesthesia practitioners in senior positions tend to be more administrative than clinical, allowing more time to search for and evaluate evidence (45). In contrast, residents and juniors have huge workloads, such as covering on-calls duties, attending cardiac arrest events, and visiting patients before and

after surgery, which makes the use of EBP in clinical practice difficult (46).

Limitations

Limitations of the current study could be attributed to the fact that the data collection instrument utilized in the study was a self-reported questionnaire, which might be subject to self-reporting bias. Also, conducting a cross-sectional study in a single hospital with a relatively small sample size limits the ability to generalize the results to all ATs in SA.

Conclusion

This study was conducted to investigate ATs' levels of knowledge, attitude, and use of EBP in a single hospital in SA. Generally, the findings show that ATs had poor knowledge and use of EBP. However, ATs showed high positive attitudes toward EBP. Also, the study revealed that certain demographic characteristics influenced the overall results within the three subscales levels. Anesthesia practitioners' academic qualifications, Job positions, and work experience revealed a significant result with a positive correlation higher level of knowledge and use of EBP. In this study, lack of knowledge about EBP principles and lack of time due to workload were reported by ATs as the main barriers that affected their attitude and use levels toward EBP. Therefore, providing training and workshops about research skills, critical appraisal skills and research utilization to all ATs should be implemented, as this would reinforce their knowledge, which in turn would reflect on the high use of EBP in clinical practice.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Prince Sultan Military Medical City Scientific Research Center. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Cultural competency among Lithuanian nurses and preparedness to work with intercultural immigrants: A quantitative study protocol

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Introduction: Health care providers are increasingly required to provide care to patients from diverse cultural backgrounds. A culturally competent approach could be used to address gaps in the health care of migrants, whether they are refugees, asylum seekers, or undocumented migrants. From June 2021 onward, there are estimated to be 4,300 asylum seekers in Lithuania who crossed the Belarusian border. Furthermore, ~65 thousand Ukrainians registered within 6 months of the beginning of the war on 24 February 2022.

Aim: To determine the cultural competence of Lithuanian nurses using the Nurse Cultural Competence Scale (NCCS) questionnaire.

Methods: A quantitative study evaluating the cultural competency of nursing professionals will be conducted using the Lithuanian version of the Nurse Cultural Competence Scale (NCCS). The study will be conducted in Lithuanian municipalities and will involve primary, secondary, and tertiary health care providers.

Discussion: This study will provide data that can guide the development and evaluation of interventions designed to reduce health disparities among migrants, including the need to identify the appropriate type of cultural competency training for nurses. In addition to the results of this study, it may provide an indication of other cultural competency required for nurses. This includes consideration of religion, sexual orientation, gender identity, household classifications on the basis of urban vs. rural areas, language spoken, and country of origin.

KEYWORDS

nurses, cultural competency, migrants, Lithuania, culture

Introduction

More than one million migrants and refugees entered Europe in 2015 (1). As a result, there were disagreements within the EU regarding the solution to this issue (1). The Lithuanian government pledged in 2015 to accept 1,077 refugees from EU and non-EU countries. During the year 2020, six refugees were transferred from Greece and Jordan to Lithuania. This agreement resulted in 499 people being resettled in Lithuania from 2015 to 2020 (2). Lithuania granted asylum to 80 individuals in 2020, a significant majority of whom were Russians (2). It is estimated that Lithuania received an unprecedented number of irregular immigrants who crossed the Belarusian border in June 2021. As a result, Lithuania is estimated to have around 4,300 irregularimmigrants in the country (3). Immigrants from the Middle East (Iraq and Syria) represent the majority of these individuals. In total, 2,858 migrants came from Iraq, which ranked first on the list of countries of origin for migrants. These were followed by 203 individuals who originated from the Congo and 179 individuals who originated from Syria (3).

As a result of the Russian invasion of Ukraine on February 24, 2022, more than 4.6 million refugees were forced to flee the country in just 2 months (4). As of October 2022, UNHCR statistics indicate that over 7 million refugees have registered throughout Europe, and ∼4 million have been granted temporary protection within the EU (4).

In addition to this, there are over 6.5 million internally displaced persons in the country (5). As the Ukrainian government requires men aged 18–60 to remain and possibly participate in the war effort, mostly women, children, and elderly men enter the EU (6). It is estimated by UNICEF that 2.5 million children have been internally displaced and two million children have fled the country (7). Lithuania's Migration Department estimates that 65 thousand Ukrainians registered within 6 months after the war began on 24 February 2022 (8). Ukrainians are required to register at a registration center upon arrival in Lithuania. There are five Registration Centers located in Vilnius,Alytus, Marijampole, Klaipeda, and Šiauliai, which provide shelter, food, and clothing, as well as medical care; those in need are then transferred to long-term housing (9).

Health care providers are required to provide care to patients who are culturally and linguistically diverse, and that number is growing. Language and cultural barriers pose an increasingly significant threat to patient safety in hospitals (10), therefore cultural competence is increasingly recognized as a crucial aspect of providing quality healthcare to culturally diverse populations (11). The concept of healthcare cultural competence encompasses the ability to understand how social and cultural factors influence the health beliefs and behaviors of patients, and to take these influences into account at many levels of a healthcare delivery system in order to promote quality care (12). The presence of cultural misunderstandings increases a healthcare provider's perception of his or her readiness to treat culturally diverse patients, as well as negative attitudes toward cross-cultural care (13).

In order to overcome different communication difficulties, the key is to gain an understanding of how society and culture impact illness, as well as to reflect on their own strengths and weaknesses when communicating with different populations (14). Interpretation services were used to overcome communication challenges both face-to-face and over the telephone (15–18). However, despite the importance of interpreting services in healthcare, patients were frequently referred to interpreters through a time-consuming process (17, 18). Obtaining interpreters increased the nursing staff's workload, particularly in emergency situations (16). Furthermore, male interpreters were frequently incompetent in understanding the needs of immigrant women receiving maternity care (15).

An individual's cultural and ethnic background has a significant impact on his or her behaviors, emotions, and lifestyle (19, 20). It is crucial for health care providers to be able to provide care that understands the cultural influences on beliefs and customs that represent the different aspects of health and illness that clients have (19, 20). Nurses in Lithuania need to be sensitive to the impact of culture on health, as the country experiences an influx of immigrants and refugees (3). Providing nursing care is crucial to easing human distress, promoting comfort, and aiding in the face of life's challenges. In addition, nurse advocates play an essential role in facilitating the access of immigrants to health and mental health services, removing language and cultural barriers, regardless of their status as migrants, refugees, or asylum seekers (21).

Nursing in the global community should focus on developing new and innovative ways to improve and integrate health and social care processes in order to meet refugees' holistic needs (21). In an increasingly multicultural society, healthcare providers need to be aware of their patients' cultural needs and provide culturally sensitive care (22). It is therefore critical for healthcare professionals to be culturally competent in order to provide high-quality, effective care to patients from diverse cultures (23). The nurses are at the forefront of the healthcare system, they can play a vital role in providing culturally sensitive care. Nursing professionals with high cultural competence have been reported to be better able to establish cross-cultural communication with their patients, enabling them to effectively assess their patients' needs, plan appropriate treatments, reduce healthcare disparities, and significantly improve patient outcomes (24). Culture plays an important role in the improvement of patient outcomes, yet the presence of cultural competence is found to be low to moderate in studies from Italy (25), Iran (26), and China (27). The cultural competency of nurses can be enhanced through cultural training (28).

Aim

Based on adaptations of the NCCS, the purpose of the study is to assess the cultural competence of Lithuanian nurses in caring for patients with diverse cultural backgrounds.

Adaptation procedure

The purpose of the study is to assess the cultural competence of Lithuanian nurses using the Nurse Cultural Competence Scale (NCCS) questionnaire of S. Perng and R. Watson (29) who have given their written consent for its use and translation in Lithuanian. In addition, they agree to the use of the original scale as a Supplementary material in this article (Annex I). The scale was adapted according to the guidelines provided for the translation-back translation instruments procedure (30). Language adaptations of the scale have been documented at every stage. As part of the adaptation process of the original version, three bilingual healthcare researchers translated the NCCS into Lithuanian. In the next step, a panel of experts comprised of nurses with various professional backgrounds and roles developed version 1.0 of the Lithuanian NCCS scale. This translation was then converted into English by three bilingual healthcare researchers.

The translation from Lithuanian to English was then compared with the original English questionnaire. It was determined that the wording of items compared fairly on the basis of their significance. The pilot study was carried out by 20 master's degree nursing students at Vilnius University. The pilot study assessed the quality of translation, the appropriate cultural adaptation, and the feasibility of implementing the instrument.

Furthermore, the researchers were able to determine the time required to complete the questionnaire (i.e., 20 min). During a 3 focus group discussions with pilot study participants, an interviewer who is a co-author of the document discussed the comprehensibility and clarity of the survey items (Annex II). A variety of factors are considered, including religion, sexual orientation, gender identity, urban vs. rural housing, language spoken, and country of origin. Additionally, the participants were invited to contribute written suggestions for enhancing the readability of the scale items as well as for improving the graphic structure of the scale. Some changes were made.

Instrument

The Lithuanian version of the Nurse Cultural Competence Scale (NCCS) will be used to evaluate the cultural competence of nursing professionals. The original NCCS consists of 41 items, which are divided into four subscales: Cultural Awareness (NCCS-CA)-10 items, Cultural Knowledge (NCCS-CK-)-9 items, Cultural Sensitivity (NCCS-CSe)-8 items, and Cultural Skills (NCCS-CS)-14 items. On a Likert scale of 1–5, the respondent's responses are scored based on how strongly they agree or disagree with the indicated statements. The overall score falls between 41 and 205 points. The higher score indicates a greater level of cultural competency.

Methodology

Nursing in Lithuania

The number of nurses per 1,000 people in Lithuania in 2019 was 7.7, which is lower than the EU average of 8.4. Furthermore, Lithuania has one of the highest numbers of doctors in the EU: 4.6 per 1,000, compared with the EU average of 3.9 (31). Although doctors are increasing in Lithuania, nurses are not, leaving 1.7 nurses per doctor in 2019—the lowest ratio since 2,000. There has been a decline in the number of nursing graduates since the 2000 s, from 626 in 2000–09 to 554 in 2010–19 (31). The aim of the National Health Strategy 2014–25 is to restore the nurse to doctor ratio to 2:1 (31). For the year 2020, statistics indicate that there are 21,906 nurses engaged in health care, health administration, health education, and research institutions (public and private) (32).

Participants and data collection

The study will take place in the Lithuanian municipalities, in the premises of primary, secondary, and tertiary health care institutions. Nurses who are interested in participating in the study will be provisionally recruited. To qualify for inclusion, a nurse must be an active professional nurse, working full- or part-time in healthcare sector. In addition, nurses in academic or research institutions are excluded, and student nurses as well-because they are not formally recognized as registered nurses and their cultural competence is still developing as part of their university education. A questionnaire will be prepared in an electronic format and sent *via* official e-mails from the head nurses or administrators of health care institutions. Data will be collected from October to November 2022.

Data analysis

The data will be entered and coded in Epidata version 4.6 for data entry and coding, and then exported to SPSS version 25 for analysis. The levels of cultural competency are determined according to the highest score achieved across the four subscales of the Nurse Cultural Competence Scale (NCCS). The Shapiro-Wilk test will be used to determine whether the variables are normally distributed. The *T*-test will be used to compare the means with the normal distribution of

variables. When variables do not comply with the assumption of normality, the Mann-Whitney *U*-test will be used. The distribution of the respondents between the categories of categorical variables will be be compared using the $\chi 2$ test, if 20% or more of expected values are >5, and Fisher's Exact Test, if more than 20% of expected values are >5. The categorical variables will include gender (male/female), age (younger than median/older than median), and place of residence (urban/rural). The significance level for the statistical analysis will be 0.05. The measures of central tendency will be: mean $\pm$ standard deviation, for variables with a normal distribution, or median (first quartile-third quartile) for variables with a non-normal distribution.

Discussion

The purpose of this study is to provide insights into the cultural competency of Lithuanian nurses. This study attempts to identify the characteristics, care situations, and nursing training associated with overall cultural competence. It is imperative that they demonstrate cultural competence if they are to be successful in their roles as nurses. Nurses will be able to rate themselves as somewhat culturally competent to culturally competent, moderately culturally competent, or as having low cultural competence. The study will yield data that can be used to guide the development and evaluation of interventions that can reduce health disparities in migrants, such as to determine the appropriate type(s) of cultural competency training that could help nurses achieve the goal of cultural competency. A culturally competent approach to care may be enhanced by formal courses, continuing education, practical experiences, and academic programs offering increased awareness, sensitivity, and behaviors (33). Nursing schools, employers, governmental and non-governmental institutions can all contribute to a culturally competent nursing workforce.

It was challenging to select appropriate cultural assessment tools during the preparation of this study. A variety of instruments were identified as a means of measuring the cultural competence of nursing students and professionals, including Bernal and Froman's Cultural Self-Efficacy Scale (34), a cultural competency assessment for health care providers, including nurses (35), a Nursing Cultural Competence Scale (NCCS) (29), and the Cultural Diversity Questionnaire for Nurse Educators (CDQNE) which developed to assess the cultural competency of nurse educators (36). In addition, we believe that the focus on the cultural competence attributes of nurses rather than the perceptions of patients (immigrants) about their care or the quality of their health may constitute a limitation of our study, as well as these instruments.

Another challenge for this study is the lack of funding resources. It was discussed among the team members whether to use paper surveys or online surveys, but most members preferred to use online surveys for various reasons, including the lower cost and the shorter amount of time required to solicit participants to complete the questionnairAs the purpose of the study is to reach nurses in Lithuania in different municipalities, we will be required to spend considerable time gathering data in the form of paper from each Lithuanian municipality and healthcare organization, as well as travel costs to various municipalities. As a result of the online format, we are probably going to receive fewer participants in the online surveys than if the team members were personally present at the health care institutions and invited nurses to participate in paper format. Further in the online survey respondents with biases may select themselves as part of the sample.

Ethical considerations

The Declaration of Helsinki (37) has guided this study. This study complies with Lithuania's guidelines for biomedical and health research involving humans (2017). The Vilnius University Department of Nursing Ethics Committee approved this study (150000-KP-47). Consent will also be obtained from the healthcare institutions that will participate in the study. Researchers have developed an information sheet (Annex III) as well as a consent form (Annex IV) in English, which has been translated into Lithuanian. The participants will be informed that their participation in this research is voluntary and that their responses will be keptconfidential. In addition, they will be informed that they may withdraw from the study at any time.

Dissemination plan

In this study, the dissemination plan is to disseminate the results, and additional data will be published in scientific journals and presented at scientific conferences and workshops.

Patient and public involvement

Patients and the public will not be involved in the design of, recruitment for, and conduct of this study. Nurses will be invited to complete the nurse cultural competence scale in paper form.

Author contributions

All authors have agreed on the final version and meet at least one of the following criteria [recommended by the ICMJE (http://www.icmje.org/recommendations/)]: (1) Substantial

contributions to the conception or design of the work, or the acquisition, analysis, or interpretation of data for the work, (2) Drafting the work or revising it critically for important intellectual content, (3) Final approval of the version to be published, and (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1025508/full#supplementary-material

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Experiences of intensive care unit nurses working with COVID-19 patients: A systematic review and meta-synthesis of qualitative studies

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Objectives: Intensive Care Unit (ICU) nurses are at the forefront of fighting and treating the Coronavirus 2019 (COVID-19) pandemic and are often directly exposed to this virus and at risk of disease, due to their direct care for infected patients. This study aims to synthesize the experiences of ICU nurses working with COVID-19 patients.

Methods: A systematic review and meta-synthesis of qualitative studies were undertaken. A systematic literature search in four databases, including Web of Sciences, Scopus, Embase, and PubMed (including Medline), was performed. Original qualitative studies and the qualitative section of mixed method studies, written in English, which focused on the experiences of only ICU nurses working with COVID-19 patients, were included.

Results: Seventeen qualitative studies and two mixed-method studies were included in the review. As a result of the inductive content analysis, six main categories were identified, as follows: "distance from holistic nursing," "psychosocial experiences," "efforts for self-protection and wellbeing," "organizational inefficiency," "job burnout," and "emerging new experiences in the workplace."

Conclusions: The findings from this study suggest that healthcare authorities and policymakers can facilitate the provision of high-quality patient care during the COVID-19 pandemic through appropriate planning to provide adequate support and training, prevent shortages of nursing staff and equipment, and provide adequate attention to the psychological needs and job satisfaction of ICU nurses.

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KEYWORDS

nurse, intensive care unit, COVID-19, experience, meta-synthesis

Introduction

Viral infectious diseases have always been a threat to human health and survival. Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS), and the current Coronavirus 2019 (COVID-19) are the three global viral infectious diseases that have occurred worldwide in the last two decades (1). COVID-19 emerged in Wuhan, Hubei Province of China, in December 2019. In just a few months, the disease was declared a pandemic by the World Health Organization (WHO), in March 2020 (2). COVID-19 has many unknown clinical dimensions and is related to SARS-CoV-2 (3). It is proven that the disease is transmitted from person to person and causes symptoms from mild upper respiratory tract infection to severe respiratory failure and even death (4).

Pandemic diseases have a huge impact on healthcare systems, especially within the workforce (5). COVID-19 has created many challenges among healthcare workers (HCWs), due to its special characteristics, such as high prevalence, being unknown, and endangering the lives of HCWs (3). Healthcare professionals stand at the forefront of pandemic diseases (6). Nurses, as the largest workforce in the health care system, play an essential role in high-quality patient care (7). Nursing is one of 40 professions with a high prevalence of job stress, according to the National Association of Safety Professionals in the United States (7). Nurses, and especially Intensive Care Unit (ICU) nurses, are at the forefront of fighting and treating pandemic diseases, they are often directly exposed to these viruses, and are at risk of disease, due to the direct care they provide for infected patients (5, 8).

Patients infected with COVID-19 may need intensive care (9). Among the hospital wards, the ICU is one equipped with sophisticated equipment which is there to provide intensive care and comprehensive services to patients with life-threatening conditions (10). Nurses working in the ICU have a wide variety of duties and responsibilities, including constant attention to patients' needs, decision-making in critical situations, and interaction with patients' families. In addition, they spend more time in direct patient care than in other wards (7, 11). The results of the study by Abbey et al. showed that ICU nurses perform 3,081 different activities during the day, including direct care, indirect care, personal activities and unit-related activities, of which 43% are performed simultaneously (12). Therefore, ICU nurses experience a heavy workload (13).

The COVID-19 pandemic has been posing an unprecedented and difficult challenge for ICU nurses (14). Witnessing death and exposure to illness, stigma, job stress (such as lack of resources, redeployment, poor organizational support), isolation from loved ones due to concerns about transmission of the disease, lack of ICU beds, multiple end-of-life decisions, lack of adequate personal protective equipment (PPE), and loneliness are risk factors that can put nurses in a state of mental and physical stress which profoundly affects their wellbeing and mental health (14–17).

Dyspnea, chest discomfort, palpitations, headache, nausea, and dizziness are some of the common symptoms reported by ICU nurses in the COVID-19 pandemic (18). In addition, a nationwide survey of 726 ICU nurses in the COVID-19 pandemic found that ICU nurses experience symptoms of anxiety (27%), depression (18.6%), and post-traumatic stress disorder (22%) (14). The results of a qualitative study in China showed that nurses caring for COVID-19 patients experienced negative physical effects and emotions, such as fatigue, helplessness, discomfort from high-intensity work, anxiety, and worry for patients and their families (15).

Knowing the experience of nurses caring for patients with COVID-19 is critical to improving patient safety, quality of care, and the work environment of staff during future pandemics (18). In this regard, studies have examined the experiences of ICU nurses during the COVID-19 pandemic. Nevertheless, to our knowledge, there is no study that has synthesized these experiences. Therefore, the aim of this systematic review was to synthesize the experiences of ICU nurses working with COVID-19 patients.

Methods

Protocol and registration

The present systematic review is a meta-synthesis of qualitative studies. Meta-synthesis is a method that synthesizes qualitative studies with an interpretive approach (19, 20). The purpose of such methods is to obtain an increasing volume of qualitative research, gather a wide range of participants' experiences, and improve healthcare by facilitating knowledge transfer (20). Therefore, this has allowed the authors to integrate and synthesize the experiences of ICU nurses working with COVID-19 patients from qualitative studies in order to create comprehensive knowledge and understanding. The Preferred Reporting Items for Systematic review (PRISMA) flow chart was applied as a guideline for finding and selecting all qualitative studies (21). The protocol of this systematic review has been registered on the PROSPERO under the code - CRD42021256070: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=256070.

Search process and eligibility criteria

Discussions were held between the members of the research team to identify the appropriate keywords. They also performed a pilot search of specialized and general databases to find relevant keywords. The Boolean search method was used to identify articles related to the experiences of ICU nurses

working with COVID-19 patients, using the following keywords: [(Nurse* OR "healthcare worker" OR "healthcare provider" OR "healthcare team" OR "healthcare personnel" OR caregivers OR "health worker" OR "healthcare profession") AND (Experience OR "lived experience" OR "reported experience" OR "personal experience") AND (COVID-19 OR "coronavirus disease 2019" OR "coronavirus pandemic" OR "SARS-CoV-2" OR "COVID-19 crisis" OR "COVID-19 outbreak") AND ("Qualitative study" OR "Qualitative research" OR "exploratory research" OR "exploratory study")]. Accordingly, the online databases of Web of Sciences, Scopus, Embase, and PubMed (including Medline) were searched up to August 2022, without time limiting for extracting articles published in online peer-reviewed scientific journals. The researchers searched the bibliographic cross-references to improve search coverage. Inclusion criteria for selecting relevant studies included qualitative studies, qualitative sections of mixed method studies, focusing on the experiences of only ICU nurses caring for patients with COVID-19, and published in peer-reviewed scientific journals. The exclusion criteria were the following: quantitative articles, articles without exact relevance to the experience of ICU nurses working with COVID-19 patients, studies focusing on the experiences of other healthcare professionals in the care of patients with COVID-19, and studies focusing on ICU nurses' experiences along with other professionals.

Study selection

Databases were searched by using predetermined keywords. The authors (MM and SA) independently screened the titles and abstracts of the studies retrieved during the search process. The results were shared among researchers *via* EndNote software to make final and collective decisions about the inclusion and exclusion of studies. The authors conducted online conversations to share search results and decide on the next steps of the study, resolve disagreements, and reach a consensus on the inclusion of selected studies. Once all eligible studies had been selected, details from each paper in the pre-piloted data extraction table were extracted and recorded.

Quality appraisal

The quality of qualitative articles and the qualitative section of two mixed-method studies was evaluated using the Critical Appraisal Skills Programme (CASP) tool (22). The CASP tool contains ten questions and is a common tool for examining the limitations and strengths of any qualitative research method (22). Studies based on this tool are classified into three levels in terms of quality: high, medium, and low. Studies with 8 to 10 criteria are in the high-quality category, studies with 5 to 7 criteria are in the medium-quality category and those with 4 criteria or less fall into the category of low quality (23). The two authors (MM and SA) independently evaluated the quality of the articles using the CASP tool; in case of any discrepancies, these were discussed and resolved by a third author (ANN). Any disagreements and discrepancies between the authors were resolved by consensus.

Data collection process and synthesis of results

A data extraction table, including the first author's surname, year of publication, country of study, the purpose of study, design, sample size and settings, sampling method, method of data collection, and type of data analysis was developed.

Methods for analyzing data in meta-synthesis were varied, in order for the number of analysis methods to match the number of authors. We used the guidelines provided by Lachal et al. for data analysis (20). The first step in this process involved carefully reading and rereading each study in order to appraise, familiarize, identify, extract, record, organize, compare, and relate. In this step, the two authors independently read each study carefully and extracted citations from the findings/results section of each study. The second stage of the process was coding. In this step, the two researchers independently encoded each part of the data extracted in the first step (all studies) and performed a line-by-line coding. The third step involved grouping the codes and categorizing them into a hierarchical tree structure. In this step, the themes in the articles were compared to match the themes of one article with the themes of the other articles, while ensuring that the key theme took the same themes from different articles. In addition, the authors obtained a list of descriptive themes very close to the data. Finally, the last stage, which is considered the most subjective stage of analysis, was the generation of analytical themes. Using the inductive content analysis and following the initial immersion in the data by reading and re-reading, final themes and sub-themes were formed (20).

Data trustworthiness

The authors used several strategies to ensure the trustworthiness of the data. Two reviewers reached a consensus at each step, before proceeding to the next step. In addition, the data analysis process was confirmed by two qualitative researchers, as peer checking. Moreover, triangulation enhances the trustworthiness of the data. Triangulation is somewhat different in the context of meta-synthesis. It involves the use of findings from qualitative research studies related to the research question. Accordingly, throughout the meta-synthesis process, a triangulation approach was maintained by comparing each included study to discover a new understanding of

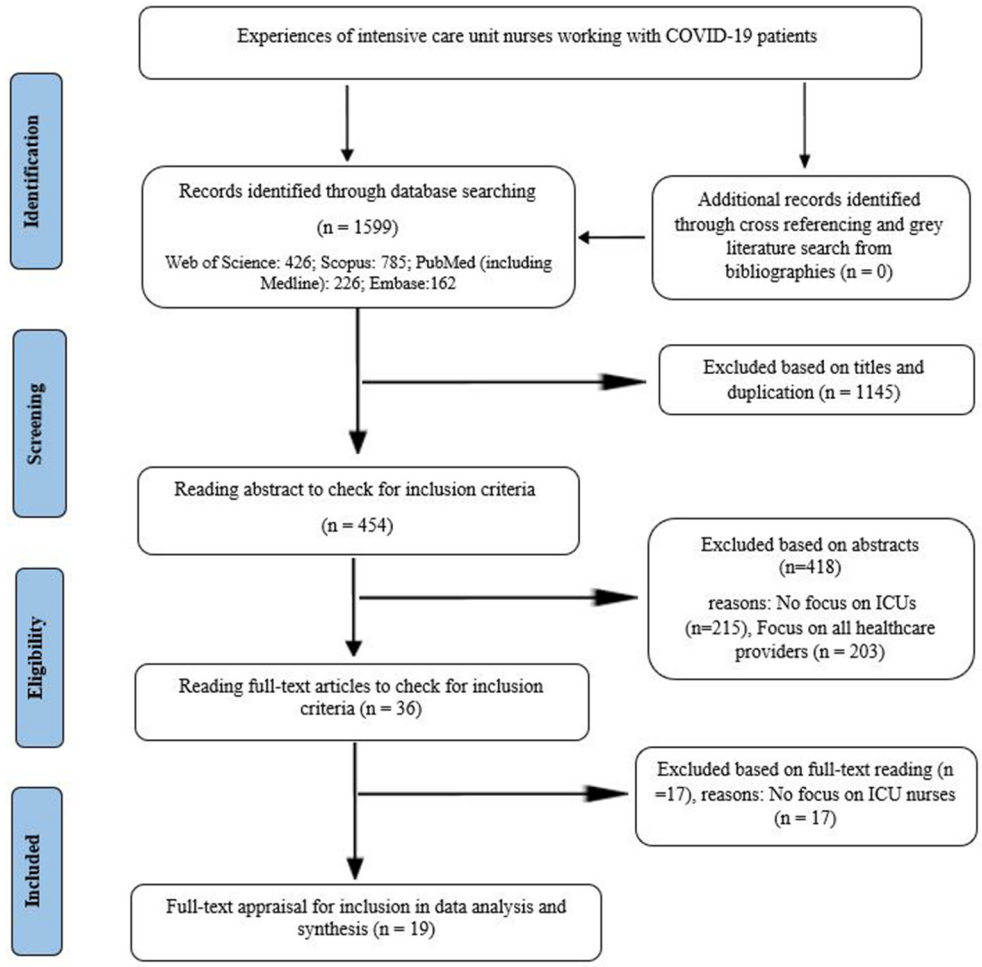

FIGURE 1
The preferred reporting items for systematic reviews and meta-analyses (PRISMA).

the experiences of ICU nurses working with COVID-19 patients. Furthermore, the researchers were experts or trained in meta-synthesis and conducting qualitative research and analysis (24–26).

during the full-text appraisal phase (Table 1). No studies were excluded from the meta-synthesis process based on their quality. The study flow chart, according to the reported preferential cases for systematic reviews and meta-analysis (PRISMA), is presented in Figure 1.

Results

Search outcome and selection of studies

The results of our search in four databases are presented in Figure 1. In the search process, which was performed using predefined keywords, 1,599 articles were retrieved. After removing duplicate and unrelated titles, and reading the abstract and full text, nineteen studies were finally selected for data synthesis. No further studies were found for inclusion in the meta-synthesis during the review of the references list of selected studies. The authors evaluated the quality of the selected studies

General characteristics of the selected studies

An overview of the included studies (n = 19) has been illustrated in Table 2. Nine articles were published in 2021 (29–32, 34, 36, 38, 41, 42) and 10 were published in 2022 (27, 28, 33, 35, 37, 39, 40, 43–45).

Five studies were from Turkey (28, 33, 39, 44, 45) three from Iran (31, 41, 42), two from the USA (30, 36), two from Spain (34, 35), two from Sweden (27, 29), one from China

TABLE 1 Critical appraisal skills program (CASP) result.

References	A	B	C	D	E	F	G	H	I	J	Score
Anderson et al. (27)	+	+	+	?	+	?	+	?	+	+	7/10
Aydin et al. (28)	+	+	+	+	+	+	+	+	+	+	10/10
Bergman et al. (29)	+	+	+	?	+	?	+	+	+	+	8/10
Cadge et al. (30)	+	+	+	+	+	?	+	+	+	+	9/10
Chegini et al. (31)	+	+	+	+	+	?	+	+	+	+	9/10
Conz et al. (32)	+	+	+	+	+	?	+	+	?	+	8/10
Demir and Sahin (33)	+	+	+	+	+	?	+	+	+	+	9/10
Fernández et al. (34)	+	+	+	+	+	?	+	+	+	+	9/10
González-Gil et al. (35)	+	+	+	+	+	-	+	+	+	+	9/10
Gordon et al. (36)	+	+	+	+	+	?	+	+	+	+	9/10
Green et al. (37)	+	+	+	+	+	?	+	+	+	+	9/10
Hu et al. (38)	+	+	+	+	?	?	+	+	+	+	8/10
Koken et al. (39)	+	+	+	+	+	?	+	+	+	+	9/10
Lee et al. (40)	+	+	+	?	?	?	+	+	+	+	7/10
Moradi et al. (41)	+	+	+	+	+	?	+	+	+	+	9/10
Moradi et al. (42)	+	+	+	+	+	?	+	+	+	+	9/10
Rheaume et al. (43)	+	+	+	+	+	?	+	+	?	+	8/10
Sezgin et al. (44)	+	+	+	+	+	-	+	+	+	+	9/10
Ünver et al. (45)	+	+	+	+	+	?	+	+	+	+	9/10

+ YES (clearly met) - NO (clearly not met) ? Can't Tell

(A) Was there a clear statement of the aims of the research?

(B) Is a qualitative methodology appropriate?

(C) Was the research design appropriate to address the aims of the research?

(D) Was the recruitment strategy appropriate to the aims of the research?

(E) Were the data collection in a way that addressed the research issue?

(F) Has the relationship between researcher and participants been adequately considered?

(G) Have ethical issue been taken into consideration?

(H) Was the data analysis sufficiently rigorous?

(I) Is there a clear statement of findings?

(J) How valuable is the research?

(38), one from Israel (37), one from Brazil (32), one from Canada (43), and one from Taiwan (40). The included studies were conducted in various contexts, in terms of the healthcare system, the number of deaths and cases of COVID-19, the nurse-to-patient ratio, economic and political status, population age pyramid, culture, equipment, and access to health services. For example, the Iranian health system was faced with more hurdles than other countries, due to the sanctions imposed against the country. Furthermore, there are physician-dominant policies in the Iranian health system (31, 41, 42). The United States makes up < 5% of the world's population. Nevertheless, it leads the world in the number of cases of COVID-19 and deaths. In addition, there is considerable variation between different states (46). Spain has the oldest population and the highest

TABLE 2 Summary of characteristics of the studies selected for meta-synthesis.

Authors, Country	Aim	Method	Data collection/ data analysis	Participant selection	Main finding
Andersson et al. (27), Sweden	To investigate person-centered care based on ICU nurses' experiences during the first phase of the COVID-19 pandemic	Qualitative	Semi-structured interviews; Content analysis	Not specified; 6 ICU nurses	Prerequisites, care environment, person-centered processes, person-centered outcomes
Aydin et al. (28), Turkey	To describe the self-transcendence of the leading fighters, intensive care nurses, during the COVID-19 pandemic	Qualitative	Semi-structured interviews; Phenomenological approach	Snowball sampling; 25 ICU nurses	Improvement in nursing roles and skills, being proud of oneself and the team, understanding the value of life, physical and mental well-being, administrative loneliness, inability to give care, fear of being a source of infection, loneliness of patients, personal and contextual factors
Bergman et al. (29), Sweden	To describe Swedish registered nurses' experiences of caring for patients with COVID-19 in ICUs during the pandemic	Mixed method survey	Online questionnaire; Inductive content analysis	Convenience sampling; 282 ICU nurses	Tumbling into chaos, diminished nursing care, transition into pandemic ICU care
Cadge et al. (30), USA	To understand how nurses experience providing care for patients hospitalized with COVID-19 in ICUs	Qualitative	Semi-structured interviews; Thematic analysis	Purposive sampling; 16 ICU nurses	Challenges of maintaining existing working relationships, challenges of working with new co-workers and teams, Importance of institutional level acknowledgment of their work, role of nursing leadership in providing information and maintaining morale
Chegini et al. (31), Iran	To describe the experiences of ICU nurses caring for patients infected by COVID-19	Qualitative	Semi-structured interviews; Phenomenological approach	Purposive and snowball sampling; 15 ICU nurses	Organizational challenges, psychological challenges, professional challenges, social challenges
Conz et al. (32), Brazil	To understand the experiences of ICU nurses providing care to COVID-19 patients	Qualitative	Individual interviews; Social phenomenological approach	Snowball sampling; 20 ICU nurses	Adjusting to the new way of delivering care in ICU, being around situations that interfere with physical and mental health, projecting professional life after the COVID-19 pandemic

(Continued)

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TABLE 2 (Continued)

Authors, Country	Aim	Method	Data collection/ data analysis	Participant selection	Main finding
Demir and Sahin (33), Turkey	To explore the experiences of nurses providing care to ICU patients diagnosed with COVID-19	Qualitative	Semi-structured interviews; Descriptive phenomenological approach	Snowball sampling; 12 ICU nurses	Fear and anxiety compromise care, difficulties in caring for COVID-19 patients in ICU, coping with the difficulties in caring for COVID-19 patients in ICU
Fernández-Castillo et al. (34), Spain	To explore the experiences and perceptions of nurses working in an ICU during the COVID-19 global pandemic	Qualitative	Semi-structured interviews; Inductive content analysis	Purposive sampling; 17 ICU nurses	Providing nursing care, resources management and safety, psychosocial aspects and emotional lability, professional relationships and fellowship
González-Gil et al. (35), Spain	To describe the experience of nurses in caring for patients with COVID-19 in ICUs	Qualitative	Semi-structured interviews; Phenomenological approach	Purposive sampling; 17 ICU nurses	The value of human resources, it's not the beds, it's the expert staff, shouldering the patient's burden, suffering because they have not cared well
Gordon et al. (36), USA	To examine the experiences of ICU nurses caring for COVID-19 patients.	Qualitative	Semi-structured interviews; Content analysis	Purposive sampling; 11 ICU nurses	Emotions experienced, care environment challenges, physical symptoms, short term coping strategies, social effects
Green et al. (37), Israel	To explore the experiences of ICU nurses caring for COVID-19 patients who eventually died during	Qualitative	Semi-structured interviews; Descriptive phenomenological approach	Purposive sampling; 24 ICU nurses	The first vs. the second COVID-19 waves, fighting for life and being unable to win, a chronicle of pre-determined death, nurse's emotional coping with patient death
Hu et al. (38), China	To examine ICU nurses' experiences of caring for patients with COVID-19	Qualitative	Individual interviews; Descriptive phenomenological approach	Purposive sampling; 13 ICU nurses	Initial response, adaption, desperation, holding on and surviving
Koken et al. (39), Turkey	To understand the experiences of cardiovascular nurses working in a COVID-19 ICU during the pandemic	Qualitative	Semi-structured interviews; Phenomenological approach	Snowball sampling; 10 ICU nurses	The duties and responsibilities in a COVID-19 ICU, the differences of COVID-19 ICU practices from cardiovascular practices, the transferrable skills of cardiovascular nurses in a COVID-19 ICU, the difficulties encountered working in a COVID-19 ICU the difficulty of working with personal protective equipment, the psychosocial effects of working in a COVID-19 ICU

(Continued)

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TABLE 2 (Continued)

Authors, Country	Aim	Method	Data collection/ data analysis	Participant selection	Main finding
Lee et al. (40), Taiwan	To understand the perceived stress and coping behaviors of ICU nurses caring for critically ill patients with COVID-19	Mixed-method	Semi-structured interviews; Content analysis	Not specified; 85 ICU nurses	Fear and worry, increased burden, coping behavior
Moradi et al. (42), Iran	To explore the protective reactions of ICU nurses providing care for patients with COVID-19	Qualitative	Semi-structured interviews; Content analysis	Purposive sampling; 14 ICU nurses	Unbalanced self-protective reactions, responsible self-protective reactions
Moradi et al. (41), Iran	To explore the challenges experienced by ICU nurses throughout the provision of care for COVID-19 patients	Qualitative	Semi-structured interviews; Content analysis	Purposive sampling; 17 ICU nurses	Organization's inefficiency in supporting nurses, living with uncertainty, physical exhaustion psychological burden of the disease
Rhéaume et al. (43), Canada	To explore Canadian ICU nurse's experiences providing care to COVID-19 patients during the second wave of the pandemic	Qualitative	Online survey; Thematic analysis	Convenience sampling; 108 ICU nurses	Managing the pandemic, witness to families' grief, our safety, futility of care
Sezgin et al. (44), Turkey	To explore the experiences of the ICU nurses caring for patients diagnosed with COVID-19	Qualitative	Semi-structured interviews; Thematic analysis	Purposive and snowball sampling; 10 ICU nurses	Death and fear of death, impact on family and social lives, nursing care of COVID-19 patients, changing perceptions of their own profession: empowerment and dissatisfaction, experiences and perceptions of personal protective equipment and other control measures
Ünver et al. (45), Turkey	To understand the PPE-related skin changes experienced by ICU nurses working during the COVID-19 pandemic	Qualitative	Semi-structured interviews; Phenomenological approach	Convenience sampling; 14 ICU nurses	Main causes of PPE-related skin changes, the location of the skin changes caused by PPE, secondary adverse effects of PPE-related discomfort, symptomatology of PPE-related skin changes, prevention of PPE-related skin changes, therapeutic interventions for curing for PPE-related skin changes

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life expectancy in the world (47). In Sweden, ICU nurses are registered nurses specializing in intensive care or anesthesia, and the nurse-patient ratio in the ICU is usually 1: 1–2, which was the case even before COVID-19 (29). Regarding the studies' methodologies, seventeen studies (27, 28, 30–39, 41–45) used a qualitative design and two had a mixed method design (29, 40).

The experiences of ICU nurses working with COVID-19 patients

As the result of inductive content analysis, six main categories were identified regarding the experiences of ICU nurses working with COVID-19 patients: "distance from holistic nursing," "psychosocial experiences," "efforts for self-protection and wellbeing," "organizational inefficiency," "job burnout," and "emerging new experiences in the workplace" (Figure 2).

Distance from holistic nursing

This review indicated that the number of patients admitted to the ICU increased during the COVID-19 pandemic. Nurses had less time to care for patients, and the nurses' interaction with infected patients was reduced due to the fear of being infected with COVID-19 and transmitting the virus to their loved ones, as well as due to the use of PPE. In addition, hospitals faced a shortage of skilled nurses specializing in intensive care. Therefore, most nurses felt that the care they provided during the COVID-19 pandemic had distanced from holistic care. Experiences related to distance from holistic nursing were divided into three subcategories, including rationing of nursing care, distance from humane care, and distance from professional care.

Rationing of nursing care

Rationing of nursing care refers to the failure to provide one or more of the required types of nursing services (48). Thus, nurses find it impossible to perform all nursing requirements, and in these situations, they may reduce, delay, or simply eliminate care (49). ICU nurses felt that they did not have enough time to perform all nursing care during the COVID-19 pandemic. They couldn't give patients the care that they normally gave them. Therefore, care, such as patient mobility, care of central and peripheral pathways devices, and primary care were not provided to patients, and a decrease in nursing care standards was reported. In addition, nurses prioritized maintaining airways, maintaining hemodynamic constants with medication, and administering essential medications to patients (27, 29, 34, 35, 42, 44).

> *"We do not have the time to do all the things that we usually do, such as oral care or changing the patients posture in bed. Relatives, who normally are a resource, cannot even visit the patient until he or she is dying" (29).*

Distance from humane care

Humane care preserves human dignity and value. Nurses must integrate humane care throughout patient care (50). Nevertheless, ICU nurses described the care provided to patients with COVID-19 as inhumane. These nurses experienced a lack of patient personalization, limited integration of patients in the ICU, ban on the presence of patient relatives, reduction or modification of their relationship with the patient, patients dying alone, and communication problems with patients (27–29, 34–36, 39, 42, 43).

> *"It just feels more distant because you're gowned up you feel like you're in a suit all the time. You can't really make that personal connection, they can't see, you can't see, you're in a mask and glasses…" (36).*
>
> *"I should not be the last voice they (patients) hear. It should be someone they love" (43).*

Distance from professional care

Nurses stated that they did not perform trained and specialized nursing duties and were restricted to the tasks of a physician's assistant. Therefore, they had feelings of inadequacy when providing care to patients (27–30, 34, 44).

> *"The quality of nursing care (and the ICU care in general) is lower than usual." "... it feels like we are just medical assistants who change the patient's infusions" (29).*
>
> *"…I just felt like sometimes I was just a body there, like I wasn't actually doing nursing things that I've been trained to do" (30).*

Psychosocial experiences

Within patient care, ICU nurses endure psychological pressure. In the current pandemic, these pressures have intensified, as it has created tremendous demands and expectations, both physically and mentally, because COVID-19 is an emerging infectious disease with a high mortality rate and yet no absolute treatment. Furthermore, they often experienced stigma outside of the hospital due to providing direct care for COVID-19 patients (30, 36). Stigma is a social process identified by labeling, separation, and stereotyping. The experience of stigmatization can lead to negative psychosocial experiences and effects (51). Therefore, ICU nurses experienced various psychological issues. Psychosocial experiences were separated into three subcategories, including emotional reactions, distance from normal life, and the image of nurses in society.

Emotional reactions

The nurses reported contradictory feelings about work in ICUs. Almost all nurses experienced negative emotional reactions including stress, fear, and worry about being infected and infecting their loved ones (27–29, 31–34, 36, 38–40, 42). In addition, they felt anxiety, helplessness, pangs of conscience, feeling lonely (27, 28, 32, 36, 39), suffering, frustration (33–36, 38), and even aggression and angry (33, 42). Furthermore, they were very depressed and sad due to facing the patients' death (37).

> *"But with these patients, because of the risk to myself (crying) and the risk of bringing home something to my family, it is very high stress" (36).*
>
> *"The stress caused by this disease has made me a little more aggressive, as I sometimes even become hostile toward my family, especially my brother" (42).*
>
> *"I mostly experienced fear… I think and fear that in the future myself or anyone in my family may encounter this disease" (33).*

If we look at the COVID-19 pandemic from another perspective, we might see that it could create positive emotional reactions in nurses. Nurses tried to empathize with patients (28, 36). They enjoyed cooperating with colleagues and were happy with their patients' recovery (28, 29). In addition, with the decrease in the number of hospitalized patients, hope arose among nurses (38).

> *"I learned to empathize with my patient, being in their shoes… That's what happened here, knowing his situation, knowing that he has kids that love him, care for him, the same level that I would love my parents" (36).*

Distance from normal life

During the pandemic, nurses were subjected to discrimination, loneliness by others, and social isolation, in addition to intense work stress. Providing care to infected individuals, working in high-risk areas, and living in isolation from their family members, led to nurses feeling that their lives had become distanced from the normal route. Their families feared getting infected and obsessed over this (42). Therefore, nurses had to reduce interactions with their families and isolate from them (28, 29, 33, 34, 36, 39, 42, 44). They felt uncertainty in life (28, 34) negative behaviors, and a lack of understanding from friends and family members (30, 33).

> *"Our lives have gone off-track, and we have no peace. Before the current pandemic, when we got home after the shift, we could at least cuddle our children. My wife and I would at least talk together, but not now! We cannot cuddle our children. Contacts are limited. We suspect and doubt anything and everything in our own home, which is the safest place in terms of Corona" (42).*
>
> *"...and I have a fear of infecting people around me, so I don't meet anyone" (33).*

The image of nurses in society

During the COVID-19 pandemic, nurses have continued to provide care for infected patients, while, at the same time, many jobs were closed or were performed online. The efforts of nurses to save human lives and provide care have also been portrayed by the media and social media. Therefore, people have become more aware of the importance of nursing. The nurses' families have shown pride in them, and the public has shown appreciation for their efforts. Nurses have been portrayed as heroes and valuable health workers (28, 31, 35, 36, 38, 39). Thus, the COVID-19 pandemic has created a unique image of nurses in society.

> *"I know that everybody's trying to be nice by calling us a hero but it's just like I don't feel that way, I never have felt that way. It doesn't feel like that, heroes are supposed to save everybody, we're not doing that" (36).*

Efforts for self-protection and wellbeing

ICU nurses were more concerned than others because they were not only at the center of the crisis and at high risk of infection to themselves and their loved ones, but also faced problems such as lack of PPE and lack of organizational support. Consequently, they tried to save their lives and wellbeing by adopting various behaviors in order to stay safe and healthy. Their efforts toward self-protection and wellbeing contain two subcategories, including responsible self-protection coping mechanisms and unreasonable self-protection coping mechanisms.

Responsible self-protection coping mechanisms

Responsible self-protection was one of the nurses' coping mechanisms when providing care for patients with COVID-19. These mechanisms include willingness to perform laboratory tests (34), self-supplying PPE, purchasing high-quality PPEs on the open market in terms of skin and respiratory protection, and strict adherence to personal protection principles when providing care to patients with COVID-19. For example, they usually wore three pairs of gloves during performing procedures (38, 42, 45). Furthermore, they tried to maintain their physical and mental health and wellbeing through positive thinking and attitude, religious activities, interaction with family and friends, entertainment, adequate sleep and food, rest, seeking support, relaxation, shopping, and positive acceptance (28, 33, 40).

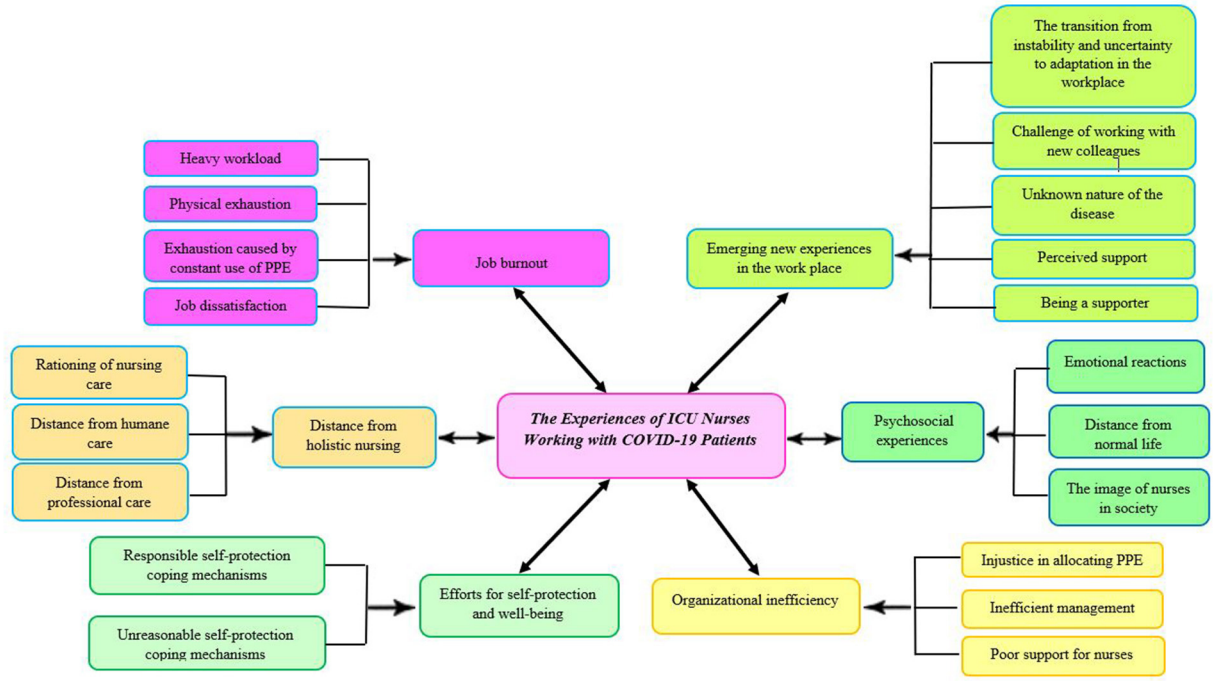

FIGURE 2
Experiences of intensive care unit nurses working with COVID-19 patients.

> *"I wasn't afraid or scared of providing care for patients with COVID-19, but I was careful; fear leads to death. I was very cautious in providing care for these patients and carefully observed all principles of personal protection" (42).*

Unreasonable self-protection coping mechanisms

Some nurses had unreasonable self-protection coping mechanisms. They displayed behaviors such as obsession with the infection, prolonged scrubbing, and doubt about the protocols (31, 42). Furthermore, some nurses considered only their own life and wanted to work in other wards. Some of them had challenges related to PPE and tried to steal PPE from other colleagues. In contrast, some others were indifferent to using PPE through self-censorship (42).

> *"We've become far too obsessive about everything. When the shift is over, it takes an hour for us to leave the ward; we disrobe and scrub. Our scrub is frightening. We think everything is infectious because of our obsession. Interestingly, it is the same at home, too" (42).*

Organizational inefficiency

Nurses felt unheard and unseen. They were dissatisfied with organizational inefficiency and poor support and expressed that the healthcare system was not ready for pandemic conditions. Organizations couldn't provide adequate support for nurses. Therefore, ICU nurses had to work in conditions such as a lack of PPE, improper PPE, and long shifts due to nursing shortage. Organizational inefficiency is divided into three subcategories including injustice in allocating PPE, inefficient management, and poor support for nurses.

Injustice in allocating PPE

Nurses complained about the doctor's dominance over the system and the discrimination of the authorities in allocating PPE (42).

> *"Doctors are dominant here. Doctors are given the best gear, but it isn't like that for nurses. A nurse is condemned to work with any equipment they are given" (42).*

Inefficient management

Inefficient management was another subtheme of organizational inefficiency. Nurses reported the nurse managers as unsupportive and invisible. They also described that managers' performance in training, supervising, providing manpower, and PPE for nurses was insufficient. The need to improve nursing skills and monitor nurses' performance was felt by nurses during the COVID-19 pandemic (27, 28, 30, 34). In addition, nurses faced problems such as a lack of preparedness of the health system to deal with the disease, nursing shortage (29, 31, 36, 40, 42, 43, 45), and lack and insufficient quantity and quality of PPE (27–29, 31, 34, 36, 40, 42, 43, 45).

> *"There was no mask in the early days of the disease. We saw that disinfectant solutions were not in the ward and could not be found. The supply of gloves was reduced. Equipment was scarce" (31).*

Poor support for nurses

Nurses expressed that they needed the support of the authorities. Nevertheless, they did not receive adequate support from officials. Ignorance by officials, cancellation of contracts in private hospitals, lack of financial support, respect, attention, and appreciation, and dissatisfaction with officials were also reported by nurses. In addition, they expected competence-based evaluation (27, 28, 30–32, 42–44).

> *"Since the outbreak of Coronavirus, no university deputies or hospital managers have come to ask 'What are you doing here? What kinds of problems are you facing?' this shows that the system is not much concerned about personnel" (42).*

Job burnout

The highly contagious nature of COVID-19 increased patients' needs for intensive care. Nurses had to wear PPE for long periods of time. Furthermore, many nurses were infected and some of them unfortunately died. Accordingly, the workload of ICU nurses increased exponentially. Therefore, during the COVID-19 pandemic, ICU nurses were constantly faced with stressful conditions, which resulted in emotional exhaustion, while managing complex treatment and care processes. Working for long periods of time in an environment with a high level of uncertainty and stress, increasing workload, with nurses' units or wards being relocated, caused ICU nurses to experience burnout more rapidly. Furthermore, the inconsistency between the ideal expectations of the nursing profession and the situations faced in real life also increased burnout. As a result, these factors contributed to the high intention to leave jobs among ICU nurses. The job burnout category was segmented into four subcategories including heavy workload, physical exhaustion, exhaustion caused by the constant use of PPE, and job dissatisfaction.

Heavy workload

Working during the COVID-19 pandemic increased the nursing workload. Nurses had long shifts without a break and multiple responsibilities such as technical management of material, and managing human resources (27, 29, 31, 32, 34–36, 38, 40, 42, 43, 45).

> *"There is a great responsibility for us with experience and competence in intensive care. We have to lead the work, support and teach our new colleagues, and at the same time be responsible for many patients besides those we care for ourselves" (29).*

Physical exhaustion

Nurses experienced various signs and symptoms of physical exhaustion including, fatigue (29, 34, 36, 42), sweating (34, 36), vomiting and fainting (34), sleep disturbances (31, 36), headache and migraine (36), hard and heavy breathing (36), and spots and skin damage (42).

> *"... The first time I took care of a patient with COVID-19 I couldn't stop sweating ..." (34).*

Exhaustion caused by constant use of PPE

Nurses have to wear PPE for long periods of time. Wearing PPE generates a lot of heat which is hard to bear. Nurses experienced many problems such as fatigue, difficulty breathing, hypotension, skin abrasions, sweating, headache, difficulty focusing, drinking, and eating due to wearing PPE. In addition, nurses spent a lot of time wearing PPE and it became more difficult for them to perform the procedure, thus their workload increased. Therefore, they described an uncomfortable feeling from wearing PPE (32, 33, 38–40, 42, 44, 45).

> *"The clothes we wear make us very tired during the shift. Besides, with these on, we cannot eat or use the bathroom, especially during night shifts" (42).*
>
> *"Since we could not remove the equipment, we could neither drink water nor go to the toilet during the time we worked" (33).*

Job dissatisfaction

Some nurses regretted being a nurse. Some quit or desire to quit their job and did not turn up for their shifts (32, 42, 44).

> *"We were all unhappy about being a nurse, and wish we had another job that would take us away from this setting" (42).*

As a result, heavy workload, physical exhaustion, exhaustion caused by the constant use of PPE, and job dissatisfaction contributed to high intention to leave jobs among ICU nurses.

Emerging new experiences in the workplace

The COVID-19 pandemic created new conditions in hospitals. In response to the current pandemic, new ICUs were established; nurses were transferred to new wards and new treatment teams were formed. Therefore, new experiences emerged in the ICU nurses' workplace. These experiences were separated into five subcategories, including the transition from instability and uncertainty to adaptation in the workplace, the challenge of working with new colleagues, the unknown nature of the disease, perceived support, and being a supporter.

The transition from instability and uncertainty to adaptation in the workplace

The COVID-19 pandemic created a standby situation for nurses. At the beginning of the pandemic, many changes were created in the structure of ICUs. Nurses were transferred to unfamiliar wards and were unsure of their duties. In addition, the condition of the patients was unstable and many of them died. Nurses stated it was like "being in a war zone" with patients dying despite their efforts to recover. Furthermore, the guidelines were constantly changing and the treatment process was different in different waves of the pandemic. Therefore, uncertainty and instability were the predominant experiences of ICU nurses. Nevertheless, with the overtime, the nurses stated that they became more patient than before, their management, planning, and practical nursing skills improved and they gained more experience in managing the pandemic, as a result, they gradually got used to the conditions. Therefore, adaptation and experience have replaced uncertainty (27–32, 36, 37, 40, 43, 44).

> *"I think that there should have been more check ins with the nursing staff that got floated, for sure, because you took them from their comfort home, you took them from doctors they know, you took them from a layout of a floor that they know and you dumped them in a unit that you had no clue about" (30).*
>
> *"…I was on guard duty at the beginning of the pandemic and I felt so bad. I had a stomachache like a child starting elementary school. But now I am doing my best. I'm just not in this situation. Many people are in this situation. Frankly, I'm going a little more comfortably because I'm doing my best. I got a little more used to it. I also learned to integrate this into my life…" (28).*

The challenge of working with new colleagues

In response to the increasing number of patients and ICU beds, new nurses were added to old care team and new teams were formed. As a result, nurses experienced a variety of challenges in working with new colleagues. They worked with new nurses on each shift and communication between new team members was poor. New nurses with no critical care experience started working in ICUs without receiving adequate training. In addition, nurses were uncertain about the qualifications of the new co-workers that they were also responsible for. Therefore, their workload increased (27, 29, 30, 34, 35, 39, 43, 44).

> *"Many new colleagues with different experiences and competencies meant a greater responsibility for me [as an ICU-nurse]. Even if I 'just' had to care for two or three patients, I also had to ensure that the other patients received appropriate care and support from my colleagues" (29).*
>
> *"The problem is that the ratio was a bit distorted because the nurse you were assigned as a companion could not take on the same as another nurse who knew the patient" (35).*

The unknown nature of the disease

The unknown nature of the disease also affected nurses during the COVID-19 pandemic. The route of transmission, clinical signs, and prognosis of the disease was unknown and there were rumors about the disease (31, 33, 42).

> *"You don't know its clinical picture either. Are fever, cough, and shortness of breath the actual signs or not? You don't really know. We have had many of such patients with none of these signs. One patient said that he only had diarrhea" (42).*
>
> *"…and it's not a disease we know of, after all; we're just learning things, so it's very backbreaking" (33).*

Perceived support

Some nurses reported that they received emotional and practical support from their colleagues and the authorities, and, in some situations, they preferred colleagues' support over institutional resources. This support included teamwork, strengthening relationships between nurses, clinical support *via* email and follow-up email notes, daily tips for ICU nurses issued by the authorities, extending contracts in public hospitals, in-group meetings with head nurses to express concerns and problems (28, 30, 31, 34, 35, 38, 39), and providing PPE and training (44).

> *"I think honestly the best thing that happened to me during COVID was I didn't realize like how great my like actual [home unit] coworkers were…everyone just came together so well and they were always there for me…we were always there for each other… I feel like everyone [was] such a family" (30).*
>
> *"However, when the rescue teams came and there were more medical staff, we felt that the pressure was not as great as before" (38).*

Being a supporter

Nurses tried to support patients and their families by creating support teams fluent in the patients' language, countering rumors, accompanying the patient when dying, helping patients communicate with their families, and training and providing appropriate evidence (30–32, 34–36, 39, 43).

> *"Early in the onset of the disease, there were many rumors, and one of our most important tasks when serving was to counter these rumors and provide appropriate evidence for patients" (31).*

Discussion

This systematic review and meta-synthesis integrated the findings of relevant studies and synthesized them to provide in-depth insight and knowledge regarding the experiences of

ICU nurses working with COVID-19 patients. Nineteen studies included in the meta-synthesis were from ten countries. Six main categories were identified, including distance from holistic nursing, psychosocial experiences, efforts for self-protection and wellbeing, organizational inefficiency, job burnout, and emerging experiences in the workplace.

The results of this review demonstrated a distance from holistic nursing. Nursing is a holistic profession, and there is a strong commitment to the idea that all components of the individual must be considered when caring for a patient. Nurses need to provide nursing care by considering the patient as a complete individual and trying to meet the biological, psychological, social, relational, and spiritual needs of the patient (52). Nevertheless, during the COVID-19 pandemic, most nurses rationed nursing care and distanced themselves from humane and professional care due to the fear of infection and a heavy workload. Such conditions affect the safety of patients. One possible solution is to reorganize nursing care in heavy-workload conditions, such as an ongoing pandemic, so that qualified ICU nurses can provide patient care.

This study found that ICU nurses experienced varied psychosocial effects. Similarly, evidence from the SARS pandemic showed that a prevalence of post-traumatic stress disorder and depressive disorder among HCWs was common (53). Furthermore, the results of a cross-sectional study on 117 ICU nurses caring for COVID-19 patients showed that 74.4% of nurses had moderate-to-severe perceived stress and 17.7% of participants indicated a probable diagnosis of post-traumatic stress disorder (54). Moreover, a systematic review found nurses experienced fear, concern, and anxiety during a respiratory pandemic (5). Stress, fear, anxiety, and worry are negative psychosocial experiences related to concerns about family members, the risk of infection, and the unpredictability of the disease, during the COVID-19 pandemic (17, 55). During the COVID-19 pandemic, ICU nurses have been witnessing the death of patients, end of life, family distress, and physical and psychological suffering. Furthermore, they have had to handle complex therapeutic regimens and sophisticated technical equipment. Therefore, working in the ICU is a source of psychosocial problems for nurses (56). In this regard, given the key role of nurses in providing high-quality care for COVID-19 patients, attention to their mental health and wellbeing should be a priority for policymakers and health system planners. In addition, appropriate interventions should be performed to improve their psychological condition, particularly in serious pandemic situations (57). Different interventions could be introduced to improve mental health, for example, screening and assessing mental health status, access to mental health care services and early supportive interventions for high-risk nurses, designated rest periods, social support to reduce feelings of isolation, sufficient PPE for nurses to provide protection (58).

The results of this review have shown that nurses have made efforts toward self-protection. Similarly to our results, a qualitative study reported nurses had obsessive behaviors during the COVID-19 pandemic (3). Infectious diseases are a significant threat to HCWs and nurses experience the risk of infection and the possibility of transmission to others (59). ICU nurses are at high risk of infection with COVID-19, due to performing aerosol-generated procedures, such as cardiopulmonary resuscitation and suction (60). Striving for survival is an inherent trait in humans. Therefore, it seems that it is normal for ICU nurses to try to save their own lives, which could be jeopardized at any time.

Our findings indicated organizational inefficiency in supporting the nurses and in pandemic management. In addition, nurses reported uncertainty in the workplace, the challenge of working with new colleagues, the unknown nature of the disease, perceived support, and being a supporter. Consistent with our results, a meta-synthesis of previous pandemics found that cooperation and camaraderie among nurses increased. Their collaboration expanded by sharing experiences, supporting each other, and fostering a team spirit. Nevertheless, organizational unpreparedness, lack of PPE, shortage of nurses, and a heavy workload were the most important challenges in working during the pandemic (5). Nurses play an important role in health promotion for patients, especially during the COVID-19 pandemic. They can provide high-quality and safe care only if they have the appropriate quality of work-life and if they receive adequate support. Therefore, it is necessary that nurse managers, nurse leaders, and healthcare officials should increase efforts to ensure the quality of work-life, dignity, and nurses' support using appropriate economic policies (61).

Findings from our review suggest that most ICU nurses experienced job burnout following physical exhaustion, heavy workload, exhaustion caused by the constant use of PPE, and job dissatisfaction, during the COVID-19 pandemic. Job burnout is defined as the experience of fatigue over a long period of time and reduced levels of job motivation, due to excessive demands in the workplace (62). Similarly, nurses experienced burnout owing to the heavy workload during the MERS outbreak (63). In addition, the results of a meta-analysis study by Galanis et al. showed that the level of burnout in nurses was high during the COVID-19 pandemic (58). Furthermore, a systematic review suggested that HCWs during the COVID-19 pandemic experienced a heavy workload, due to increased working hours, staff shortages, increased paperwork, and the use of PPE (64). Therefore, the need to decrease ICU nurses' burnout is evident. In this regard, healthcare organizations can help nurses by decreasing working hours and paperwork, increasing staff, attracting volunteer and skilled nurses, and providing more leave.

Limitations

To the best of our knowledge, this study is the first systematic review and meta-synthesis concerning the experiences of ICU nurses working with COVID-19 patients. However, our study had several limitations. Firstly, it only included studies published in English. Secondly, this systematic review and meta-synthesis only synthesized the experience of ICU nurses. Therefore, it is recommended that, in future studies, researchers review the experience of nurses and other HCWs working in other hospital wards. Thirdly, the development of COVID-19 vaccines may affect nurses' experience of caring for patients with COVID-19, and it is suggested that this be considered in future research.

Conclusion

This systematic review and meta-synthesis focused on the experiences of ICU nurses working with COVID-19 patients. Given the critical role of ICU nurses in the care process of COVID-19 patients, they require adequate attention and support. The findings from this review suggest healthcare authorities and policymakers can facilitate the provision of high-quality patient care during the COVID-19 pandemic through appropriate planning to provide adequate support and training, prevent shortages of nursing staff and equipment, and provide adequate attention to the psychological needs and job satisfaction of ICU nurses.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Effects of the COVID-19 pandemic on the mental health of rehabilitation area professionals: A systematic review

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Background: The role of the physiotherapist is vital in the recovery of post-COVID-19 patients, but fear of contagion is a possible feeling among healthcare professionals. The objective of this study is to assess the mental health effects that COVID-19 has had on healthcare workers, including rehabilitation care, in times of pandemic.

Methods: A systematic review was conducted using the PRISMA format in the Pubmed, SCOPUS, and Web of Science databases between July and September 2022. Keywords included were "healthcare providers," "COVID-19," "Mental Health," and "Psychological Distress." Methodological quality was assessed using the Joanna Briggs Institute critical appraisal tools.

Results: A total of 14 studies were included in this review. The study population was healthcare professionals including the rehabilitation services. In total, 4 studies reported exclusively on anxiety and stress levels in physiotherapists providing care during the pandemic.

Conclusions: The mental health of healthcare professionals has been compromised during the pandemic. However, initially, research was only focused on physicians and nurses, so the need arises to include those professionals, such as physiotherapists, who are also in direct contact with COVID-19 patients.

Systematic review registration: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=367664, identifier: CRD42022367664.

KEYWORDS

health professionals, physiotherapist, rehabilitation, mental health, psychological stress, anxiety, depression, COVID-19

Background

COVID-19 is a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (1), so defined because of its similarities to the 2003 SARS-CoV virus, with which it shares RNA characteristics but can cause both mild and severe respiratory infections. As the pandemic has progressed, the World Health Organization (WHO) has been regularly updating the classifications of SARS-CoV-2 by considering its phenotypic characteristics, degree of complexity, mode of manifestation, and geographical distribution (1). According to WHO, those most at risk of severe SARS are people over 60 years of age and those with comorbidities or pre-existing diseases, such as people with diabetes, obesity, cancer, or hypertension, among others. However, any person, regardless of age or health status, can develop complications, as can be seen by the high mortality rates, with a total of 6,547,162 deaths and 618,144,676 diagnosed cases worldwide as of October 2022, according to the Johns Hopkins Coronavirus Resource Center (2). The impact on the health system is massive as well as on Physical Rehabilitation Medicine services throughout the countries (3).

For COVID-19 to be declared a pandemic in March 2020, it had to show alarming levels of spread and severity affecting a large number of people, as well as outbreaks in more than one continent. Some of the consequences of SARS-CoV-2 implied limitations in participation and restrictions in access to different care spaces and services. Many of the diagnosed patients and others with different pathologies began to receive care through online appointments, leaving face-to-face consultations for more serious cases in order to combat the onslaught of the disease and its spread (4, 5). In addition, borders and some facilities were closed to help mitigating the psychological, environmental, and economic effects of COVID-19 (6, 7).

COVID-19 also has a serious impact on people's mental health (8). Psychological stress, including depression and anxiety, has been reported by healthcare workers with high frequency during the time of the pandemic (8, 9). Several factors increase the risk of mental health issues, including exposure to social, economic, geopolitical, and environmental circumstances. Mental health risks and protective factors are found in society at different scales, although, the most vulnerable people have taken the greatest impact (10). Global threats increase the risk of mental illness, including disease outbreaks, humanitarian emergencies, and forced displacement, among others (8, 11). But there are more vulnerable groups of professionals which had been affected by this pandemic, in example, those who worked in nursing homes, where access to protection measures was scarce and consequences went lethal both for professionals and residents (3). The pandemic has left great changes in its waves, with an impact on the mental health of people. Therefore, it is important to design and adopt protection strategies for the mental health of health professionals, as well as the early diagnosis of possible mental health problems (10).

The Job Demands-Resources (JD-R) model, in contrast to the theories of job design and job stress, highlights the role of job stressors, being used to predict burnout, engagement, and additionally, to identify the consequences of sickness absenteeism and job performance. With the JD-R model, it is possible to explain, understand, and predict employees' wellbeing. According to the theory, work environments can be divided into job demands and job resources, and this can be applied to all occupations. However, there are job demands and job resources specifically relevant to each occupation or profession (11). Job demands refer to those physical, psychological, organizational, or social aspects (e.g., work pressure, emotional demands, burnout) of work that require sustained effort, while job resources refer to those variants that can reduce the demands of work (e.g., social support, autonomy, development opportunities, organizational climate, commitment, etc.). In this sense, job resources are necessary to cope with job demands. Therefore, the interventions to be undertaken at the company level are both personal and organizational, applied in the redesign of the job, the job position, and/or by providing training resources that meet the objective of the intervention (11, 12).

According to a systematic review, some of the risk factors most associated with psychological distress during the COVID-19 pandemic were being female, from lower socioeconomic status (lower income, lower level of education, and unemployment), belonging to rural areas, and those at higher risk of COVID-19 infection (healthcare professionals, older people, or people with comorbidities). These population groups showed a higher prevalence of suffering episodes of depression and anxiety compared to other groups (12). In fact, during the first months of the pandemic, between 70 and 90% of health workers who were exposed to high risks, triggered various health problems, including stress, anguish, anxiety, fear, irritability, among others. This led to potentiate negative effects on the mental health of health workers, including the development of post-traumatic stress as part of a long-term problem resulting from this pressure (13, 14).

Abbreviations: CBI, Copenhagen Burnout Inventory; CES-D, Center for Epidemiologic Studies Depression Scale; COVID-19, Coronavirus Disease 2019; DASS-21, Depression Anxiety Stress Scales; GAD-7, Generalized Anxiety Disorder Tool; HADS, Hospital Anxiety and Depression Scale; HAMD-17, Hamilton Depression Scale; IES-R, Impact of Events Scale-Revised; JBI, Joanna Briggs Institute; JD-R, Job Demands-Resources; MBI, Maslach Burnout Inventory; MeSH, Medical Subject Headings; PHQ, Patient Health Questionnaire; PRIME-MD, Primary Care Evaluation of Mental Disorders; PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses; PSS-10, Perceived Stress Scale; RNA, Ribonucleic acid; SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus 2; SDS, Self-rating Depression Scale; WHO, World Health Organization; WHOQOL BREF, World Health Organization Quality of Life.

TABLE 1 PICO format: keywords (rehabilitation and COVID-19, Spain, 2022).

Population	Physiotherapist
Intervention	To assess mental health (depression, anxiety, stress, and fear)
Comparator	Mental health levels of other healthcare professionals
Outcomes	Prevalence of cases of people with depression, anxiety, stress, and fear; comparison of levels before and during the COVID-19 pandemic, predisposing vs protective factors, differences between countries, comparison according to type of profession/service.
Time period	During the COVID-19 pandemic
Research question	*How has the COVID-19 pandemic affected anxiety and fear levels in rehabilitation professionals?*

TABLE 2 Terms used in the search (Rehabilitation and COVID-19, Spain, 2022).

MeSH	Terms
Health personnel	Healthcare Professionals *OR* Healthcare Workers *OR* Healthcare Providers *OR* Professional Health Care
Physical therapists	*Physical Therapist OR therapist OR physiotherapist*
COVID-19	Coronavirus 2019 *OR* 2019-Ncov *OR* Cov-19 *OR* Coronavirus Disease-19
Mental health	Mental health
Psychological distress	Stress
Anxiety	Anxiety
Fear	Fear
Depression	Depression

There is the fact that research during this time of pandemic has yielded significant outcomes in different areas, being one of them healthcare professionals. However, it is understood that "those in the front line" are only physicians and nurses (13), leaving aside other key occupations in the recovery process of patients. For this reason, generating knowledge and evidence from other healthcare professions such as rehabilitation professionals is crucial to understand the effects of the pandemic (1).

Healthcare professionals play a major role in the care and contact with people with COVID-19, many of them being part of the first line of defense against the virus (13). They may also be afraid of infecting their family and friends, suffering from social discrimination, and experiencing increased work stress due to the high demand of patients in care, even leading to, in some cases, a decrease in the quality of care (15, 16). For all these reasons, the healthcare personnel may experience emotional disorders (anxiety, fear, depression), sleep problems, and even post-traumatic stress in those who have participated in previous outbreaks. Therefore, the physical and mental wellbeing of healthcare staff is compromised, and its preservation may be essential to combat the effects that COVID-19 leaves in its wake (16).

Due to the impact of the pandemic on all health services, a restructuring of rehabilitation services was initiated as Physical Therapy areas were transformed into temporary hospitalization rooms. In fact, the Spanish Society of Physical Medicine and Rehabilitation (17), published in 2020 recommendations in relation to health care and home restrictions, considering the consequences of the pandemic on population's health and leading health professionals (including rehabilitation services) to take on new challenges in patient care, appropriate treatment, and protocols to prevent the spread of the virus (3). That was a primary concern that required all rehabilitation professionals to participate in a comprehensive assessment in search of optimal care measures with focus on the patient's recovery, but also in controlling the spread of COVID-19. With this publication, it was reassured the necessity of knowing about the psychological impact of the pandemic on rehabilitation professionals, including, as part of future research, relating or reviewing differences with respect to other similar pandemics (e.g., SARS-CoV-1 and MERS) (14).

The aim of this study was to assess the effects that COVID-19 has on the mental health, i.e., the psychological distress, of healthcare workers of the rehabilitation services when caring for patients in times of pandemic.

Methods

Study design

A systematic review was conducted following the guidelines of the PRISMA statement (18) (Preferred Reporting Items for Systematic reviews and Meta-Analyses). For this purpose, the authors used a protocol to carry out this systematic review, which was registered in the International Prospective Register for Systematic Reviews (CRD42022367664).

Databases and search strategy

The search was carried out in the following electronic databases: Pubmed, SCOPUS, and Web of Science. It was based on the key words provided by the research question that followed the PICOT strategy (Table 1). Gray literature resources were not assessed.

Following these keywords, the Medical Subject Headings (MeSH) thesaurus was consulted, yielding the descriptors health personnel and physiotherapists, mental health, physiological stress, anxiety, depression, and COVID-19. In order to enlarge the scope of the search, synonymous terms were used to complete the search based on the Medical Subject Headings (MeSH) descriptors (Table 2), linked by the Boolean operators AND and OR.

TABLE 3 Search strategy used by database (rehabilitation and COVID-19, Spain, 2022).

Database	Search strategy	Results	Selected
Pubmed	((depression[Title/Abstract] OR anxiety[Title/Abstract] OR stress[Title/Abstract] OR fear[Title/Abstract] OR mental health[Title/Abstract]) AND (COVID-19[Title/Abstract])) AND (physiotherap*[Title/Abstract]) Filters: publication date years 2020–2022	86	17
Scopus	(TITLE-ABS-KEY (depression OR anxiety OR stress OR fear OR mental AND health) AND TITLE-ABS-KEY (COVID-19) AND TITLE-ABS-KEY (physiotherap*)) AND PUBYEAR >2019	247	22
Web of Science	TS = (Depression OR anxiety OR stress OR fear OR mental health (Topic) AND COVID-19 (Topic) AND physiotherap* (Topic)) Refined by: years 2020–2022 and type of document (ARTICLE) and search in: HUMANS	148	9
Google scholar	Items identified through other resources	5	2
Total	490	50/14[a]	

[a]After eliminating duplicates.

Table 3 shows the search strategy used on 27 July 2022 for each of the above databases during the search process.

Selection criteria

Original articles, including meta-analyses, systematic reviews, cohorts, cross-sectional, and case-control studies published in English and Spanish were included in this review.

The following criteria were used for the selection of articles:

Inclusion criteria

- Original articles published in English and Spanish.
- Articles published from 2020 to date.
- Type: original articles, meta-analysis, case reports.
- Articles measuring any of the following values and/or effects: level of depression, level of stress and level of anxiety, number of cases of professionals with depression, stress and/or anxiety, comparison of levels before vs. during the COVID-19 pandemic, and comparison according to country or type of profession/service.

Exclusion criteria

- Studies that did not meet the previously established inclusion criteria, that did not answer the research question, or that were not related to the objective of the review.
- Studies of low scientific-technical quality after applying the quality assessment tool.
- Study population other than healthcare professionals and which did not include rehabilitation professionals.
- Typology: opinion articles, commentaries, editorials and letters to the editor/head, and quasi-experimental.

Data collection and extraction

Initially, two researchers independently carried out the searches, as set out in the search strategy for each of the chosen databases. Subsequently, one researcher eliminated duplicate articles and those that did not meet the previous criteria, and finally included studies accordingly, after reading the titles and abstracts. Subsequently, one author reviewed the full text of the potential studies for the review and made the decision to include or exclude them. Discrepancies were resolved by the first two authors.

Assessment of methodological quality

The methodological quality of the selected studies was determined using the critical appraisal tools of the Joanna Briggs Institute (JBI) of the University of Adelaide (19). The purpose of this tool is to assess the methodological quality of a study and to determine the extent to which a study has excluded or minimized the possibility of bias in its design, conduct, and/or analysis. The versions for quantitative cross-sectional studies (19) (8 items), the JBI checklist for analytical cohort studies (20) (11 items), and for qualitative studies (21) (10 items) were used, setting the cut-off point at 6 for acceptance for inclusion in this review (see Supplementary Tables S1–S3 in Supplementary material).

Table 4 shows the characteristics of each of the 14 final articles for this review, and it is based on the Iberoamerican Cochrane Centre Handbook guidelines (22). These characteristics were categorized by authors and year of publication, geographical context, objective, type of study, participants, measurement instrument(s), and main findings; in addition, the results of the JBI critical appraisal tool were added.

TABLE 4 Characteristics of the studies included in the systematic review (rehabilitation and COVID-19, Spain, 2022).

References	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality
Alnaser et al. (23)	Kuwait (Western Asia)	To examine the level of anxiety among occupational therapists (OTs) and physiotherapists (PTs) who have interacted with patients during the COVID-19 pandemic	Quantitative cross-sectional study	Occupational therapists and physiotherapists in public hospitals ($n = 98$)	GAD-7 PHQ-15	GAD-7 and PHQ-15 were positively correlated ($p < 0.000$). Likewise, an association was shown between anxiety levels and somatic symptoms in both tests ($p < 0.000$). The final overall GAD-7 score was (9.21 ± 5.63), showing 27% of participants with no anxiety and 21% with severe anxiety. Significant differences were obtained between occupational and physical therapists for GAD-7 scores ($p = 0.026$), with PTs having higher anxiety levels than occupational therapists ($\mu = 8.13 \pm 5.49$). Additionally, therapists residing with their parents showed higher levels of anxiety vs. those residing without their parents ($p = 0.013$), as did those working in neurology compared to the other services (pediatrics and orthopedics)	6/8
Aly et al. (24)	Egypt	To assess perceived stress, anxiety, and depression among healthcare workers facing the COVID-19 pandemic in Egypt	Quantitative cross-sectional study	Physicians, physiotherapists, nurses, and others ($n = 316$)	GAD-7 PSS-10 PHQ-9	98.5% of the sample showed moderate to severe stress levels, 90.5% showed some degree of anxiety, and 80% showed varying degrees of depression, ranging from mild to severe. About 87% of the participants suffered from all 3 disorders (stress, anxiety, and depression), and only 3.5% suffered from only one. The three mental health disorders assessed showed no statistically significant differences between the different socio-demographic characteristics (age, sex, marital status) ($p > 0.05$)	7/8
Chatzittofis et al. (25)	Republic of Cyprus (Mediterranean)	To assess the mental distress of healthcare workers during the COVID-19 pandemic in Cyprus, in particular the presence of symptoms of post-traumatic stress disorder, depression, and anxiety	Quantitative cross-sectional study	Nurses, physicians, physiotherapists, and others ($n = 428$)	PHQ-9 IES-R PSS-10	Older age in men was a statistically significant variable associated with reduced scores on the PHQ-9 ($p = 0.003$) and the IES-R scale ($p = 0.005$). A history of depression was associated with increased mental health disorders and depressive symptoms during the pandemic ($p = 0.02$); however, a personal history of anxiety was not associated with mental health disorders or intensity of depressive symptoms ($p = 1.1$). In addition, an inverse association was observed between years of work experience and PHQ-9 score ($p = 2.6$)	6/8

(Continued)

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TABLE 4 (Continued)

References	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality
de Sire et al. (26)	Calabria (Italy)	To assess the correlation between work environment factors and psychological distress in a cohort of physiotherapists working in hospitals in southern Italy during the COVID-19 pandemic	Quantitative cross-sectional study	Physiotherapists in clinics with COVID-19 patients ($n = 80$)	Online local questionnaire C.A.L.A.B.R.I.A (nine questions)	Physiotherapists working in the public sector reported higher confidence in their skills ($a\tau = -0.32$, $p < 0.01$) and their employers worked harder to ensure good and safe conditions ($a\tau = -0.48$, $p < 0.001$)	6/8
Jácome et al. (27)	Porto (Portugal)	To describe burnout among physiotherapists working in Portugal and to analyze possible predictors during the COVID-19 pandemic	Cross-sectional study	Physiotherapists working during the COVID-19 pandemic ($n = 511$)	CBI. Resilience Scale DASS-21 Satisfaction with Life Scale.	42% of participants reported work-related distress and 25% reported patient-related distress. 55% of patients reported moderate levels of resilience and only 18% indicated levels of stress, anxiety, and depression. Significant differences were found in scores for personal ($p = 0.001$), work-related ($p = 0.043$), and anxiety levels ($p = 0.019$) of burnout between physiotherapists who directly cared for COVID-19 patients and those who did not. Correlations between measures of burnout, resilience, depression, anxiety, and stress were all statistically significant ($p < 0.001$)	6/8
Medeiros et al. (28)	Fortaleza (Brazil)	To document the prevalence of each burnout domain and the factors associated with these domains during the COVID-19 outbreak.	Quantitative cross-sectional study	Physicians, nurses, auxiliary nurses, and physiotherapists ($n = 265$)	-MBI-HSS	48.6% showed high levels of emotional exhaustion and almost 1/3 (29.4%) of them, showed high levels of depersonalization. 18.1% showed low levels of professional efficacy The determinants of burnout due to depersonalization were age <33 years (OR 2.03; 95% confidence interval, CI 1.15–3.56; $p = 0.01$) and being female (OR 0.33; 95% CI 0.18–0.62; $p = 0.01$). Increased workload was associated with emotional exhaustion (OR 1.89, 95% CI 1.04–3.58, $p = 0.030$).	6/8
Pigati et al. (29)	Sao Paulo (Brazil)	To investigate the levels of stress, depression and anxiety, event impact, resilience, and the determinants/modulators of these responses in physiotherapists working or not in contact with patients with COVID-19	Quantitative cross-sectional study	Physiotherapists ($n = 519$)	IES-R DASS-21	Physiotherapists with low resilience showed significantly higher depression, anxiety, stress, and event impact scores compared to the high resilience group ($p < 0.001$). In addition, working with COVID-19 patients increased levels of depression, anxiety, stress, and event impact compared to the non-COVID-19 group ($p < 0.001$). These responses were modulated by age, sex, number of absences from work, and whether these took place or not	8/8

(Continued)

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TABLE 4 (Continued)

References	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality
Syamlan et al. (30)	Indonesia	To explore mental health status and health-related quality of life (HRQoL), and to identify determinants, in healthcare workers in Indonesia	Quantitative cross-sectional study	Nurses, physicians, physiotherapists, and others ($n = 502$)	HQol SF12V2 DASS-21	Of the total respondents, 29.4% experienced depression, 44.9% anxiety, and 31.8% reported stress. In addition, depression, anxiety, and stress were more prevalent in women (34.7, 50.6, and 44.9%, respectively). Work during the COVID-19 pandemic was found to be statistically significant ($p = 0.015$)	7/8
Szwamel et al. (31)	Poland	(17) To analyse the burnout phenomenon, the level of anxiety, depression, and quality of life among healthcare workers in times of the COVID-19 pandemic. (1) To establish the factors that significantly determine the level of occupational burnout in this group.	Quantitative cross-sectional study	Nurses, physiotherapists, physicians, and others ($n = 356$)	MBI HADS WHOQOL BREF	71.63% showed high and moderate levels of emotional exhaustion during the pandemic, 71.43% reported low and moderate levels of job satisfaction, while 40.85% showed high and moderate levels of depersonalization. In addition, 62.57% showed borderline anxiety disorders and 83% ($n = 193$) suffered from depression. Emotional exhaustion seemed to be much higher in nurses and other healthcare professionals than in physiotherapists ($p = 0.023$)	8/8
Yang et al. (32)	South Korea	To investigate mental health burden by COVID-19, including stress and anxiety levels, in physiotherapists	Quantitative cross-sectional study	University hospital physiotherapists ($n = 73$)	GAD-7 PHQ-9	21 out of 73 physiotherapists showed anxiety (GAD-7 ≥ 5) and 12 out of 73 physiotherapists (18.5%) showed depression (PHQ-9 ≥ 10). The results revealed that physiotherapists who lived with an infant or child $\leq$6 years or a person $\geq$65 years had a significantly higher risk of suffering from anxiety ($p = 0.014$). If a physiotherapist had an infant or child $\leq$6 years, the risk of anxiety was significantly increased, reaching 6.72 times higher than for those who did not have a child $\leq$6 years ($p = 0.007$)	7/8
Farì et al. (33)	Southern Italy	To assess the impact of COVID-19 on the mental health burden of Italian healthcare workers, comparing their condition with that prior to the emergency	Quantitative, analytical, retrospective cohort study	Physicians, nurses, and physiotherapists ($N = 68$)	PHQ-9 GAD-7 MBI	50% of the assessed professionals scored above the cut-off point for burnout during the COVID-19 emergency. Moreover, it increased by 17% compared to the levels before the pandemic ($p < 0.0001$). The PHQ-9 scale showed statistically significant differences between before and during the pandemic ($p < 0.0001$), and anxiety levels tripled during the pandemic ($p < 0.0001$). Differences on the PHQ-9 were found in women being more exposed to anxiety ($p = 0.040$).	8/11

(Continued)

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TABLE 4 (Continued)

References	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality
Jeleff et al. (34)	Vienna (Austria)	To address the structural determinants and the physical, mental, emotional, and professional challenges of HCWs during the COVID-19 pandemic	Exploratory qualitative study	Physicians, nurses, physiotherapists, and others (n=30)	Semi-structured interviews (30 min)	There was a lack of preparedness (shortage of personal protective equipment and critical patient conditions), structural conditions that could be improved (understaffing and overload), and concerns about the physical and mental health of healthcare workers (stigma and avoidance behavior of colleagues)	7/10
Palacios-Ceña et al. (35)	Madrid (Spain)	To describe and explore the experiences and perspectives of physiotherapists working in public hospitals in Madrid, Spain, during the COVID-19 pandemic	Exploratory qualitative study	Physiotherapists (n = 30)	Interviews Inductive thematic analysis	3,912 codes and 13 categories were identified, resulting in 3 topics. As the COVID-19 infection spread dramatically, hospitals became contaminated and overwhelmed, and all floors became COVID-19 rooms (call of duty). Secondly, every day, therapists received 'the war report' and orders, complied with personal protective equipment requirements, and faced fear (working in wartime). Finally, working during the pandemic had an impact on the therapists' families and the information shared with them (when I get home)	9/10
Palacios-Ceña et al. (36)	Madrid (Spain)	To explore the emotional experience and feelings of physiotherapists working in the frontline in public health hospitals in Madrid (Spain) during the first outbreak of COVID-19	Exploratory qualitative study	Physiotherapists from rehabilitation services in public hospitals (n = 30)	Interviews Inductive thematic analysis	2,135 codes and nine categories were identified and three topics emerged to describe emotional experiences and feelings. Firstly, related with negative and positive critical events (Critical Events). Secondly, with emotions, feelings, and coping strategies (Emotional Rollercoaster). Finally, on the conclusions of the COVID-19 outbreak experience, with the meaning of the COVID-19 outbreak from a personal and professional perspective (Last words)	8/10

GAD-7, Generalized Anxiety Disorder (range 0–21; scale 0–3; Minimal anxiety 0–4/Mild anxiety 5–9/Moderate anxiety 10–14/Severe anxiety ≥ 15); PHQ-9, Patient Health Questionnaire depression module (scale 0–3, range 0–27; None-Minimal 0–4/Mild 5–9/Moderate 10–14/Moderately severe 15–19/Severe 20–27); IES-R22, Impact of Event Scale-Revised (range, 0–88); CBI, Copenhagen Burnout Inventory; DASS-21, Depression Anxiety Stress Scales (Depression, Normal 0–9/ Mild 10–13/Moderate 14–20/Severe 21–27/Extremely severe ≥ 28); MBI, Maslach Burnout Inventory; MBI-HSS, Maslach Burnout Inventory, Human Services Survey version; HADS, Hospital Anxiety Depression Scale; PSS-10, Perceived Stress Scale (scores from 0 to 13 "low stress"; from 14 to 26 "moderate stress," and between 27 and 40 "high perceived stress"; HCW, Healthcare workers; HRQoL, Health-related quality of life; SF12V2, Short Form 12 item (version 2) Health Survey.

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Results

The initial search strategies identified a total of 490 references, which were screened according to the topic of this review. A total of 14 articles were finally selected (Figure 1), 11 of which were quantitative (ten cross-sectional and one retrospective cohort) and three qualitative.

There was a variety of countries identified in the studies, among them, two were conducted in Spain, two in Brazil, two in Italy, and one in other countries such as Portugal, Korea, Austria, Indonesia, and Egypt, among others. In relation to the sample, in 6 of the 14 studies included in the review, the sample was exclusively composed by physiotherapists.

The included articles were assessed with the JBI critical appraisal tool, where both quantitative and qualitative studies obtained medium-high scores.

Level of anxiety

To assess anxiety levels, the different studies used the following scales: GAD-7, DASS-21, and HADS. The Generalized Anxiety Disorder tool (GAD-7) is a self-administered screening test designed to identify probable cases and severity of anxiety. The GAD-7 is used in adults >18 years old and includes 7 items on a Likert-type scale (0 = not at all; 1 = several days; 2 = More than half the days; 3 = Nearly every day). Scoring ranges from 0 to 21, with scores of 5, 10, and 15 set as cut-off points for mild, moderate, and severe anxiety, respectively. Further assessment is recommended when the score is 10 or higher (23).

The level of anxiety can also be assessed with the DASS-21 "Anxiety subscale," which has been one of the preferred assessing instruments during the COVID-19 pandemic (27, 30, 37, 38). This version consists of a 21-item, four-point Likert questionnaire which includes three self-report subscales designed to measure the negative emotional states of depression, anxiety, and stress (which apply to the participant from not at all to most of the time). Scores for each subscale range from 0 to 21, with higher scores indicating a more negative emotional state.

Level of depression

The Center for Epidemiologic Studies Depression Scale (CES-D), the Patient Health Questionnaire depression module (PHQ-9), the Depression Anxiety Stress Scales (DASS-21: Depression subscale), the Hamilton Depression Scale (HAMD-17), and the Self-rating Depression Scale (SDS) (39) are available to assess depressive symptoms.

The HADS is one of the scales used in the assessed studies to evaluate depression and anxiety. It had been used before with nursing staff in Poland (31, 39). It originally contained 7 items assessing anxiety and 7 items related to depressive states. After modification, 2 items for irritation and aggression were added. In total, the scale consists of 16 closed questions with 4 possible response options. Each answer can be scored between 0 and 3 points. The categories are distinguished individually for the anxiety and depression subscales (0–7: no disorders; 8–10: borderline state; 11–21: present disorder).

In addition, the level of depression was qualitatively assessed through semi-structured interviews to record and code the emotional experiences of healthcare professionals, including the rehabilitation services, in times of pandemic (34–36).

Level of stress

The Perceived Stress Scale (PSS-10) consists of 10 questions about feelings and thoughts during the last month. Responses are given for each question on a 5-point scale which ranges from "never" to "very often." Then, the total is calculated. Scores ranging from 0 to 13 are regarded as low stress; scores from 14 to 26, moderate stress; and between 27 and 40, scores are considered high perceived stress (24, 25).

The 22-item Impact of Events Scale-Revised (IES-R) is used to assess post-traumatic stress symptoms during the past 7 days. Each item is scored from 0 to 4. The total scale score ranges from 0 to 88. Values above the cut-off point of 33 indicate a clinically relevant symptom (25, 29).

Other data

All studies included questionnaires covering socio-demographic data (age, sex, marital status, and occupation). However, some of them included questions related to the health of the participants (25, 28) and others about the way of working during the pandemic (face-to-face, telework, etc.) (27).

Regarding mental health, some studies (26–29, 34, 36) used the Patient Health Questionnaire (PHQ) to measure the level of somatisation. It is a self-administered version of the PRIME-MD (Primary Care Evaluation of Mental Disorders) diagnostic instrument for common mental disorders (24, 25, 32, 33). The PHQ-15 (23) comprises 15 somatic symptoms from the PHQ. The 15 items are scored on a 3-point Likert scale (0 = does not bother me at all; 1 = bothers me a little; and 2 = bothers me a lot). However, due to cultural sensitivities, two items (question no. 4: menstrual cramps or other problems with your periods and no. 11: pain or problems during intercourse) were removed from the questionnaire and the mPHQ-15 (modified version) with 13 somatic symptoms emerged. The mPHQ-15 total score ranged from 0 to 26 and scores of 3, 18 and 13 were set as cut-off points for mild, moderate, and severe somatisation levels, respectively. The PHQ-15 has demonstrated high reliability and validity for application in clinical and occupational health care settings (23).

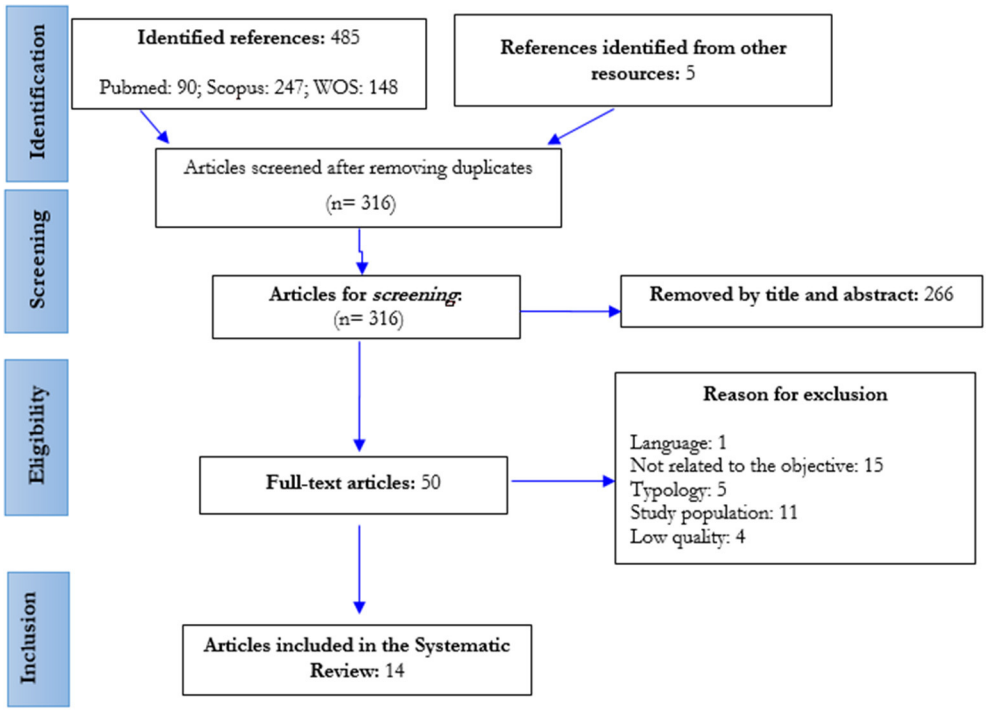

FIGURE 1
Flowchart of the study selection process (PRISMA) (rehabilitation and COVID-19, Spain, 2022).

The Maslach Burnout Inventory (MBI), on the other hand, assesses the level of burnout. It is composed of 22 items designed to evaluate the three dimensions of burnout: Emotional Exhaustion (nine items); Depersonalization (five items); and Personal Accomplishment (8 items). All MBI items are scored using seven-level frequency ratings, from "never" (=0) to "every day" (=6). Burnout is confirmed by obtaining high scores on the subscales that assess emotional exhaustion (0–54 items) and depersonalization (0–30 items) and low scores on the Personal Accomplishment subscale (0–48 items) (28, 31, 33). Similarly, the Copenhagen Burnout Inventory (CBI) is a scale designed to measure burnout, including 19 items in subscales (personal, work-related, and client-related). All items are scored on a five-point Likert scale (Always/To a very high degree = 100; Often/To a high degree = 75; Sometimes/Somewhat = 50; Seldom/To a low degree = 25; and Never/Almost never/To a very low degree = 0) (27).

The WHOQOL measures health-related quality of life. It was assessed using the Polish version of the abbreviated World Health Organization instrument (WHOQOL BREF). It has 4 domains: D1-Physical; D2-Psychological; D3-Social Relationships; and D4-Environmental, and consists of 26 questions. The respondents rate each aspect on five-point Likert scales. The domain score reflects an individualized perception of each quality-of-life domain, and it is scaled in a positively framed direction: the higher the score, the higher the health-related quality of life (30, 31).

Discussion

The COVID-19 pandemic has radically led to a change in lifestyle, affecting different aspects (work, family, personal, among others) (40). Newly published research studies recommend the work of the physiotherapist in the recovery of post-COVID-19 patients. However, though mental health is a determining factor in people's wellbeing and it should not be disregarded, fear of contagion is latent in healthcare professionals and leads to an increase in their levels of stress, anxiety, and fear of providing care to patients.

Regarding the qualitative assessment, three of the analyzed studies have something in common (34–36), namely that the experiences of the COVID-19 outbreak have led to emotional disturbances, which have required coping strategies, not only on a personal, but also on a family and professional level. However, one study, in contrast to the others, included in its conclusions some experiences such as "*But not everything was bad. I have learned a lot*" (35). A Spanish study highlighted that not being single, having a number of years of professional experience and being a man, was associated with a greater use of

coping techniques that protect against stressors and threatening emotions. Young people have shown that they have suffered more from isolation from their physical, family and social environment (10). Another issue to highlight is the importance of access to and use of personal protective equipment, as part of the contagion was due to the lack of resources or their misuse (35).

One of the qualitative studies (35), two quantitative studies (23, 32), and one systematic review (40) mention that the latent fear in healthcare workers was that they might infect their family members. This fear sometimes led to self-stigmatization or avoidance behaviors (sleeping in separate beds, not sharing objects/space with family members, among others). In addition, gratitude and appreciation were important issues for most healthcare workers.

On the other hand, most of the quantitative studies, with the exception of one (33), followed a cross-sectional method for measuring and obtaining study results. Among the commonalities between studies, they all shared the assessment of anxiety and stress levels. Also, the most commonly used instruments were the PHQ-9 and GAD-7. Several studies (24, 25, 28) showed associations between anxiety levels and somatic symptoms. Aly et al. (24) indicated that the vast majority of participants suffered from mental health disorders. However, they showed no differences related to age or sex. On the contrary, Chatzittofis et al. (25) and Farì et al. (33) do show in their results significant differences by age and sex, though with opposing results, indicating in the first study that men and older subjects showed increased levels of anxiety while, in the second study, women were more exposed to increased levels of anxiety. In addition, Syamlan et al. (30) indicated that women had a higher prevalence of suffering from depression, anxiety, and stress.

Farì et al. (33) concluded that there were differences in the level of anxiety before and during the pandemic. Only the study by Medeiros et al. (28) mentioned professional efficacy during the pandemic, indicating that just 18% showed low levels of professional efficacy. However, other studies mention that rehabilitation professionals identified negative effects on the quality of services they provided as a consequence of COVID-19 (41, 42). Fear is a human response to threatening situations, and SARS-CoV-2 has become a major global threat, generating this feeling. Emotional burden, perceived risk factors, as well as lack of well-evidenced information, may be associated with the perception of fear of COVID-19 and the impact on health (14).

As for the differences found between types of healthcare professionals, only Szwamel et al. (31) showed that emotional exhaustion was higher in nurses than in the other professionals evaluated, such as physiotherapists. Del Pozo-Herce et al. (14) showed that the pandemic has left a great psychological impact on health professionals, both in terms of stress and in the use of coping strategies, and they indicated that professionals who did not have appropriate working conditions (i.e., type of contract and salary) or those with less years of experience, were more affected in mental health than others.

Strengths and limitations of study

This study allowed to examine professionals in the area of rehabilitation as an important part of health care during the pandemic. Including this population in the investigation and carrying out research to generate new interventions in mental health are the strongest parts of this research. Likewise, the assessment of rigor and methodological quality of the included studies, and their variables, permit to support solid conclusions and generalizations. Despite the results of interest provided in this research, it would be pertinent to continue deepening the subject of study.

The present study shows some limitations. Firstly, it should be noted that one article written in German was rejected, as no translation could be found, so it is possible that some articles that met the rest of the inclusion criteria were left out for this language reasons. In addition, eleven articles were rejected for not having the exact study population, i.e., only included physicians and nurses but not rehabilitation professionals, or there was not a clear statement about their inclusion in the study. The vast majority of studies was also found to not show strategies to control for confounding factors, except for two articles that do mention this aspect.

Some of the studies did not show a balance between men and women, so it was not possible to assess sex differences related to the variables described in the objective. On the other hand, certain articles did not include a variety of professional groups that would allow establishing differences between professionals/services. Therefore, the findings may have a limited possibility for generalization to all healthcare professionals as the studies only considered physiotherapists to study the professionals of rehabilitation services, and did not include other groups of important professionals, i.e., occupational therapists, speech therapists, etc. Likewise, although there is a variety of countries in the total number of studies, the quantity is not sufficient, and therefore, the representativeness of the results found cannot be extrapolated to the rest of the health professionals who carry out their healthcare work in the rest of the countries of the world.

Implications and contributions to the field of knowledge

Professionals of the rehabilitation services indicated that the quality of services has been affected by COVID-19, compromising the effectiveness of care (41, 42). For this reason,

some activities were temporarily suspended during the last 2 years of the pandemic, and programmes based on work from home were implemented in order to reduce contact with patients. It is therefore relevant to continue researching those factors that compromise the comprehensive care of users in order to implement new care strategies that do not diminish the quality of the service, but allow for continuity.

The use of technology is a good strategy for communication and medical intervention, including rehabilitation. In this sense, it is also important to carry out studies that compare results between professionals in the same health care area, i.e., not only taking into account physiotherapists as the only ones involved in rehabilitation, though this may not be applicable in all cases, as telerehabilitation allows contact to be maintained without fear of contagion. Technology applied to medicine may also empower the patient in their treatment to become an active participant in their recovery, and would also enable the caregiver to assume their role while avoiding overload and being supportive in the process of rehabilitation of the patient, without requiring the continuous presence of the professional in charge.

Equally, the information on the psychological impact of the pandemic throughout the last 2 years contributes to expand knowledge and increases the interest on intervention strategies focused on the health worker's mental health, including professionals in the rehabilitation area. These interventions can be designed to modulate or reduce the risks and consequences of mental health deterioration, as part of a method of prevention of occupational diseases.

Conclusion

Mental health of healthcare professionals, in general, has been compromised as the COVID-19 pandemic has progressed, compared to before the onset of the pandemic. Women were also found to be more likely to suffer increased levels of anxiety, burnout, and depression, and professionals with children and families showed higher levels of distress and anxiety in caring for patients with COVID-19. Additionally, professionals who were in the front line of the battle against the virus have seen their mental health compromised but with values below those of the general population.

Changes in working hours and care settings, patient overload, fear of becoming infected and infecting loved ones and/or patients, among others, may be precipitating factors for an alteration in the mental health of healthcare professionals in times of the COVID-19 pandemic. Such an alteration can be a major problem at a personal, family, and professional level and can increase the risk of professional malpractice.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding authors.

Author contributions

Conceptualization: SB-B, RA-C, JG-S, CM-L, JG-I, JF-R, and CR-F. Data curation: SB-B, JG-I, and RA-C. Formal analysis: SB-B, RA-C, JG-S, CM-L, CR-F, JG-I, and CR-F. Investigation: SB-B, RA-C, JG-S, CM-L, JG-I, and JF-R. Methodology: SB-B, JG-S, CM-L, CR-F, and JF-R. Project administration: JG-S and CR-F. Resources: RA-C, JG-S, CM-L, JG-I, and JF-R. Software: SB-B, RA-C, JG-S, and JF-R. Supervision: JG-S, JF-R, JG-I, and CR-F. Validation: RA-C, JG-S, CM-L, and CR-F. Visualization: JF-R and JG-I. Writing—original draft: SB-B, RA-C, JG-I, and JG-S. Writing—review and editing: JG-S, CM-L, JF-R, and CR-F. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1085820/full#supplementary-material

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Research trends in healthcare and hospital administration in Japan: Content analyses of article titles in the journal of the Japan society for healthcare administration

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This study quantitatively analyzed healthcare administration studies in Japan using text mining, focusing on articles published during 1994–2021 in the *Journal of the Japan Society for Healthcare Administration* (prior to 2008, the journal was called *Hospital Administration*). Both the co-occurrence network and the correspondence analysis (these are extracted words that refer to the two systems) demonstrate two major changes: (1) the introduction of the long-term care insurance system, which was enacted in 1997 and came into effect in 2000, and (2) the introduction of the late-stage medical care system for the elderly in 2008, both of which had a significant impact on the Japanese public health and welfare system. *Co-occurrence network* and *correspondence analysis* were conducted to understand changes in research interests. The analysis used two time periods following a change in the journal's name in 2008. To readily comprehend changing research trends, 10-year segments were considered, resulting in three time periods. The research features and trends during the aforementioned periods were examined using correspondence analysis. Configuration figures derived from this analysis plotted *time transition* (first dimension) against certain *abstract/concrete situations* (second dimension). The extracted words displayed in the configuration maps at the axes' intersection were *patient, survey,* and *evaluation.* They revealed no distinctive features compared with other words and were commonly used in article titles within this journal during each period. The following results were obtained from the correspondence analysis: first, changes in the geriatric care system of public medical insurance and the introduction of the long-term care insurance system in 2000 were expressed in the characteristics of the extracted words; second, in the 14 years after the journal's name changed, published studies frequently referred to the roles of doctors, nurses, and other healthcare professionals. A chi-squared test on these extracted words and the period classification confirmed a statistically significant relationship between them.

KEYWORDS

research trends, healthcare administration, hospitals, public medical insurance, content analysis, correspondence analysis, Japan

Introduction

The global spread of the novel coronavirus disease since 2019 has allowed researchers and practitioners in the healthcare field to challenge and reconsider the appropriateness of previous healthcare policies and hospital management practices. In Japan, the core functions of community healthcare have long been performed by public hospitals run by local governments. However, since the 1990's, economic constraints and a subsequent deterioration in national and local government finances have led to a reduction in the number of public hospitals and hospital beds, and a change in management methods from direct management to greater control by local independent administrative agencies. Amid the current coronavirus crisis, the importance of organizational flexibility and the need to improve the working conditions of medical personnel (including doctors, nurses, and clinical engineers who operate ventilators and extracorporeal membrane oxygenation), and ensure stable availability of personnel, have become critical issues. For instance, the workload of medical staff is increasing and their working environment is deteriorating. Hence, research is being conducted to find ways to optimize staff schedules (1). In this context, it is important to reflect on changes across research trends in healthcare administration regarding the efficient management of hospitals and hospital organizations to consider and implement future healthcare policy and management effectively. Concerning longer-term changes in the healthcare system and healthcare policy, since the 1980's, maturing of the Japanese economy and the declining birthrate and aging population have harmed the financial situation of national and local governments, thereby affecting the healthcare system. For instance, under these circumstances, the medical care system for older persons in Japan is being reviewed, with an increase in the co-payment ratio and financial separation from the general public medical insurance system.

This study examined the changing trends in healthcare administration research in Japan using content analysis and text-mining methods. Understanding changes in research trends can promote an understanding of the changing trends and representative cases regarding problems and how to address them in the field of healthcare administration. As research trends are somewhat related to actual institutional changes and trends in issues, quantifying these changes in the healthcare management field allows reconfirmation of the shifts in healthcare management systems that have been historically described, such as changes in universal health insurance systems. A content analysis method was proposed by Krippendorff (2) in the 1980's, focusing on the symbolism and meaning of documents and texts. The method was elaborated in subsequent studies (3–5). With the development of analytical technology and an increase in available software, the number of studies applying text-mining methods has increased. We employed a text-mining analysis, targeting article titles in the *Journal of the Japan Society for Healthcare Administration (Nihon Byoin Kanri Gakkai-shi)*. The journal was called *Byoin Kanri (Hospital Administration)* from 1964 to 2007. When the society's name changed in 2008, the journal's name also changed to its current one.

The volumes targeted for text mining ranged from volume 35 (1), published in 1994, to volume 58 (4), published in 2021. The volume numbers extend through the changes in the journal's name. The text-mining method is an enhanced version of content analysis, focusing on symbolic phenomena and semantic content in much social research. Krippendorff defines content analysis as "a research technique for making replicable and valid inferences from data to their context" (2 p. 21). With the development of computer technology, it has become possible to process greater amounts of content-related data than before, and this technique is often referred to as text mining. Researchers can also use the same open data generated to perform additional tests and reproduction studies, leading to more scientifically rigorous assessments to ensure verifiability.

In 1961, Japan's medical insurance system became universal, with all citizens covered by the public medical insurance system. The former Health Insurance Law, enacted in 1922, during the Taisho era (1912–1926), insured only manual laborers whose remuneration was below a certain amount in certain institutions with 10 or more employees. Later, in 1938, during the Showa era (1926–1989), a revised National Health Insurance Law was enacted. However, as enrollment was voluntary for both institutions and individuals, many citizens were not covered. Upon further revision of the National Health Insurance Law in 1958 and the implementation of universal health insurance in 1961, the public health insurance system has remained unchanged. The system differs greatly from the United States and other similar countries where most people subscribe to private medical insurance. However, two major changes have been introduced to the Japanese public insurance system, namely, the Health Care Law for the Elderly in 1983 and the Long-Term Care Insurance Law in 1997, which were in response to the rapid increase in the cost of medical care for older adults due to the aging of society in Japan.

This study analyzed changing trends in healthcare administration research in Japan using text-mining methods concerning article titles of the *Nihon Iryo Byoin Kanri Gakkai-shi (Journal of the Japan Society for Healthcare Administration)*. Prior studies have used bibliometrics in healthcare management and medicine to analyze research trends (6–10). Some of these studies (6–8) reviewed research trends related to new coronavirus infections *via* bibliometric analyses. Identifying research trends using bibliometric data is important in facilitating and positioning subsequent individual, original research. The text-mining analysis used in this paper is one of the research methods that uses bibliometric data.

The Japanese Ministry of Health, Labor, and Welfare states that Japan's public medical insurance system has the following four characteristics: one, all citizens are covered by public medical insurance; two, all citizens can freely choose medical institutions (free access); three, advanced medical care is provided at a low cost; four, public funds are invested in maintaining universal coverage, while the system is based on social insurance (11).

The Japanese public healthcare system has developed in response to ongoing economic challenges and the rapid aging of the population following an earlier period of high economic growth after World War II. According to definitions provided by the United Nations and the World Health Organization, a society with >7% of the population comprised of older persons is called an "*aging*" society; a society with a value of more than 14% is called an "*aged*" society, and that with a value of more than 21% is called a "*super-aged*" society (12). The aging rate in Japan has continuously risen, with Japan reaching the stage of an *aging society* in 1970, an *aged society* in 1994, and a *super-aged society* in 2007. First, in response to this evolving situation, the 1983 Health Care Law for the Elderly abolished the free medical care system for those aged 70 years and over (replacing the previous system of free medical care for older adults, which had been operating since 1973). Furthermore, medical insurance subscribers aged 75 years and over (65 years and over for those with disabilities above a certain level and certified under the Health Care Law for the Elderly) were classified separately from those insured under that age. The medical care system for older adults in these age groups is funded by public expenditure (derived from taxation) and contributions from various medical insurance systems, including public employee mutual aid societies (*Kyosai Kumiai*) and the health unions of general companies (*Kenko Hoken Kumiai*). The Long-Term Care Insurance Law, which passed in 1997 and came into effect in 2000, aimed to separate nursing care benefits from the medical care system, wherein medical insurance covered nursing care for older adults in convalescent beds in geriatric care, as symbolized by "social hospitalization." The law established a public nursing care insurance system for those over 40 years with the basic local governments as the insurer, to clarify cost-sharing and benefits, and simultaneously secure financial resources for nursing care (13). The introduction of the long-term care insurance system in 2000, like the abolition of the free medical care system for older adults in the 1983 amendment to the Health Care Law for the Elderly, represented systemic reform to cope with the expansion of medical costs associated with the aging of society.

A further change was introduced concerning late-stage medical care for older adults in 2008. Older adults aged 75 and over are enrolled in an independent late-stage medical care system operated by a regional federation (of which the basic municipalities are members) and receive medical benefits (14). Finally, the 2015 Medical Insurance Reform Law resulted in the expansion of financial support for the national health insurance system, a gradual increase in the cost of meals at the time of hospitalization, and the introduction of a fixed fee for visits to large hospitals without a referral.

In the following paragraphs, a description of the selection process for target journal in applying text-mining analysis of research trends is presented. The following data on academic societies were derived from the *Gakkai Meikan* database of the Science Council of Japan, the Japan Science Support Foundation, and the Japan Science and Technology Agency (https://gakkai.jst.go.jp/gakkai/). The database was last updated on March 19, 2021, with results based on the fiscal year 2020 survey of academic societies. The following database searches were conducted in January 2022.

A textbook for practitioners in the field of medical management in Japan lists ten Japanese academic organizations related to hospital management: the Japanese Society of Medical Science, the Japanese Society of Internal Medicine, the Japanese Association of Surgeons, the Japanese Society for Healthcare and Hospital Administration, the Japanese Society of Nursing Science, the Japanese Society for Nursing Administration, the Japanese Society for Health Care Management, the Japanese Society for Clinical Pathology, the Japanese Society for Medical Work Assistance, and the National Association of Medical Affairs Research (15). Data concerning the first seven of these are available in the *Gakkai Meikan* database. The Japanese Society of Medical Science is an umbrella society for medical research, with the second, third, and fourth organizations listed being registered as subcommittees within it. Only the fourth and seventh organizations listed specifically target medical and hospital administration in general, including nursing administration. Table 1 summarizes the characteristics of these two societies based on the *Gakkai Meikan* database. As of July 2022, the *Gakkai Meik*an database is no longer in service. Therefore, the following information was valid as of January 2022, prior to the submission of this article. A list of academic organizations that meet certain criteria is available from the Science Council of Japan.

Concerning the two academic societies presented in Table 1, this study chose to focus on the *Journal of the Japan Society for Healthcare Administration,* as the society has been in existence the longest and its related journal has the longest publishing history in the field. Therefore, it was likely to provide a clear picture of changing academic research trends. A sufficiently long publication history is needed to provide the necessary text data to track changes in research trends. In addition, the society's affiliation with The Japanese Association of Medical Sciences was stressed when selecting the target journal. The Japanese Association of Medical Sciences (https://jams.med.or.jp/index.html) is a comprehensive representative medical academic research network with 141 umbrella societies in Japan, which works in collaboration with the Japan Medical Association (https://www.med.or.jp/).

TABLE 1 Academic associations concerned with healthcare administration studies in Japan.

Name of association	Establishment date	Name of the journal the association publishes	Number of members (individuals)	Number of members (legal entities)	Is the society affiliated with The Japanese association of medical sciences?
Nihon Iryo Byoin Kanri Gakkai (Japan society for healthcare administration)	April 3, 1968	Until 2007, from 1964, the journal was named Byoin Kanri (Hospital Administration). From 2008 onwards, it is called the Journal of the Japan Society for Healthcare Administration	1,490 (regular member)	-	X
Nihon Iryo management Gakkai (Japan society for health care management)	1998 (Launch of the predecessor Critical Path Study Group)	*Journal of Japan Society for Health Care Management* (from 2000)	7,900	13	

Content analysis or text-mining methods are increasingly used to analyze research trends in academic journals. Examples in various fields have been discussed previously (16). While Krippendorff (2) pioneered the content analysis method, Alcaide-Muñoz et al. (17) developed a quantitative method, specifically a science-mapping approach, to identify research trends in the field of local governments. Their research applied a bibliometric approach across e-government fields to visualize research trends and classify relevant studies by building a strategic and evolutionary map. The text-mining method used in this study also enabled the visualization of relevant characteristics and changes in research trends using correspondence analysis and co-occurrence network analysis. A quantitative analysis of articles published in the *Journal of Japan Society for Healthcare Administration* over 9 years, from January 2005 to December 2014, was previously conducted (18). This prior study considered the same journals as the current study. The previous study was in Japanese, with only the Abstract available in English. According to the Abstract, *nursing, systems,* and *management* were the three most frequently used words extracted in the analysis. Although the period covered was only 9 years, the study showed that from 2010 to 2014, the most frequently used terms extracted were related to the use of big data from Diagnosis Procedure Combination: DPC and receipts, home healthcare and home nursing, analysis-based management, and handling foreign patient care. The difference between their study and the current study is that the former also used the Abstracts of the target articles as data, whereas the current study only used the article titles and incorporated a longer analysis period. The current study used only the titles because they are more appropriate for understanding research trends, as titles are a straightforward description of the papers' themes. In addition, the long analysis period of 28 years enabled an accurate representation of changes in research trends. Furthermore, the publication of two quantitative analyses in the same journal enables the validity of the approaches to be verified.

Adunlin et al. (19) conducted a system analysis and bibliometric analysis of research trends in the medical field. Hao et al. (20) also used text-mining methods to conduct a bibliometric analysis of medical research trends. Khalil and Gotway Crawford (21) conducted a bibliometric analysis of behavioral risk factor surveillance studies in the United States. In the field of public administration, a field related to medical administration, Ni et al. (22) applied bibliometric methods to identify research trends in administrative studies published in the *Public Administration Review* concerning the United States. They selected 3,934 articles from the *Public Administration Review* and analyzed bibliometric data focusing on author attributes, showing the top 50 words most frequently used in the titles during three target periods. Many other bibliometric studies have also used the *Public Administration Review* as an object of analysis (23–26).

Materials and methods

Collection of materials

This study quantitatively examined research trends in hospital administration studies after the 1980's in Japan using article titles published in the *Journal of the Japan Society for Healthcare Administration*, ranging from volume 35 (1), in 1994, to volume 58 (4), in 2021. This is a total of 28 years, including 14 years each before and after the change in journal name in 2008 [the new name applied from volume 45 (1) onwards].

The article titles from the *Journal of the Japan Society for Healthcare Administration* were gathered to determine post-war research trends in hospital administration studies in Japan.

The search results were saved as Excel spreadsheet files in tab-separated values format (implemented on November 28, 2021). As the CiNii Articles database only contains volumes from 1995, articles from four issues of volume 35 in 1994 were inputted by the author and added to the dataset based on the tables of contents of originally published journals. The table of contents information provided by the National Diet Library for the journal was used to check the accuracy of the journal titles. The data from volume 35 to volume 58 were consolidated into one dataset file in Excel spreadsheet format. The dataset file was translated from Japanese to English using the Google Translate application. The dataset used machine translation to facilitate replication and follow-up research by third-party researchers. The author read the entire translated text, confirming the appropriateness of the machine translation.

The author then made the following modifications to the dataset file: first, titles, such as "Preface," "Editor's Postscript," "Special Remarks," "Special Lectures," "Annual Meeting," "Inauguration of the President," and "General Contents," and "book reviews" were omitted; second, non-research articles with blank author names that usually comprised administrative communication articles concerning the association and annual conferences were also omitted. The final dataset comprised 692 articles from the journal. The author used decade periods to capture changes in research trends. The resulting three-period classification was used in the analysis of the extracted words.

To analyze the text data of the articles in the journal, KH Coder (version 3.Beta.04a), produced by Dr. Koichi Higuchi of Ritsumeikan University, was employed because it is free to use and has advanced visualization features for conducting correspondence analysis. Higuchi (27) provides details concerning the software and an application example for real text materials. KH Coder offers a choice of several methods for processing English extracted words, and the Stanford POS Tagger was chosen for morphological analysis of sentences (this option is the default for KH Coder, but other options include FreeLing, and Snowball). POS Tagger (Part-Of-Speech Tagger) is a generic term for software that focuses on parts of speech, such as nouns and adjectives, to segment sentences. Stanford POS Tagger is one POS Tagger software package, officially named the Stanford Log-linear Part-Of-Speech Tagger (https://nlp.stanford.edu/software/tagger.shtml). The statistical analysis used tests such as the $\chi 2$ test. The significance level was defined as 5%.

Results

The dataset was loaded into KH Coder for the text analysis, and the extracted words were pre-processed using Stanford POS Tagger. The author conducted correspondence and co-occurrence network analyses to graphically depict the relationships between the extracted words. By drawing configuration maps as revealed in the correspondence analysis with 10-year periods as external variables, the changes in and characteristics of each period in terms of healthcare administration studies in Japan were visualized.

Co-occurrence network analysis

The co-occurrence network analysis with 60 filtering edges is shown in Figure 1. A co-occurrence network analysis was performed to understand the change in focus before and after the change in the journal name from January 2008. The year 2008 saw the introduction of the late-stage medical care system for older adults, a trend aimed toward separating the elderly care component within public medical insurance, and a greater injection of public funds. Using the two periods before and after the change in the public medical insurance system in 2008 was considered likely to facilitate a good understanding of differing research trends during the pre-and post-2008 periods. This study used the Jaccard index to determine the selection criteria (28); the Jaccard index is the default option for KH Coder. A detailed mathematical explanation of the Jaccard index is provided in the aforementioned reference.

We found an extensive use of the extracted words *prefecture, relationship, change, future, safety,* and *doctor*, among others, for the period 2008 onwards (see the right side of Figure 1). The year 2008 marked the introduction of the late-stage medical care system for the elderly in Japan. Under this system, the medical care system for the elderly, which covers about 16.1 million people aged 75 and over, is distinguished from other age groups, and a 4:1:1 ratio was set between the national, prefectural, and municipal governments for. In addition, as for the portion of the cost borne by public health insurance, the financial burden from the younger age groups to the later elderly generation was set at about 40%. The word *prefecture* refers to the prefectures that now account for about 16.7% of the public funding that makes up half of the late-stage medical care system for the elderly (about 8.3% of the total). This major change in the public health care system can be noticed in the words *change* and *future*.

On the left side of Figure 1, the words *insurance, elderly,* and *long-term* were extensively used in the journal prior to January 2008 (from 1994). These words refer to the introduction of a new healthcare system for older adults in 1997, which was actively discussed at conferences and in published papers. In other words, this major change lies in the passing of the Long-Term Care Insurance Law in 1997 and its implementation in 2000. The enactment of the Long-Term Care Insurance Law was a major change to Japan's health and welfare system, primarily by separating the provision of long-term care services to the elderly from the medical insurance system and transferring them to public long-term care insurance, and changing the focus of welfare services from government directive measures to citizens' contracts with private providers. The extracted words *care, medical, hospital, evaluation, management, patient, nurse,*

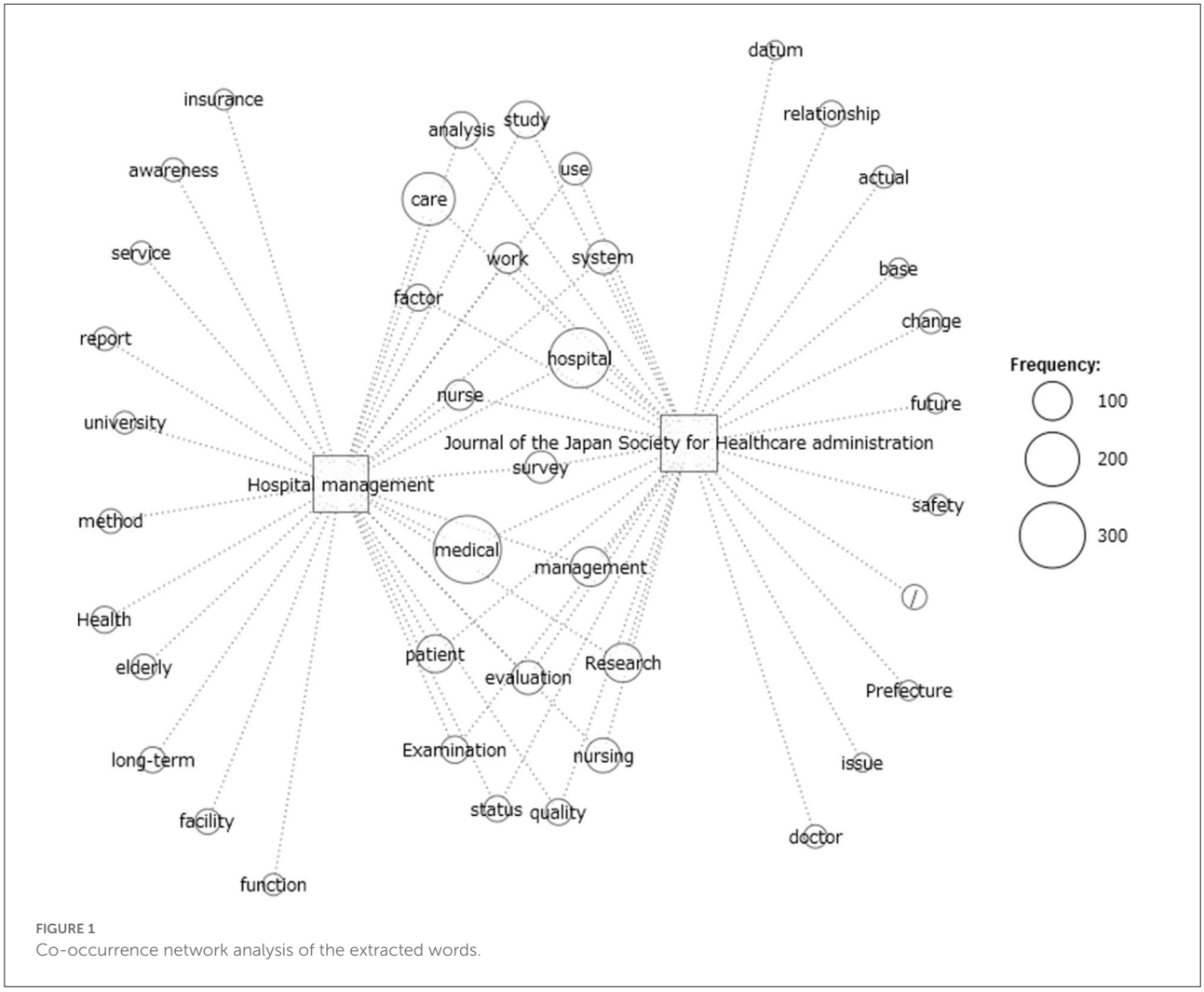

FIGURE 1
Co-occurrence network analysis of the extracted words.

examination, system, and *quality* were commonly featured in studies of healthcare administration in Japan throughout the two periods, as shown in their predominance at the center of Figure 1.

Correspondence analysis

This section examines the relationship between the extracted words using the correspondence analysis method, which facilitates a graphical display of categorical data. A 10-year period was set as the external variable. Thus, three 10-year periods were used to display relevant characteristics and changes in healthcare administration studies over time in Japan. The final 2 years, 2020–2021, were included in the preceding period, 2010–2019, because the period 2020–2021 was too short. To facilitate verification by other researchers, the author did not limit the target focus in this study, as narrowing the target parts of speech or excluding certain extracted words can inhibit the process of conducting the correspondence analysis. For this reason, extracted words unrelated to the research theme, such as the slash symbol, are shown in the following analysis results.

The results of the correspondence analysis based on the three periods are presented in Figure 2. Extracted words strongly associated with each time period category are indicated near each period display. The words *welfare, classification, hospitalization,* and *university* appeared in the upper left quadrant of Figure 2, near the 1994–1999 display. These extracted words are related to the content of studies conducted between 1994 and 1999. The words *nurse, Japan, staff, management,* and *safety* appear on the right side of the configuration map, near the 2010–2021 display. In Figure 2, the chronological indication with a black background presents the variables of the periods (white on black) of 1994–1999, 2000–2009, and 2010–2021 in a left-to-right time transition pattern. The extracted words located near the origin where the first and second dimensions intersect, such as *survey, patient*, and *evaluation*, had no distinctive features compared to the other

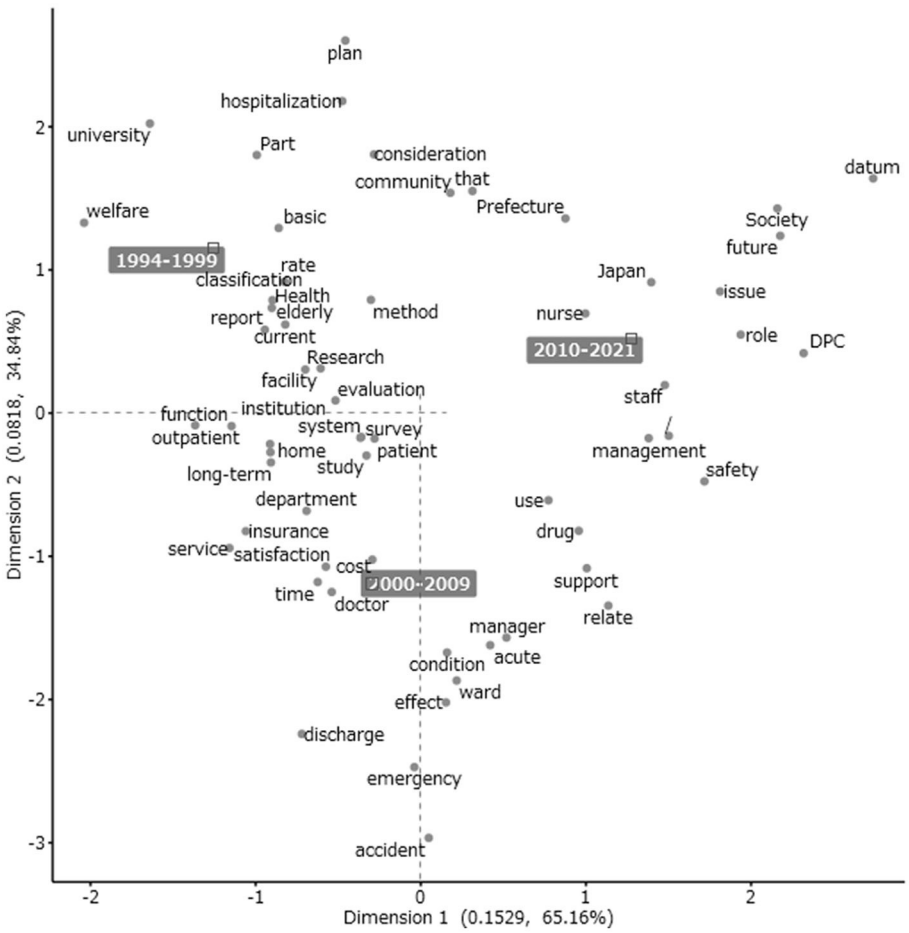

FIGURE 2
Correspondence analysis (dimension 1 [time] and dimension 2 [abstract/concrete situations]).

words. These words were often used regardless of the period and are characteristic of the diachronic research trends in this field. The most influential axis from left to right was the time dimension in the configuration map (the contribution ratio was 65.16%).

The words *doctor, manager, cost, acute, insurance, service, satisfaction,* and *condition* appear in the lower part of Figure 2, near the 2000–2009 display. The word *acute* forms part of the expression "severe acute phase" and is used in relation to the type of hospital involved—the English title of Yoshida et al. (29) includes the phrase "severe acute pancreatitis." The severe acute phase is called *Kyuuseiki* in Japanese and is used in combination with the chronic phase, known as *Manseiki* in Japanese. Differences in the values of dimension 2 are expressed as differences in positioning between the top and bottom of Figure 2. The words at the far end represent the most characteristic of that axis, so *accident* and *emergency* are one pole and *plan* the other. The word *plan* is located at the highest position, and extracted words related to medical policy, such as *university* and *hospitalization*, are also found in the upper part of Figure 2. In the lower part of Figure 2, the words *accidents, emergencies,* and *discharges* appear, indicating types of policy and specific situations in hospitals. Dimension 2 can be interpreted as an axis representing certain abstract/concrete situations. Although the interpretation of dimensions is subjective and alternative interpretations are possible, such interpretation is often used in correspondence analysis to facilitate subsequent scholarly discussion.

The extracted words located in the earlier period had no distinctive features compared to the other words. The extracted words displayed in the configuration map at the intersection of the two axes, around the center of Figure 2, are *patient, survey,* and *evaluation,* which were commonly used words in the titles of articles published in this journal, regardless of the period.

The words *doctors, staff, nurses, nursing, managers, roles,* and *relationships,* which relate to the occupations, roles, and

TABLE 2 Target words included or not included pre- and post-2008 in the journal.

	Included (1)	Not included (0)	Total
Journal of the Japanese society on hospital administration (pre-2008)	68 17.8%	314 82.2%	382 100.0%
Journal of the Japan Society for Healthcare Administration (2008 and post-2008)	74 23.9%	236 76.1%	310 100.0%
Overall	142 20.5%	550 79.5%	692 100.0%

Target words: Doctors, staff, nurses, nursing, managers, roles, and relationships.

interrelationships of medical professionals, were tagged to include them together in subsequent analyses. Table 2 shows a cross-tabulation in relation to whether the title of each article included or did not include these tagged extracted words and the two periods (pre- and post-2008) by journal name. A $\chi 2$ test conducted with the data presented in this table revealed a chi-squared value of 3.87, indicating a statistically significant association between the two variables at the 5% level.

Discussion

This study quantitatively analyzed research trends using data mining in healthcare administration studies in Japan, surveying article titles spanning 28 years taken from the *Journal of the Japan Society for Healthcare Administration.* Most significantly, it was found that through the co-occurrence network analysis and correspondence analysis, we were able to find two major changes in the Japanese health and welfare system among the extracted words: first, the introduction of the long-term care insurance system in 2000 and second, the late-stage medical care system for the elderly introduced in 2008. In the correspondence analysis, with three 10-year periods set as an external variable, the first dimension of the configuration figures was identified as an axis of time transition, and the second dimension concerned abstract/concrete situations regarding the placement of extracted words in the configuration map. The extracted words located in the earlier period had no distinctive features compared to the other words. The extracted words displayed in the configuration map at the intersection of the two axes, around the center of Figure 2, were *patient, survey,* and *evaluation,* which were commonly used in the titles of articles published in this journal, regardless of the period.

This study is novel in that it analyzed research trends in healthcare administration and hospital administration management in Japan using quantitative methods and clarified relevant diachronic characteristics and changes over time. Changes in practice within the Japanese healthcare administration were reflected in the prevalent research trends in the target journal. Through co-occurrence network analysis and correspondence analysis, changes in research trends in academic societies that corresponded to changes in Japan's public medical insurance system could be identified.

Limitations

One limitation of this study is that it covered only a certain period in a single journal. Adding other journals to the analysis and comparing individual results can be addressed in future studies. A similar analysis of other journals would help validate the results of this study's analyses and simultaneously clarify potentially differing research trends among the various academic societies and associations. The author intends to conduct such a comparison in future studies through an analysis of the *Journal of the Japan Health Care Management*, in order to verify the current findings. In addition, quantitative analyses have certain limitations. A text-mining analysis of journal article titles focuses on the frequency of extracted words in the article titles. Therefore, it is possible that studies with infrequently used words that have a decisive impact could be overlooked. In addition, the same phenomenon may be described using different words. This problem needs to be addressed by tagging or grouping extracted words. In addition, this text mining analysis focused on nouns, which may have led to some elements being left out. There are certainly limitations to the part-of-speech analysis based on morphological analysis, for which artificial intelligence methods, which are currently on the rise, will eventually be developed so as to get closer to the actual meaning. The author would further like to study new methods and apply them to the field of this research.

Future research agendas

This was a meta-analytical study that addressed research trends rather than individual empirical studies. Reviewing past changes in academic research trends and accumulating individual empirical studies in the academic community is important. Such efforts could result in better progress in healthcare administration studies. As mentioned above, the author would like to continue analyzing research trends in Japanese healthcare administration using quantitative text mining methods or meta-analysis techniques.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Factors associated with burnout in Polish healthcare workers during the COVID-19 pandemic

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Introduction: The COVID-19 pandemic has placed the healthcare system under substantial strain that has caused elevated psychological distress among healthcare workers (HCWs). Previous studies have found a high prevalence of burnout among HCWs exacerbated by the COVID-19 pandemic and have delineated some associated factors, but further research is needed. Little is known, for example, whether the economic status of HCWs or experiencing negative and positive emotions contribute to burnout. The present study was meant to fill this gap.

Methods: A total of 412 HCWs (i.e.: nurses - 47%, physicians-28%, psychologists-14%, and other healthcare professionals-11%), aged 21–69 years (M = 36.63; SD = 11.76) participated in a web-based cross-sectional study. Data was collected from June to November 2020. The participants filled out measures assessing two dimensions of burnout (Exhaustion and Disengagement), depression, generalized anxiety, positive and negative emotions, along with the survey evaluating organizational aspects of their work during the pandemic.

Results: Burnout thresholds were met by 54 and 66% of respondents for Disengagement and Exhaustion, respectively, which is high but comparable to levels found in other countries during the pandemic. Similarly to previous work, depression and anxiety were high in HCWs, with 24 % of them being in the risk group for clinical severity of depression and 34% in the risk group for a clinical generalized anxiety disorder (GAD). Regression analysis showed that the intensity of negative emotions was the strongest predictor of Exhaustion, whereas the intensity of positive emotions was the strongest predictor of Disengagement. Depression and GAD symptoms were positively related to Exhaustion, and economic status was inversely related to Disengagement.

Discussion: These results suggest that distress in HCWs during the pandemic was related to symptoms of burnout, whereas higher income and experiencing positive emotions were associated with reduced burnout levels. Our findings call for the development of burnout intervention programs that could build capacities for dealing with depression and other negative emotions and at the same time teach skills on how to increase positive emotions in HCWs.

KEYWORDS

COVID-19, pandemic, burnout, empathy, healthcare workers, mental health, anxiety, depression

Introduction

Burnout is described as a self-reported state of care- or work- related physical and mental stress (1), which consists of three-dimensional affective response: emotional Exhaustion, depersonalization, and a loss of sense of personal accomplishment (2, 3). According to other conceptualizations, burnout is composed of two elements: "Exhaustion", which is related to excessive work demand; and "Disengagement" linked to insufficient job resources (4). Burnout has a negative impact on healthcare staff as well as patients (5, 6) and is of crucial importance to effective healthcare delivery, in particular at the challenging times.

The coronavirus disease 2019 (COVID-19) pandemic has led to a significant global public health crisis with an unprecedented strain on the healthcare system. The COVID-19 pandemic had a serious impact on health systems imposing significant changes in healthcare delivery, including cessation of routine services, repurposing of clinical areas and redeployment of staff (7). During the pandemic, healthcare workers (HCWs) experienced various kinds of stressors, including: unprecedented demands, extensive responsibilities, shortage of personal protective equipment, and constant risk of complaints for negligence (8, 9). Moreover, healthcare workers struggled with deterioration of some of the job resources e.g., COVID-19 restrictions led to reduced social connectedness at work due to closure of community spaces, cancellation of gatherings designed for celebration and connection with others or improving knowledge and professional skills (10). It is no surprise, therefore, that studies showed an increased level of burnout in HCWs during COVID-19 pandemic (11–13), as well as elevated risk of mental health problems such as depressive and anxiety disorders, PTSD, suicidal ideation (14–16) and also cognitive impairments due to COVID-19 (17). Research showed that previous infectious diseases outbreaks, such as severe acute respiratory syndrome (SARS) and Middle East Respiratory Syndrome (MERS), also evidenced their negative effects on the psychological well-being of HCWs, including burnout (18). In comparison to previous pandemic, however, the psychological impact of the COVID-19 pandemic is even more pronounced and widespread (19).

In the current research we focus on the factors associated with burnout in Polish healthcare workers. On March 15th 2020 a national lockdown started in Poland following the first case of COVID-19 reported in the country on March 4th 2020. Twenty three hospitals were turned into infectious diseases hospitals, and 67 of hospitals had infectious disease wards dedicated to cases of COVID-19. In spite of the fact that HCWs in Poland and other countries were subjected to significant burdens, there is paucity of studies assessing burnout level and its predictors. In the advent of the COVID-19 pandemic, research into burnout among HCWS has emerged, still, further investigation into the determinants of burnout in HCWs during pandemic is warranted. The only pre-pandemic study in Poland using OLBI as a tool for burnout in professions of social services ($N = 1804$) including HCWs ($N = 491$) showed mean Exhaustion score of 2.31 and the mean score of 2.38 for Disengagement (20). Several factors were proposed to have contributed to burnout of HCWs during COVID-19 pandemic, including persistent stress, excessive workload, concerns about infections and health of the families, as long as clinical role of HCWs, being redeployed, and levels of anxiety and depression (8, 13). Previous studies revealed that burnout, anxiety and depression are distinct constructs that are reciprocally related to each other (21, 22). Much less is known about the relation of economic status and experienced emotions to burnout.

The aims of the current study were twofold. First, we aimed at assessing the level of burnout and its dimensions in HCWs during COVID-19 pandemic in Poland in comparison to burnout levels reported in other countries. In addition, we wanted to assess if different HCWs groups differed in terms of burnout and mental health indicators and establish how many of them fulfilled the criteria for clinical risk of depression and generalized anxiety. Second, we aimed at evaluation of economic status, and emotions, in addition to depressive and anxiety symptoms as predictors of the two dimensions of burnout. We expected that there would be a high level of burnout among all HCWs groups, similarly as in other countries during the pandemic. Furthermore, we hypothesized that intensity of negative emotions along with depression and anxiety would positively predict both dimensions of burnout, whereas positive emotions and economic status would be negatively related to them.

Methods

Participants

The study link was clicked by 461 participants, of whom 412 indicated their profession. Out of the 412, 306 participants completed all questionnaires. The participants were aged 21–69 years ($M = 36.63$, $SD = 11.76$) and were recruited to the study by advertisements in medical portals and dedicated mailing to health professionals. The majority of the sample were women (88%), workers with higher education level (95%), and people living in large (i.e., over 500 000 habitants, 33%) or medium size cities (i.e., 100 000 habitants, 28%). In terms of profession, nurses constituted the largest group of surveyed specialists (47%), followed by physicians (28%), psychologists (14%), and other healthcare professionals (11%). When asked about the workplace, the participants mentioned various types of institutions and 32% indicated more than one type of workplace. Substantial number of the HCWs (21%) worked in facilities dedicated to COVID-19 patients as a result of transformation of the current workplace or as a consequence of being delegated

to a different healthcare facility. About one third of the surveyed professionals (32%) worked remotely and almost one fifth (19%) experienced COVID-19 infection or it was highly probable that they had been infected before or at the time of conducting the study. Detailed information about the participants is presented in Table 1.

Procedure and measures

The current study was a part of a wider research concerning experiences and psychological aspects of the pandemic among healthcare workers. All data were collected from July to November 2020, which coincided with the beginning of the second wave of the pandemic in Poland and the period immediately preceding its start. The research was approved by the institutional review board of the Faculty of Psychology, University of Warsaw. The survey was conducted using an online questionnaire, which was shared in Polish medical portals and social media groups dedicated to healthcare professionals.

The opening part of the survey included questions related to demography and participants' individual and professional situation such as economic status. Economic status was assessed subjectively with the following question: "Overall, how do you assess your family's current financial situation?" on a six-point scale from very bad to very good (see Table 1 for detailed information about other demographic measures). Following parts consisted of, among others, measures of burnout [Oldenburg Burnout Inventory, (23)], general anxiety [The Generalized Anxiety Disorder-7 questionnaire, (24)], depression [The Patient Health Questionnaire-9, (25, 26)], and positive and negative emotions [Questionnaire of Emotional State based on Lazarus and Folkman's theory, (27, 28)].

The Oldenburg burnout inventory

The Oldenburg Burnout Inventory (OLBI) is a 16-item questionnaire to assess burnout (23) with two dimensions: Exhaustion and Disengagement. Exhaustion describes feelings of emptiness, physical Exhaustion, overwork, and a strong need for rest, whereas Disengagement refers to distancing oneself from the objects and content of one's work. Each dimension consists of eight items rated on a 4-point Likert scale with both positively and negatively worded questions. Cronbach's alpha was $\alpha = 0.72$ for Disengagement and, $\alpha = 0.76$ for Exhaustion in the current study.

The patient health questionnaire-9

The Patient Health Questionnaire-9 [PHQ-9; (25, 26); Polish version: www.phqscreeners.com] is a screening tool for assessing the risk of depressive disorders. It consists of nine basic items that refer to the frequency of depressive symptoms (described in the DSM-IV and DSM-V diagnostic criteria) in the last 2 weeks. The participants give answers on a scale from 0—not at all to 3—nearly every day (in our study $\alpha = 0.91$).

The generalized anxiety disorder-7

The Generalized Anxiety Disorder-7 questionnaire [GAD-7; (24); Polish version: www.phqscreeners.com] is a screening measure for assessing risk of generalized anxiety disorder. It consists of seven items about the frequency of symptoms during the last 2 weeks. The participants answer on a scale from 0—not at all to 3—nearly every day ($\alpha = 0.94$).

Questionnaire of emotional state

Questionnaire of Emotional State [QES, (28, 29)] is a 15-item measure constructed by Heszen-Niejodek et al. (28) on the basis of a similar tool, initially introduced by Folkman and Lazarus (27). It contains a list of 15 adjectives describing different emotional states.

Exploratory factor analysis was performed. The eigenvalues acquired for consecutive solutions showed that only the first two values fulfilled the Kaiser criterion, i.e., were higher than the cut-off value equal to 1. The first eigenvalue was equal to 6.81, the second one was equal to 2.69 and the third one was equal to.81. Therefore, two factors were extracted. Next, the reliability of the extracted factors was verified. Cronbach's alpha was $\alpha = 0.91$ for Negative Emotions (e.g., anger, disappointment, helplessness), and $\alpha = 0.91$ for Positive Emotions (e.g., hope, optimism, enthusiasm).

Statistical analysis

Firstly, the level of Disengagement and Exhaustion and their clinical thresholds were computed. Next, the groups of nurses, physicians, psychologists, and other health professions were compared with the use of one-way ANOVA. The analyzed variables did not differ significantly from normal distribution in terms of skewness and kurtosis. However, the groups compared were not equal. Therefore, one-way analysis of variance was followed by Gabriel *post-hoc* test. With the use of linear regression analysis we analyzed the relationships between professional burnout and positive and negative emotions, depressive symptoms, GAD symptoms, economic status, and variables describing reorganization at work (such as redeployment to a different facility). Conventional cut-off point of.05 for statistical significance was applied. In all statistical analyses the cases with missing values were excluded pairwise.

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TABLE 1 Detailed information about participants of the study.

	Overall HCWs		Physicians	Nurses	Psychologists	Other HCWs
	N	%	%	%	%	%
Gender						
Female	378	89	75	97	93	84
Male	48	11	25	3	7	14
Other/refused to answer	1	0	0	0	0	2
Education						
Secondary	6	1	0	2	0	7
Post-secondary	17	4	4	3	0	14
BA	127	30	2	61	0	2
MA or PhD	274	65	94	34	100	77
Economic status						
Very bad	3	0	2	1	0	0
Rather bad	11	3	3	4	0	0
Hard to define	46	11	8	10	13	9
Rather good	135	32	21	38	30	39
Good	180	42	48	40	43	36
Very good	51	12	18	8	14	16
Place of residence						
Village	60	14	16	15	9	11
City <20K of habitants	28	6	4	8	5	11
City <99K of habitants	75	18	13	21	11	14
City <500K of habitants	121	29	17	34	37	27
City >500K of habitants	142	33	50	22	38	37
Workplace (multiple choice)						
Public facility	112	27	38	21	23	34
Non-public facility	80	19	33	10	27	16
Health center	81	19	33	9	32	11
Hospital ward	218	52	47	64	46	25
Isolation ward	8	2	3	2	2	0
Emergency ward	9	2	4	1	0	2
Private medical practice	59	14	35	3	14	9
Other facility	46	11	5	10	7	30
Type of facility						
Dedicated or transformed into facility dedicated to COVID-19	87	21	21	21	16	28
Type of work						
Remote	129	32	60	12	48	26
On-site	258	63	38	81	52	58
Not applicable	21	5	2	7	0	16
COVID-19 infection status						
Infected/probably infected during the research	33	8	6	12	2	2
Infected/probably infected in the past	47	12	11	15	11	2
Never infected	234	57	57	54	67	61
Unknown	96	23	26	19	20	35

Results

The level of burnout

The average OLBI scores were 2.14 and 2.43 for Disengagement and Exhaustion, respectively. Burnout thresholds were met by 54 and 66%of respondents for Disengagement and Exhaustion, respectively, with 86% meeting thresholds for either and 66% for both. The mean Disengagement scores were descriptively highest for nurses (2.89) and lowest for physicians (2.82), whereas mean Exhaustion scores were descriptively highest for psychologists

(2.62) and lowest for other medical groups (2.54), however, there was no significant difference in the scores between different HCWs groups (see Table 2).

Between-group comparison

Table 2 and Figure 1 presents mean values of the level of Exhaustion and Disengagement, and other measures in the HCWs professional groups with the values of one-way ANOVA.

No statistically significant between-group differences regarding Disengagement and Exhaustion were detected. However, there were differences in terms of depression symptoms, GAD symptoms, and positive emotions. The average level of generalized anxiety and depression in our sample reached 7.66 ($SD = 5.78$) and 8.55 ($SD = 6.31$), respectively. The threshold of moderate or severe symptoms of generalized anxiety [≥10 points; (24, 30)] was met by 34% of the participants of the current study, while the threshold for depression [>12 points, (31)] was met by 24% of the respondents. 19% of the participants fulfilled moderate or severe intensity of generalized anxiety and depression.

The level of generalized anxiety and depression varied among different groups of HCWs. The intensity of depression symptoms was significantly higher in the group of nurses than in the group of physicians, $p < 0.01$, and in the group of psychologists, $p < 0.001$. The intensity of GAD symptoms was also significantly higher in the group of nurses than in the group of physicians, $p < 0.01$, and in the group of psychologists, $p < 0.001$. The intensity of GAD symptoms was also significantly higher in the group of other health workers than in the group of physicians, $p < 0.05$, and in the group of psychologists, $p < 0.05$. The intensity of positive emotions was significantly lower in the group of physicians than in the group of nurses, $p < 0.05$. The rest of the differences were not statistically significant.

Positive and negative emotions, depressive symptoms, GAD symptoms, and economic status as predictors of burnout

In the first step, partial Pearson correlation analysis of burnout, psychopathological symptoms, experienced emotions, economic status, and the rest of measured variables was performed (Table 3). Participants' age was used as a controlled variable. Gender was not included as a control variable due to the fact that the majority of participants were women (89%) and such a distribution did not allow for a reliable analysis of gender effects.

Next, in order to verify whether positive and negative emotions, depressive symptoms, GAD symptoms, and economic status are statistically significant predictors of burnout, linear regression analysis was performed. Tables 4, 5 present results acquired in the model for Disengagement. Due to a very strong correlation between the GAD and depressive symptoms, $r(344) = 0.80$, $p < 0.001$, they were analyzed in two separate regression models.

In the model with depressive symptoms as predictor, intensity of positive emotions and economic status were negatively related to Disengagement, whereas intensity of negative emotions was positively related to it. Intensity of positive emotions explained 12% of Disengagement variance, intensity of negative emotions explained 2% of Disengagement variance, and economic status explained 1% of variance. The model controlled for participants' age, redeployment to a different facility, COVID-19 dedicated workplace, work reorganizations, COVID-19 infection, psychological help at workplace, and depression level.

In the model with GAD as predictor, the model explained more of Disengagement variance: intensity of positive emotions explained 16%, intensity of negative emotions explained 3%, and economic status explained 1% of Disengagement variance, while controlling for the rest of variables.

Tables 6, 7 present results acquired in the model for Exhaustion.

Intensity of negative emotions, depressive symptoms, and GAD symptoms were positively related to Exhaustion, whereas intensity of positive emotions was negatively related to Exhaustion. In the model including depression symptoms, these symptoms explained 28%, positive emotions explained 7%, and negative emotions explained 5% of Exhaustion variance, while controlling for the same variables as earlier (participants' age, redeployment to a different facility, COVID-19 dedicated workplace, work reorganizations, COVID-19 infection, psychological help at workplace). In the model including intensity of GAD symptoms, these symptoms explained 22% of Exhaustion variance, positive emotions explained 10% of Exhaustion variance, and negative emotions explained 5%, whereas economic status was not related to the level of Exhaustion, while controlling for the rest of variables.

Discussion

The aim of the current study was to evaluate the level of burnout among HCWs during COVID-19 pandemic and to study predictors of burnout. We found that burnout thresholds for both Disengagement and Exhaustion were met by 66% of HCWs. This is comparable to the rates (67% HCWs) reported by Denning et al. (8) in the multinational cross-sectional study assessing 3,537 healthcare workers, including 232 HCWs from Poland in the similar period of COVID-19 pandemic with the same tool for measuring burnout. Our mean scores of

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TABLE 2 Mean values of the level of Exhaustion and Disengagement and other variables in the groups of nurses, physicians, psychologists, and other health professions.

Professional	Group										
	Physicians		Nurses		Psychologists		Other				
Groups	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*df*	*p*
Disengagement	2.82	0.50	2.89	0.53	2.88	0.50	2.86	0.41	0.40	3.313	0.75
Exhaustion	2.59	0.55	2.56	0.52	2.62	0.48	2.54	0.55	0.25	3.313	0.86
Positive emotions	3.76	1.05	4.20	1.28	3.82	0.98	3.88	1.32	3.07	3.306	0.03
Negative emotions	3.87	1.57	4.06	1.43	3.75	1.38	4.03	1.66	0.66	3.305	0.58
Depression symptoms	7.31	5.83	9.84	6.36	5.65	4.95	9.21	6.64	7.93	3.357	0.001
GAD symptoms	6.26	5.44	8.82	5.80	5.43	4.41	9.23	6.36	7.73	3.339	0.001

M, mean value; SD, standard deviation; F, analysis of variance value; df, degrees of freedom; p, statistical significance.

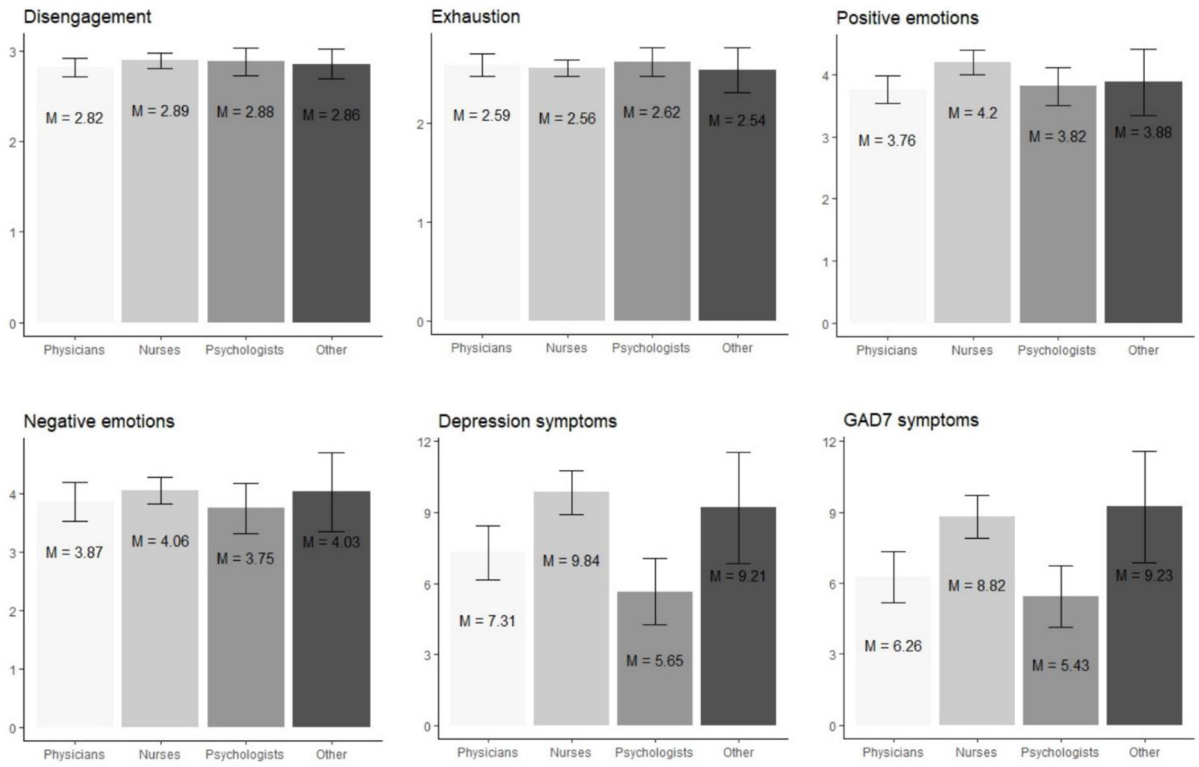

FIGURE 1
Visual comparison of levels of Exhaustion, Disengagement, and other variables in the groups of nurses, physicians, psychologists, and other health professions. Mean values are represented by bars and standard deviations are visualized using error bars.

burnout dimensions, 2.14 and 2.43 for Disengagement and Exhaustion, respectively, are also comparable to those reported in Singapore in the same period of COVID-19 pandemic with mean Exhaustion and Disengagement scores of 2.38 and 2.25, respectively (32). These rates suggest that the COVID-19 pandemic and its burdens were related to elevated rates of burnout amongst HCWs in Poland. When we used the Polish burnout norms for social service workers established in 2016 (20), 76% of our HCWs presented a moderate (cutoff 1.91) or high (cutoff 2.75) level of Exhaustion and 54% experienced moderate (cutoff 1.89) or high (cutoff 2.72) level of Disengagement. Comparison of the burnout scores obtained in our study and the mentioned study from 2016 which was conducted before pandemic in professions of social

TABLE 3 Partial Pearson correlations of depressive symptoms, generalized anxiety symptoms, positive and negative emotions, and burnout controlling for age, redeployment to a different facility, COVID-19 dedicated workplace, work reorganizations, COVID-19 infection, psychological help at workplace, and economic status.

	1	2	3	4	5	6
1. Depressive symptoms	-	0.73***	−0.39***	0.61***	0.31***	0.51***
2. Generalized anxiety	0.73***	-	−30***	0.69***	0.22***	0.46***
3. Positive emotions	−0.39***	−0.30***	-	−0.39***	−0.44***	−0.45***
4. Negative emotions	0.61***	0.69***	−0.39***	-	0.36***	0.54***
5. Disengagement	0.31***	0.22***	−0.44***	0.36***	-	0.57***
6. Exhaustion	0.51***	0.46***	−0.45***	0.54***	0.57***	-

***$p < 0.001$; All controlled variables except for age and economic status (i.e. redeployment to a different facility, COVID-19 dedicated workplace, work reorganizations, COVID-19 infection, and psychological help at workplace) were dummy coded (0-no; 1-yes) dichotomous variables.

TABLE 4 Positive and negative emotions, depressive symptoms, and economic status as predictors of Disengagement.

Predictors	*B*	*95% CI*	*Beta*	*t*	*p*
Participants' age	<0.001	−0.002, 0.006	−0.04	−0.83	0.41
Redeployment to a different facility	0.01	−0.20, 0.189	0.00	0.10	0.92
COVID-19 dedicated workplace	0.05	−0.18, 0.07	0.04	0.83	0.41
Work reorganizations	0.08	−0.19, 0.03	0.08	1.48	0.14
COVID-19 infection	0.02	−0.15, 0.11	0.02	0.31	0.75
Psychological help at workplace	−0.06	−0.04, 0.17	−0.06	−1.22	0.22
Depression	0.01	−0.02, 0.01	0.07	0.98	0.33
Positive emotions	−0.15	0.10, 0.20	−0.35	−6.16	0.001
Negative emotions	0.06	−0.11, −0.02	0.18	2.71	0.007
Economic status	−0.06	0.00, 0.11	−0.10	−1.96	0.05

B, unstandardized regression coefficient; 95% CI, 95% confidence intervals for B; Beta, standardized regression coefficient; t, test for statistical significance of predictor; p, statistical significance.

TABLE 5 Positive and negative emotions, GAD symptoms and economic status as predictors of Disengagement.

Predictors	*B*	*95% CI*	*Beta*	*t*	*p*
Participants' age	0.00	−0.002, 0.01	−0.06	−1.13	0.26
Redeployment to a different facility	0.01	−0.21, 0.18	0.01	0.14	0.89
COVID-19 dedicated workplace	0.05	−0.18, 0.08	0.04	0.78	0.44
Work reorganizations	0.09	−0.20, 0.02	0.08	1.61	0.11
COVID-19 infection	0.02	−0.15, 0.10	0.02	0.37	0.71
Psychological help at workplace	−0.08	−0.02, 0.19	−0.08	−1.57	0.12
GAD	−0.01	−0.01, 0.02	−0.07	−1.02	0.31
Positive emotions	−0.15	0.11, 0.20	−0.36	−6.56	0.001
Negative emotions	0.09	−0.14, −0.04	0.26	3.62	0.001
Economic status	−0.06	0.01, 0.12	−0.11	−2.25	0.03

B, unstandardized regression coefficient; 95% CI, 95% confidence intervals for B; Beta, standardized regression coefficient; t, test for statistical significance of predictor; p, statistical significance.

services including HCWs (20), suggests presumably higher levels of Exhaustion but lower mean of Disengagement in our sample. Note, that current research did not include repeated measurements and the pre-pandemic scores were obtained in professions of social services in the other study, in different time and context, which make any direct comparisons questionable. Still, it may indicate the direction of relationships and suggest that persistent, increased tension and demands that emerged with medical resources and services placed at their maximum capacity during COVID-19 pandemic may affect burnout level and Exhaustion dimension in particular [see also (33)]. At the same time, these demands placed on HCWs required unprecedented engagement in their work, which if accompanied by adaptive self-regulation of emotion might buffer the elevation of Disengagement component of burnout (34) at this stage of COVID-19 pandemic in Poland, the hypothesis that requires verification in future studies. Still, 54% of HCWs in the present study met the burnout thresholds for Disengagement and 66% for Exhaustion.

Regarding predictors of burnout, we hypothesized that intensity of negative emotions along with depressive and anxiety symptoms will positively predict both dimensions of burnout, whereas positive emotions and higher economic status will be negatively related to them. Our results confirm some of our predictions. Indeed, when controlling for participants' age, and several variables related to work organizations during the pandemic (e.g., redeployment to a different facility, work reorganizations, COVID-19 infection), intensity of negative emotions was positively related to both Disengagement and Exhaustion. However, depression and GAD symptoms were positively related to Exhaustion only. Intensity of positive emotions was a negative predictor of both dimensions of burnout, and economic status was a negative predictor of Disengagement, but not Exhaustion.

A number of previous studies showed positive relationships between depression, anxiety, and burnout [e.g. (8, 32)]. Also a recent meta-analysis supported this observation and indicated that there is no conclusive overlap between burnout and

TABLE 6 Positive and negative emotions, depression symptoms, and economic status as predictors of Exhaustion.

Predictors	*B*	*95% CI*	*Beta*	*t*	*p*
Participants' age	0.00	−0.002, 0.01	−0.05	−0.99	0.32
Redeployment to a different facility	−0.08	−0.11, 0.26	−0.04	−0.83	0.41
COVID-19 dedicated workplace	0.04	−0.16, 0.08	0.03	0.65	0.52
Work reorganizations	0.05	−0.15, 0.06	0.04	0.90	0.37
COVID-19 infection	−0.05	−0.07, 0.17	−0.04	−0.86	0.39
Psychological help at workplace	−0.01	−0.09, 0.11	−0.01	−0.18	0.86
Depression	0.02	−0.03, −0.01	0.24	3.92	0.001
Positive emotions	−0.11	0.07, 0.16	−0.25	−4.85	0.001
Negative emotions	0.11	−0.15, −0.07	0.30	5.10	0.001
Economic status	−0.01	−0.05, 0.06	−0.01	−0.29	0.77

B, unstandardized regression coefficient; 95% CI, 95% confidence intervals for B; Beta, standardized regression coefficient; t, test for statistical significance of predictor; p, statistical significance.

depression and burnout and anxiety (22). The finding that Exhaustion is related to depression and anxiety specifically was also reported by other researchers (35, 36). We did not find, however, any study that took into account broader constructs of negative emotions or positive emotions of HCWs as predictors of burnout. Therefore, the novel aspect of the present study, among others, is to evidence the importance of experienced emotions in predicting burnout.

Experiencing negative emotions (e.g., anger, sadness) contributed in our research mainly to the Exhaustion dimension of burnout. This is understandable as Exhaustion is a result of persistent, chronic tension caused by physical, emotional, and cognitive demands of a job that is accompanied by negative emotions (21). Negative emotions explained a substantial part of Exhaustion variance (33%), much more than other predictors: depression and positive emotions (4 and 7% respectively). These results show that the use of a broader spectrum of negative emotions (as in our research model) than just anxiety and depression, enables a better understanding of burnout. Earlier studies showed that negative emotions experienced by people under stress narrow down their thought action repertoire (37). Negative emotions experienced by HCW's might contribute to maladaptive strategies to cope with increased job demands, such as inflexible coping and self-undermining, which may in consequence impair self-regulation abilities [see also (34)].

Positive emotions were in our research the strongest predictor of Disengagement—they explained 22% of its variance. It suggests that experiencing positive emotions may reduce withdrawal toward HCWs clients and co-workers and possibly support HCWs well-being. The role of positive emotions shown in our research, broadly speaking, is consistent with the assumptions of the Broaden and Build Model of Positive Emotions proposed by Fredrickson (38, 39). According to this model, positive emotions enable adaptive and constructive functioning. Positive emotions broaden perception in a way that helps to have a wider and appreciative perspective, and therefore build additional resources to cope with stressful situations. The search for new resources to apply seems to be incongruent with Disengagement, and can be viewed as protective in the light of the recently reformulated, by inclusion of self-regulation, Job Demands–Resources theory (34). Factors enabling the rebuilding of resources are particularly important in situations of chronic and uncontrolled stress, which was the case during the period of the COVID-19 pandemic when our study was conducted.

In our study, generalized anxiety and depression were noted in 34 and 24% of participants, respectively, which is similar to depression rates in other studies, but at the same time higher with respect to anxiety (15, 19, 40). We found that anxiety was more prevalent than depression [see also (8)]. Respondents with depression or generalized anxiety were likely to also have symptoms of burnout, which is consistent with a number of studies, including a recent meta-analysis (40). The level of generalized anxiety and depression varied among different groups of HCWs, with nurses having significantly higher rates of psychopathological symptoms than physicians and psychologists, as well as other healthcare workers having significantly higher levels of GAD symptoms than physicians and psychologists. Nurses and other healthcare workers also had higher means of depression and generalized anxiety in comparison to the means of the Polish population measured in May, June, July, and December 2020 (41, 42).

Another novel aspect of the present study was the inclusion of economic status as a possible predictor of burnout. We found that economic status was a negative predictor of Disengagement and explained over two times more variance of this dimension than negative emotions. It implies that good economic status was associated with less withdrawal among HCWs. Other studies showed that organizational interventions such as alterations to workload or changes to working practices produce longer-lasting effects than individual approaches to burnout prevention (43). The current findings suggest, in addition, that good

TABLE 7 Positive and negative emotions, GAD symptoms, and economic status as predictors of Exhaustion.

Predictors	*B*	*95% CI*	*Beta*	*t*	*p*
Participants' age	0.00	−0.002, 0.01	−0.05	−1.06	0.29
Redeployment to a different facility	−0.06	−0.13, 0.25	−0.03	−0.63	0.53
COVID-19 dedicated workplace	0.03	−0.16, 0.09	0.03	0.55	0.58
Work reorganizations	0.07	−0.17, 0.03	0.06	1.32	0.19
COVID-19 infection	−0.05	−0.07, 0.17	−0.04	−0.85	0.40
Psychological help at workplace	−0.02	−0.08, 0.12	−0.02	−0.39	0.70
GAD	0.01	−0.03, −0.002	0.16	2.36	0.02
Positive emotions	−0.13	0.08, 0.17	−0.28	−5.59	0.001
Negative emotions	0.12	−0.17, −0.07	0.33	4.94	0.001
Economic status	−0.01	−0.04, 0.01	−0.02	−0.46	0.65

B, unstandardized regression coefficient; 95% CI, 95% confidence intervals for B; Beta, standardized regression coefficient; t, test for statistical significance of predictor; p, statistical significance.

financial situation of HCWs may have beneficial effects on burnout prevention, particularly its Disengagement facets. Future studies need to evaluate whether this burnout predictor is valid also for the HCWs working in other countries, as low level of healthcare financing from public funds and low incomes of HCWS is a specific ongoing problem in the Polish healthcare system (44).

Correlational analysis in our research revealed a few weak associations of some variables with burnout. These relationships were too weak to include those measures in our regression analysis for establishing burnout predictors, but are still worth commenting on. First, there was a correlation of test-confirmed COVID-19 infection in HCWs and elevated Exhaustion, which could be expected as burnout was reported to be associated with fear of exposure to or transmission of SARS-CoV-2 virus (12). Quite unexpectedly, we were not able to confirm an association between burnout and staff redeployment, which is at odds with some previous studies (8). There was, however, a relationship between burnout dimensions and reorganizations at work in the expected direction showing that reorganizations at work were related to the increase in Exhaustion and Disengagement.

Limitations and future directions

The current study has some limitations concerning the cross-sectional design, which precludes causality inference. In addition, the sample was acquired through posts and advertisements and is limited to Polish HCWs, therefore, generalizability of the results is limited. Another limitation is that the current study relied upon self-report scales, which are prone to a number of inherent confounds, such as biases in recall, social desirability or the participants' mood (45). Future studies may benefit from diary and ecological momentary assessment methods that enable researchers assessing the ongoing experience of examined individuals in their natural environment while reducing biases in recall (46). Finally, our sample was not representative. Still, we believe, the current study contributes to the literature on the subject of burnout in health professionals in a number of ways, including evidencing the importance of experienced emotions and economic status as possible predictors of burnout.

Conclusions and implications

Previous research showed that burnout is related to increased risks of both physical and psychological long-term detrimental effects in health professionals, along with their increase in sick leave, absenteeism, job withdrawal, and poor work efficiency (44). Therefore, elevated rates of burnouts in HWCs during prolonged stressful situations such as the COVID-19 pandemic might reduce the capacity of health systems to effectively cope with the increased demand of care (47, 48). As timely recognition of burnout problems is crucial for implementation of effective prevention or therapeutic programs, it is important to promote monitoring of the HCWs mental health status and to deliver prevention programs including psychological first aid for individuals at risk. Results of the current study suggest that presence of depression and anxiety along with negative emotions should be taken into account in interventions aimed at preventing the development of burnout in HCWs. Our findings suggest also that such interventions should be aimed not only at decreasing depression and negative emotions, but also at increasing positive emotions. It is worth noting that positive and negative affect are independent (49), thus reduction of negative emotions does not mean that positive emotions increase.

The important role of experienced emotions as a predictor of burnout in a situation of chronic stress prompts us to refer to James Gross's Emotional Regulation model (50). According to this model, there is a wide range of strategies that may help to modify experienced emotions, and considering this model

may be helpful in burnout prevention (43, 48, 51). Such burnout interventions and prevention programs should take into account a broad range of factors that possibly cause burnout including those delineated in the present study. Such interventions should also implement a variety of strategies both on an organizational as well as on an individual level [see (51) for a meta-analysis]. The findings of the current study indicate also that a good economic status of HCWs may play an important role in the prevention of burnout and should be taken into consideration by health providers.

Data availability statement

The datasets for this study can be found in the [OSF] [https://osf.io/3w5ak/].

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board of the Faculty of Psychology, University of Warsaw. The patients/participants provided their written informed consent to participate in this study.

Author contributions

PH, MG, KH, GK, EP, KB-M, and EŁ contributed to conception and design of the study. PH and NW organized the database and performed the statistical analysis. PH wrote the first draft of the manuscript. NW, MG, KH, GK, EP, KB-M, and EŁ were involved in writing sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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A new generation of physicians—The Generation Z. Are you ready to deal with it?

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What does Generation Z mean? Generation Z is the name given to the current generation of young people by many demographic researchers. According to the Pew Research Center (1), Generation Z is the generation of people born between 1997 and 2010. It is the successor to Generation Y and precedes Generation Alpha. It is defined as the first generation to be born into a world with the Internet, smart devices and apps. As a result, these individuals have radically different views on the meaning of privacy, trust and relationships in the digital world. They are also more dedicated to overall personal wellness—but everything it encompasses, including economic security, nutrition, fitness, sleep and stress management. Members of Generation Z are fighting for social change, racial equity and environmental protection. They are also more likely to be highly educated and include many participants in medical professions. These are aspects that the healthcare industry has never addressed.

Caring for patients is a form of priesthood, we've been taught, and we know stories of physicians who have dedicated their lives to caring for others, some even losing their lives in the process (for example during wars, environmental disasters and pandemics). The recent experience with the COVID-19 outbreak has shown us how physicians have risked their lives to save patients.

I will always remember my medical school days, the hospital internships during which I wished I had more and more work to learn more, and especially to learn as much as possible. I enjoyed the difficult shifts, during which we spent the whole night working non-stop. And the next day, my colleagues and I were curious to know the fate of the patients we had seen during the shift. I also know doctors who work without counting the hours, without respite, always ready to help their colleagues in difficulty, at the risk of sacrificing their family life (2). Have times changed today? Physician suicide is an emerging and very concerning issue today. The current literature announces more alarming statistics (3, 4). Indeed, extended hours of intense work with sometimes complex patients can lead to mental and physical fatigue. As a result, this may explain the risk for suicide among physicians.

Some physicians have experimented with shorter work hours in the hope of circumventing fatigue, burnout and depression. I have chosen here to describe the experience of a young colleague, 25 years old, who chose to work 5 hours a day from Monday to Friday. This colleague keeps a sports activity, 2 h a day, from Monday to Friday. He explains his choice by saying that he wants to give priority to his comfort, his moral and physical well-being, and his family life. He indicates that some physician work can be done by telecommuting. He also argues that he chose to be a doctor in order to be of service to other human beings, but he also feels strongly that taking care

of himself should be a priority. He says that doctors are often insensitive to their own dire needs. They burn both ends of the candle and accumulate a rather large nest egg toward the end of their lives. They often plan to take their many remaining days off at the end of their career, but unfortunately, many will die before their retirement date or develop some incapacitating illness. Moreover, the medical profession having taken a personal toll on their personal, social lives- they end up dying alone. Their families often detest the fact that, they care more about their jobs and their own finances than their own kith and kin. These older generation physicians appear to be only thinking about their profession, to the detriment of their families and their own well-being. They are victims of the health care system that demands more and more investment, but which does little to improve the working conditions. Sadly, most health authorities do not care about the amount of work doctors do since what matters to them is sheer productivity. They do not care about the quality of life at work. On the other hand, younger generation doctors often see things in a radically different manner. Like my 25-year-old colleague, younger generations say they want to have a choice in how they live their profession; they don't want to be subjected to it. They say that work should be fulfilling, not exhausting. They have chosen the profession of physician with full knowledge of the facts. But from there to being totally over whelmed, they say no. In the next few years, we should expect a generation of doctors who will work less and less, who will be more and more demanding about the way they are treated by the health authorities and who will ask for more means to work better. Under these conditions, should we change the way we live our lives as physicians? Are the health authorities ready to mobilize more resources to recruit more doctors?

The two generations, often practicing side-by-side, need to learn to live and work together in harmony, despite different outlooks. This is also in the patient's best interest, as healthy doctors are more capable of making rational, evidence-based decisions. In addition, this new generation has radically different access to medical knowledge. Indeed, a smartphone contains the equivalent of a library of several dozen textbooks. A recent article can be accessed in real time during a medical meeting. The assistant or resident thus has direct and extraordinarily simple access to the same information as the seniors and the head of the department, which can call into question (and this is very good!) a hierarchy of knowledge, sometimes locked in a pyramidal manner, and formerly essentially based on experience and not necessarily on knowledge.

With a very peculiar (?) way of life and a paradigm-shifting attitude that challenges the "pecking order" and the existing medical hierarchy, the digital natives, as they are called, are going to disrupt the medical world (5). This evolution is forcing managers and healthcare systems to adapt. With the arrival of these young people whose ambitions are different from those of their elders, the medical world will undergo profound changes. Indeed, Generation Z advocates equality, with a more direct, more personal relationship. Listening, trust and transparency are their main expectations. If the hospital conveys a rather strict and stressful image, its previously established codes are going to be disrupted as these young doctors are no longer looking for a stable job. As a result, a diversification of tasks is going to become mandatory and considered beneficial to their blossoming. Challenges, objectives, punctual missions are going to punctuate the ideal professional daily life of this generation. Indeed, because of their close relationship with the digital world, they will be able to manage several tasks simultaneously. For these young people of Generation Z, the new digital tools need to be designed such that they do not disrupt the rhythm of work, while the management of schedules must be more flexible, and the transition from the clinic to the home be made more fluid. Management will quickly undergo radical changes in its organization. After adapting, as the healthcare system will have to do, managers will have to think about another, equally important point: what can they do to retain this generation of ultra-mobile doctors? In addition, with the feminization of the medical profession, this will change the game even more. The priority will be the family, and maybe not the hospital. It should be noted that this is also an issue for nurses and clearly explains the current shortage in many countries. Gone is the generation of the doctor who sacrifices his family life to devote himself fully to his work? In addition to telemedicine, other solutions are certainly possible in the organization of teams to combine quality of care, professional satisfaction and quality of extra-professional life: (i) the grouping of healthcare professionals in private practice allows for coordinated practice, which has the particular advantage of allowing for a more respectful organization of professionals' time; (ii)in hospitals and private practices, certain medical tasks can also be delegated to other healthcare professionals such as medical assistants or advanced practice nurses, in order to reduce the workload; (iii) at the same time, it may be wise to allow time for relaxation and recreation with loved ones.

In any case, Generation Z physicians are already here. We will have to adapt to their way of conceiving the profession, the health authorities have been warned. Will they really have a choice?

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Prevalence of and risk factors associated with depression among nursing students acting on the frontline of COVID-19 pandemic: A cross-sectional study

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Introduction: The widespread devastation caused by the ongoing waves of COVID-19 imposed a significant burden on the healthcare labor force. At the frontline in the battle against the deadly COVID-19 virus, nursing students in Vietnam were at a much-increased risk of developing mental health conditions. This study aims to identify the prevalence of depression and its related factors, along with coping strategies used by nursing students in the COVID-19 pandemic in Vietnam.

Materials and methods: The study was cross-sectional in nature, with convenient sampling at the epicenters of COVID-19 outbreaks in Vietnam (N = 191) from April to November 2021. After conducting a questionnaire pilot, the data was collected strictly using an internet-based approach. The Depression, Anxiety, and Stress Scale-21 items were used to identify the risk of depression among nursing students. The Chi-square test was used to assess the differences between coping strategies among nursing students. A multivariate logistic regression model was used to identify risk factors associated with depression.

Findings: The percentage of nursing students affected by depression was 21.5%, and almost half of the nursing students (49.2%) had no coping strategies for dealing with mental health concerns. Among the remaining nursing students, video-based mental consultation was the most popular method (25.7%). Being females (AOR: 2.7, 95% CI: 1.1–6.7), collecting bio-samples (AOR: 2.9, 95% CI: 1.4–6.2), providing support to vaccination spots (AOR: 2.3, 95% CI: 1.1–5.1), and not vaccinating against COVID-19 (AOR: 3.1, 95% CI: 1.1–9.1) were found as risk factors for depression among nursing students.

Conclusion: Our research revealed a significant number of nursing students suffering from depressive symptoms and underscoring the need for more

effective methods of dealing with this condition. Depression management and coping skills focusing on female populations and those whose direct contacts with infectious sources should be implemented in the nursing curricula and continuous training credits. Those trainings, would support future nurses in handling crisis situations better.

KEYWORDS

depression, nursing students, Vietnam, pandemic, mental health, COVID-19

1. Introduction

Nursing is considered to be one of the top first-line dedicated professions in disaster response (1), as well as any primary and secondary infectious disease prevention efforts, including COVID-19 (2, 3). During the COVID-19 pandemic, nurses need to reassure, inform, and support patients, patients' families, and the community to stay healthy following the latest guidance on COVID-19 prevention (4) while delivering the nursing care plan in all phases of the illness trajectory. In this harsh time, nurses are responsible for all patients' demands, including supplying and usage of sanitation materials and personal protective equipment, offering screening information, confinement guidelines, and triage or quarantine protocols (5). To be a health model and ensure all nursing tasks during the pandemic, nurses, therefore, must first be mentally and physically healthy. Conversely, nursing is considered as a high-risk group of occupational stress and a higher risk of depression than other groups of health professionals (3). The COVID-19 pandemic caused mental health concerns for nurses, becoming even more alarmed than other professionals as nurses continued to work while other residents stayed at home for their safety, making nurses more susceptible to the high risk of COVID-19 infection and mental disorders (6, 7). Evidence gathered over the previous years indicated a significant number of nurses suffering from depression, ranging from around 22.5 to 52%, according to several systematic studies (8–11).

The fourth wave of the COVID-19 pandemic in Vietnam started on 27th April 2021 and recorded 1,207,498 confirmed cases and 24.657 deaths until 28th November 2021 (12). Most positive cases were recorded from Ho Chi Minh, Binh Duong, and Dong Nai, mainly related to the Delta variant (13). The virus has spread in both the local communities and large industrial zones, putting a heavy burden on the whole healthcare system. In response to the Ministry of Health's call for assistance to fight COVID-19, many students from nursing schools voluntarily registered to be on the frontline fighting with COVID-19. In the previous waves in Vietnam, students' support has witnessed certain advantages in preventing and controlling the COVID-19 outbreak (14).

Like other countries, the continuous waves of COVID-19 placed a significant burden on the healthcare workforce in Vietnam. Hospitals, health centers, and clinics were always in an overloaded situation with continuous peaks in the numbers of suspected COVID-19 cases, positive cases, and ICU treatments, while the shortage of health workers could not be solved within months or weeks (14). To accommodate these difficult circumstances, nursing students and other healthcare students were called for their voluntary to participation in the "fence" against COVID-19 (4, 5). Vietnamese nursing students were treated as practice nurses under the supervision of lecturers and registered nurses to detect COVID-19 cases, support vaccination, and deliver caring activities. These emerged jobs and responsibilities with the boundary of COVID-19 infection fear placed them at high risk of mental illnesses. From the beginning of the COVID-19 pandemic, depression and associated mental health problems of frontline health workers have been examined in many papers in many other countries (15–17).

In developing countries as Vietnam where the future pandemic or latent diseases can affect the healthcare system and the whole community at any time, preparing for the future workforce is essential. Most publications in Vietnam typically evaluated the mental health of all health professionals instead of focusing on nurses, and none focusing on the special healthcare workforce as undergraduate nursing students who provided round-the-clock assistance to patients with the highest dedication and thoroughness during the pandemic (18–20). Only in this special scenario of the pandemic, the nursing students had the chance to act as a nurse with lots of ups and downs regarding the working experience and the emotional fluctuation. Therefore, this research aims to explore the prevalence of depression and its related factors and coping strategies used by nursing students in the COVID-19 pandemic in Vietnam. This will be one of the first papers providing evidence for nurse lecturers and nurse managers for their future working plans with nursing students during the pandemic as well as pinpointing useful predictors for socialists in their community mental health projects.

2. Materials and methods

2.1. Research design

A cross-sectional study design was used.

2.2. Research time and setting

The study was conducted in the hotspots of COVID-19 outbreaks in Vietnam from April to November 2021. Given the evidence that the prevalence of anxiety and depression among frontline healthcare workers was high during the COVID-19 pandemic, we employed a method known as purposive sampling, which involved selecting high-risk communities of COVID-19 pandemic from a comprehensive review of the material provided by the government. Finally, three large provinces and cities in the North and the South of Vietnam (Ho Chi Minh City, Binh Duong, and Hai Duong Province) were selected due to the most COVID-19 suffering regions of the country during that period (21). Therefore, these areas were the main settings to conduct the survey.

2.3. Research subjects

Nursing students acting as volunteers in both hospitals and the community on the front line at Hai Duong province, Binh Duong province, and Ho Chi Minh city were invited to participate in this study.

2.3.1. The inclusion criteria

Nursing students who (1) were involved in supporting activities for suspected or confirmed COVID-19 patients either in the hospital or in the community; (2) worked in the frontline areas for at least 2 weeks; and (3) volunteered to take part in the research.

2.3.2. The exclusion criteria

Nursing students who (1) did not involve in activities requiring directly contacted with suspected or confirmed COVID-19 patients; (2) have been diagnosed with mental disorders, or physical illness were excluded.

2.4. Sampling and process of data collection

2.4.1. Sample size

Convenient sampling was employed. Nursing students who met the selection criteria were invited to participate in the study with a sample size calculated according to the formula provided by Lwanga and Lemeshow in 1991 (22):

$$\frac{Z^2_{1-\alpha/2}\ p(1-p)}{d^2}$$

α: Confidence level

p: Anticipate population proportion

d: Relative precision

n: Sample size

With $\alpha = 0.05$, $Z_{1-\alpha/2} = 1.96$, $p = 0.52$ according to prevalence of depression among nursing students in a systematic review assessed 17 studies (23), and $d = 0.07$, the estimated sample size was 196 participants. We added 10%, ensuring the required sample size if any attrition happened. The final sample size was 216.

2.4.2. Data collecting process

The data was collected through an online-based method using Google Forms. Prior to the formal release of the online surveys, the research team piloted the questionnaires to ensure that the questions and instructions were clear and that any possibility for confusion was eliminated. The questionnaire was distributed to a group of around 10 nursing students in order to determine the time required to complete it and to ensure that the questions were clear and unambiguous. After contacting the nurse manager(s) of hospitals or community health stations at the hotspots of COVID-19 outbreaks for permission, a consent form and a link to the online questionnaire survey were directly sent to them for posting in the group-discussion forums/flat forms of those hospitals or health stations. Nursing students at the hotspots willing to participate in the study clicked the link (https://forms.gle/maZDkBFTmrJrVDAy6) and initially answered the questions relating to inclusion criteria. Once they met the study criteria, they were directly linked to a consent form and then a survey questionnaire for completion of participation. In addition to a set-up of single response, participation in the study was a voluntary basic, no incentive was provided. The data collected therefore were individual responses.

2.5. Research instruments

The research instrument is divided into 4 parts:

PART 1: Demographic information.

PART 2: The tool to assess the level of risk of depression of nursing students was 07 items of the Depression scale in the 21-item Depression Anxiety and Stress Scale (DASS-21, which were validated on rural northern Vietnamese women and translated into Vietnamese in 2013. The DASS21 was first translated from English into Vietnamese, then evaluated by a panel of health experts and research workers to ensure it was culturally and linguistically suitable, and then its document was translated back to English for final verification (24). The score was equaled by summing up the score of every question and then multiple two. The level of risk of depression among respondents will be "mild" if the total score from 10-13, "moderate" if the score from 14 to 20, "severe" if the score 21–27, and "very severe" if score higher than 28 up to 42.

PART 3: Tool to assess factors relating to the level of depression of nursing students was the questionnaire developed by Shechter and colleagues (25) with permission prior to data collection.

PART 4: Coping strategies, including questions about received, preferred, or applied strategies such as video-based approach, online consultation, online network, self-care to help nursing students deal with mental health problems.

2.6. Data management and analysis

SPSS version 26.0 was used to enter and analyze data. Data from the online survey was extracted and transferred to an SPSS file and then cleaned prior to analysis. If certain data were ambiguous or missing, the study team individually contacted individuals to get further information. All identified information of the study participants was removed prior to data analysis. Descriptive statistics were summarized and performed by tables and charts. The Chi-square test was used to examine the differences between coping strategies among nursing students. Binary logistics regression was performed to examine the influence of variables on perceived depression among nursing students, along with two-sided $p < 0.05$ was considered statistically significant. First, a bivariate analysis between perceived depression and its predictors was performed. Predictors showing a potential relationship with depression ($p < 0.2$) were selected to add to the regression model by using Enter method (26). No binary correlation between perceived depression and coping strategies was found. In the beginning, the model containing two independent variables (age and gender) was entered for the first step of the equation. Next, predictors including registered to be specifically on the current task, having family relatives working in the quarantine area, being vaccinated with COVID-19, collecting bio-samples in the community, supporting vaccination spots, and academic year were entered as a block for step 2 while controlling for the effects of age and gender. The Hosmer-Lemeshow test was used to determine the goodness of model fitting. The model outcomes were presented with adjusted OR (95%CI) after the entry of all independent variables.

3. Results

3.1. Demographic characteristics

A total of 216 nursing students voluntarily completed the online questionnaire. However, after cleaning the data and excluding ineligible responses, only 191 (88.4%) responses were included in the analysis. After checking against the margin of error which is vary from 5 to 10%, we found that the sample of 191 met requirements for power analysis and for reflecting the figure reported. Therefore, data analysis was performed on those 191 respondents.

Table 1 shows the characteristics of the study participants. Participants' age ranged from 19 to 25 years ($M = 21.8$; SD $= 1.1$). Of these 191 participants, 83.2% were women, and 99.0% were single. A large proportion (83.8%) of the nursing students who participated in the study do not have a history of chronic illness. Up to 96.3% of nursing students voluntarily selected their current working sides in epidemic prevention as frontline healthcare workers, while the rest registered their interest and then mobilized to be in the sides. About 65.4% of the study participants had family relatives working in the quarantine station, and only 89.0% of them were vaccinated with COVID-19. When asked about their primary task, about 67.0% collected bio-samples in the community. Most participants (85.9%) were university students, 44.0 and 33.5% of whom were year 3 and year 4 students, respectively.

3.2. The prevalence of perceived depression

As shown in Figure 1, the overall prevalence of mild-to-extremely severe levels of perceived depression among participants, was 21.5% ($n = 41$). In total, 12.0% ($n = 23$) of nursing students reported moderate-to-extremely severe perceived depression.

3.3. Strategies nursing students used to cope with depression

Participants were asked about the supporting method they received or applied by themselves to help them deal with mental health problems, including depression. Table 2 shows nearly half of the participants (49.2%) had no coping strategy for mental health issues. However, the rest of the nursing students also applied various supporting methods for themselves, among which the video-based approach of mental consultation was the most common, accounting for 25.7%; followed by partial support from professionals (25.1%) and an online network to support medical staff on the frontline (14.7%). In terms of coping strategies for depression, there was a significant association between depression with an online network supporting medical staff on the frontline ($\chi^2 = 6.232$; $p < 0.05$).

3.4. Factors influencing perceived depression among nursing students

In the first step, where only background factors, namely gender and age, were included in the primary model, only

TABLE 1 Characteristics of the study participants.

Characteristics		$n = 191$	Percentage (%)
Age (Mean ± SD)		21.8 ± 1.1	
Gender	Male	32	16.8
	Female	159	83.2
Marital status	Engaged/living with partners	1	0.5
	Divorce/widowed	1	0.5
	Single	189	99.0
History of chronic illness	No	160	83.8
	Yes	31	16.2
Volunteer	To be on different tasks	7	3.7
	To be specifically on the current task	184	96.3
Had family relatives working in the quarantine station	Yes	125	65.4
	No	66	34.6
Being vaccinated with COVID-19	Yes	170	89.0
	No	21	11.0
Student's primary task on the frontline	Take care of confirmed positive cases	37	19.4
	Collect bio-samples in the community	128	67.0
	Follow up on suspected cases	26	13.6
	Contact tracing	41	21.5
	Epidemiological screening	40	20.9
	Volunteer at vaccination spots	71	37.2
	Administrative tasks and logistics	16	8.4
Level of education	University students	164	85.9
	College students	27	14.1
	Vocational students	0	0
Academic years	Year 1	3	1.6
	Year 2	40	20.9
	Year 3	84	44.0
	Year 4	64	33.5

between 1.8% (Cox and Snell R square) and 2.8% (Nagelkerke R squared) of the variation of perceived depression was explained by these two factors. In the second step, other variables, including being vaccinated with COVID-19, collecting bio-samples in the community, and supporting vaccination spots, were entered and became significant predictors ($p < 0.05$). The complete model containing all predictors was statistically significant, χ^2 (df = 9, $n = 191$) = 21.606, $p < 0.001$, indicating that the model could distinguish between students who reported and did not report depression problems. The model as a whole explained between 10.7 (Cox and Snell R square) and 16.5% (Nagelkerke R squared) of the variance in perceived depression and correctly classified 79.1% of cases. The Hosmer-Lemeshow goodness of fit indicated no evidence of poor fit with $\chi^2 = 7.39$, $p = 0.389$. As shown in Table 3, three independent variables made statistically significant contributed to the model (being vaccinated with COVID-19, collecting bio-samples in the community, and supporting vaccination spots). The strongest predictor of depression among nursing students was vaccinated with COVID-19, recording an odds ratio of 3.156. This indicated that respondents vaccinated were over 3 times more likely to perceive depression than those vaccinated against COVID-19 after controlling for all other factors in the model. Besides, nursing students potentially exposed to people at risk of COVID-19, specifically collecting bio-samples in the community and supporting vaccination spots, were over 2.9 and

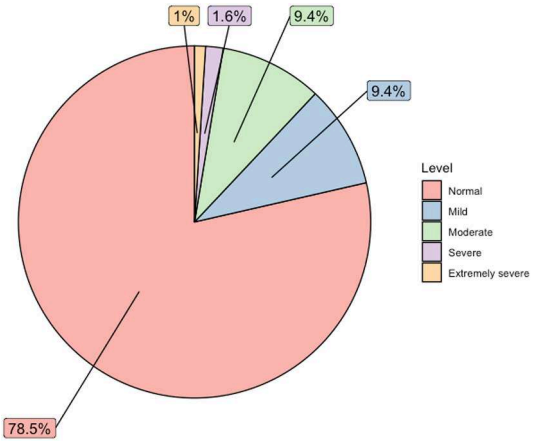

FIGURE 1
The prevalence of risk of depression among nursing students ($n = 191$).

2.3 times more likely to report depression than other primary tasks on the frontline.

4. Discussion

Our study provides insight into the depression experienced by nursing students in Vietnam, who voluntarily joined the nursing workforce on the frontline due to the rapid spread of the COVID-19 pandemic. During the pandemic, individuals were put under tremendous stressful conditions resulting in a higher risk of developing depression, particularly for nursing students on the frontline. The results of the present study revealed that 21.5% of nursing students suffered from mild to extremely severe depression. Our findings were consistent with the pooled prevalence rate of depression among healthcare workers during COVID-19 reported by Pappa et al. (27). Using the same DASS-21 depression scale, the percentage of risk of depression among nursing students in our study was similar to the depression rate of 26.8% in Chinese medical student volunteers, according to Zhang et al. (28). Likewise, another survey conducted among front-line healthcare workers in Italy found that 28.6% of healthcare workers experienced depression measured with the DASS-21 depression scale (29). However, in terms of targeted populations, healthcare workers who were nurses comprised only 25% of participants in that study. In comparison to a similar study conducted in Hanoi during the first wave of Covid-19 pandemic, the percentage of students who perceived depression in our study was higher than the prevalence of students who screened positive for depression, with 21.5 and 14.5%, respectively (11). The difference can be explained by the discrepancies in the depression scale. In addition, recent studies highlight that healthcare workers, including nurses who are directly engaged in the frontline, are more prone to mental disorders (30). Besides, the rate of depression in our results is lower than in another study conducted among Vietnamese students with the rate of depression being 46.0% (31). One possible explanation for this difference comes from the academic year of the sample, which indicates that the rate of depression among 1 or 2-year students is higher than the rate of depression among four or beyond 4-year students due to their stable mentality (31).

Interestingly, a significant proportion of the study participants (49.2%) did not use coping strategies during their working time on the frontline. However, our study findings explicated that the rest were using various strategies to cope with work-related mental health problems such as video consultations, joining an online support network, online consultations for individuals/groups, and receiving partial support from professionals. Nursing students spontaneously utilized these coping strategies without any instruction or guidelines before or during their frontline workforce participation. Therefore, those implemented tactics seemed not to address the depression they had, as our study found no statistically significant association between depression and coping strategies. This finding is like the previous work in Tohoku Region, Japan (32). In the previous research, various coping strategies were frequently used among nurses to manage their depression, such as a positive approach, problem-solving, and positive re-evaluation (33). Even though coping is a context-dependent phenomenon, coping strategies to avoid mental distress pre- and in-healthcare services supplies should be integrated into nursing education programs and into continuous training for vulnerable groups such as female students, or those at risk of mental health issues as a way to better prepare students for managing depression while responding to a crisis or health disasters in the future.

In addition to equip students with depression management training, the delivery method of training and support programs should meet the nursing students' preferences to be effective. This study highlighted a significant association between an online network and depression among nursing students ($p < 0.05$). This finding was consistent with one study from Nigeria that revealed emotional support was an effective coping strategy against depressive symptoms (34). Another survey conducted among healthcare workers in Vietnam shortly after the first wave of COVID-19 also confirmed that those with severe stress levels expected to receive psychological support from web-based interventions (18). Considering this evidence, developing a web-based mental wellness program to support nursing students working at the frontline during a health crisis is recommended.

Working non-stop days-and-nights, high risk for depression is understandable, and thus, depression risk factors should be managed to support nursing students stay-well and work-well. This study asserted that female students were more likely to

TABLE 2 Differences in perceived depression by coping strategy.

Variables	Perceived depression		Total	Chi-square	*p*
	Yes (*n*, %)	No (*n*, %)			
Total	41 (21.5)	150 (78.5)	191 (100)		
Video-based approach					
Yes	14 (28.6)	35 (71.4)	49 (25.7)	1.974	0.16
No	27 (19.0)	115 (81.0)	142 (74.3)		
Group online consultation					
Yes	2 (15.4)	11 (84.6)	13 (6.8)	0.306	0.738
No	39 (21.9)	139 (78.1)	178 (93.2)		
Individual online- consultation					
Yes	3 (15.8)	16 (84.2)	19 (9.9)	0.403	0.769
No	38 (22.1)	134 (77.9)	172 (90.1)		
Online network to support medical staff on the frontline					
Yes	1 (3.6)	27 (96.4)	28 (14.7)	**6.232**	**0.011**
No	40 (24.5)	123 (75.5)	163 (85.3)		
Self-care for mental well-being with partial support from professionals					
Yes	7 (14.6)	41 (85.4)	48 (25.1)	1.802	0.18
No	34 (23.8)	109 (76.2)	143 (74.9)		
None of the above					
Yes	22 (23.4)	72 (76.6)	94 (49.2)	0.412	0.521
No	19 (19.6)	78 (80.4)	97 (50.8)		

The bold values indicate the *p*-value less than 0.05 which is considered to be statistically significant in our results.

experience depression than their male counterparts (AOR = 2.67, 95%CI 1.07–6.70). This finding is aligned with previous studies confirming a higher risk of developing depression and anxiety among women working in health workforces during a pandemic or crisis (30, 35–37), suggesting a focus on female groups while providing depression management programs for nursing students. In addition, we also found evidence that the risk of depression among nursing students who were not vaccinated against COVID-19 was three times higher than those who had been vaccinated. Protected with vaccination is therefore essential in increasing confidence and reducing depression for nursing students working in high-risk-of-infection environments.

This study found that nursing students who participated in collecting bio-samples in the community and providing support to vaccination spots had a higher risk of depression than nursing students who oversaw other tasks. It is understandable because having regular direct contact with suspected patients or their bio-samples increases the risk of exposure, leading to increased depression (35). As reported by previous research, the fear of direct contact with patients led many respondents to volunteer in non-patient contact works other than patient-contact activities.

We acknowledged that our study had a few limitations. First, we used an online survey for data collection, and therefore, we may have missed some of the potential nursing students willing to do this survey. Nonetheless, collecting data via an online platform was the only possible solution during the lockdown period, the advantage and convenience of this method promise a large application even when the COVID-19 situation is over. Second data collection was conducted in three provinces where considered as hotspots of COVID-19 explosion and where healthcare students were mobilized to support the local health staff. Controlling the setting of the study in three large provinces of Vietnam during the fourth way of COVID-19, our study could have some limitations in data generalizability. Finally, anonymous self-reported data could result in inaccurate data, despite the fact that we made an effort to validate the participants by carefully checking the answer of the respondents. Further studies on a larger scale should be conducted in the future to demonstrate the representative of nursing students in Vietnam.

To recapitulate, our research results have attempted to prove that the mental health of nursing students who were working on the frontline is affected by the COVID-19 pandemic and there was no reliable coping strategy for depression among those.

TABLE 3 Predictors of depression among nursing students by binary logistic regression ($n = 191$).

Block	Factors	AOR*	*p*	95%CI	
Block 1	**Age**	0.997	0.984	0.729	1.363
	Gender				
	Female	2.257	0.06	0.965	5.278
	Male	Ref			
Block 2	**Age**	1.070	0.697	0.762	1.503
	Gender				
	Female	2.676	**0.036**	**1.068**	**6.705**
	Male	Ref			
	Volunteer to be specifically on the current task				
	Yes	4.259	0.094	0.78	23.248
	No	Ref			
	Having family members on the frontline				
	Yes	1.258	0.584	0.553	2.864
	No	Ref			
	Being vaccinated with COVID-19				
	Yes	Ref			
	No	**3.156**	**0.034**	**1.088**	**9.154**
	Collecting bio-samples in the community				
	Yes	**2.917**	**0.005**	**1.373**	**6.196**
	No	Ref			
	Supporting vaccination spots				
	Yes	**2.347**	**0.033**	**1.073**	**5.135**
	No	Ref			

*Odds ratio adjusted by age, sex.

Therefore, it is necessary to develop some feasible interventions to positively foster nursing students' mental health, especially in the case of working in quarantine areas.

5. Conclusion

In conclusion, this cross-sectional study indicated a high prevalence of mild to extremely severe depression among Vietnamese nursing students working on the frontline against COVID-19, which was 21.5%. Being females, collecting bio-samples, providing support to vaccination spots, and not vaccinating against COVID-19 were found as risk factors for depression among this population. Our findings revealed that depression management and coping strategies should therefore be integrated into nursing programs for nursing students at educational institutes to better prepare them for working in a crisis in the future. The future training programs should also focus on factors associated with depression as found by the study, and how nursing students can manage these factors while working in a high-risk depression environment.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Assessment of nursing undergraduate's perceptions of Interprofessional learning: A cross-sectional study

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Background: Inter-Professional Learning (IPE) is based on mutual respect, and it improves collaboration and teamwork, and satisfaction among students and professionals.

Objective: This study aimed to assess the perceptions of IPE among Nursing students in Saudi Arabia.

Methods: This is a cross-sectional survey-based study conducted among students from three different universities in Saudi Arabia, among nursing students over 6 months from May 2021 to October 2021. Descriptive analysis was used to assess the perceptions of IPE and inferential testing was used to assess the association of perception scores among variables using a statistical package for social science version 26 (SPSS).

Results: A total of 517 participants responded to the questionnaires. A higher proportion ($n = 281$, 54.4%) of the participants were females and were between 21 and 24 ($n = 350$; 67.7%) years old. The mean age of the participants was 21.35 (SD = 1.46). The majority of them were from King Saud University ($n = 273$, 52.8%), followed by King Khalid University ($n = 127$, 24.6%). Of the participants (80.4 %) agreed learning with other students will help them to become more effective members of a healthcare team. The mean overall score for RIPLS was 70.85 (SD = 6.611). The mean score for teamwork and collaboration was 37.19 (SD = 4.79), professional identity, 23.23 (SD = 2.89), roles and responsibilities 10.42 (SD = 2.20). The mean score is significantly associated with the university type ($p = 0.0001$), and previous knowledge of IPE ($p = 0.0001$).

Conclusion: The majority of the students had positive perceptions of understanding IPE and a good level of preparation for IPE. This means that if IPE is conducted among Saudi students, students will benefit from it, and it has the potential to improve their capacity to deliver holistic nursing care to their patients.

KEYWORDS

perceptions, readiness, Saudi students, nursing, patient care

Introduction

In recent days Interprofessional education (IPE) is an important part of a healthcare student's education. Interprofessional learning involves students from two or more professions, who may learn together during their professional education, to establish a collaborative practice for providing patient-centered care (1–7) by analyzing their needs and interests through IPE for professional success, learning gaps between health education and practice settings are eliminated (8). Although IPE differentiates multi-professional education from shared and common learning (9). In contrast to traditional education, IPE focuses on providing the knowledge and trainee skills needed for collaborative teamwork (4, 10). Notably, IPE should be incorporated into the curriculum of healthcare students for achieving better health outcomes through collaborative teamwork.

According to World Health Organization IPE is defined as "when students from two or more professions learn about, from, and alongside each other to enable successful collaboration to improve the health outcomes (11, 12). Earlier studies from other countries revealed IPE allows students to learn about various professions, create positive attitudes, and acquire cooperative teamwork through social engagement with other disciplines (13–15).

Interprofessional collaborative practice has also been shown to be a key to better patient-centered, efficient, and cost-effective care, as well as a reduction in error rates (16, 17). Despite the team-oriented nature of the IPE, literature additionally suggested that IPE improves staff communication and interactions, as well as patient outcomes (17–20). Interprofessional education has several advantages in terms of academics and health outcomes (12).

Implementation of IPE has been shown to boost job satisfaction and minimize conflict and tension in the workplace (10, 21). The utilization of IPE has aided students in developing high-level knowledge, abilities, and professional attitudes to deal with the complexities of clinical circumstances in a collaborative and Interprofessional manner (22) Countries such as the United States, the United Kingdom, Canada, and European countries have effectively implemented IPE for nearly two decades, whereas Interprofessional education is only now being created in many other countries, including Saudi Arabia (23–25).

According to earlier studies, many international universities showing interest in IPE (26–29). An earlier study by Pollard et al., among British university students, assessed students' perspectives on IPE and found that they have positive attitudes toward IPE (28). Similarly, another study by Lumague et al. stated that healthcare students who have had Interprofessional experience understand the value of Interprofessional teamwork in inpatient care (29). Similarly, another recent study done on professors of medical, nursing, and pharmacy schools in South Korea reported that 85.2% of studied subjects were unaware of IPE (30). In 2016 Zeeni et al. assessed students' perceptions of IPE and found that students' readiness for IPL improved after participating in the IPE program. Additionally, students were satisfied with their learning experience, and assessment results revealed that all of the IPE learning objectives had been met (31). In Saudi Arabia there is a dearth of literature on the perceptions of students toward IPE, therefore we aimed this study to evaluate the perceptions of nursing students toward IPL in Saudi Arabia.

Methods

Study design, setting, and population

A cross-sectional web-based study was conducted in three different Saudi universities namely king Saud, King Khalid, and Taif universities in Saudi Arabia from May to October 2021 using structured validated self-administered questionnaires. All the undergraduates who were enrolled in the nursing curriculum in Saudi universities were included. Before data collection ethical approval was obtained from the college of medicine, King Saud University Riyadh, Saudi Arabia (Reference No. UQU-COP-EA #143706). Before carrying out the study verbal informed consent was obtained from the participants, and the participants were assured that the data would be used only for research and confidentiality would be maintained throughout the study. Moreover, this research study followed the principles of the Declaration of Helsinki 1995 (32).

Sample size

There were ∼2,000 residential students currently enrolled in nursing courses at Saudi universities in Saudi Arabia. Similar to the previous studies (33–38) we calculated the required sample size using the Raosoft sample size calculator (http://www.raosoft.com/samplesize.html.) with a 95% CI and a pre-determined margin of error of 5%. Because we were unaware of the potential results for each question, we assumed that the response distribution for each question would equal 50%. Although the sample size was projected to be 132, we opted to poll at least 200 students to assure greater reliability.

Questionnaire design

An Arabic version of a RIPLS questionnaire for this study was used based on a previously published study by Bashatah et al. (39). The original version of the Readiness for IPL Scale (RIPLS) was published by Parsell and Bligh (40). The original questionnaire was in English language and was translated

into Arabic language. The translation of the questionnaires was done by using forwards and backward procedures (41). The prepared questionnaire was subjected to face and content validity by two academics with extensive experience in preparing research questionnaires.

The questionnaire was modified in light of the feedback received from the experts. The final version of the questionnaires consisted of 25-items divided into four sections. The first section collected data on the demographic characteristics of the participants, including age, type of university, and level of education, the second section collected information on the perception of students about the Readiness for Inter-Professional Learning Scale (RIPLS) with a total of 19-items divided into three domains namely teamwork and collaboration (items 1–9), professional identity (items 10–16), and roles and responsibility (items 17–19). All these questionnaires were accessed student's perceptions on a five-point Likert scale. (1 = strongly disagree, 5 = strongly agree). The mean scores were calculated for each of the items in the scale, the total mean scores were further computed by combining all the item scores.

The data was gathered from the target population's using a convenience sampling approach. An online survey was used to gather the data. The electronic link was built using the Google forms we created. To determine the point of contact for the targeted population for data collection, we first spoke with the course instructor. The online poll used social media (WhatsApp). The study title was followed by a revealing statement, consent, and authorization to utilize completed information for publishing at the beginning of the survey. The students were informed that their participation was voluntary and anonymous, and those who read the following page and nodded in agreement were given the go-ahead to answer the research questions on it.

Data analysis

The collected data were analyzed using the IBM SPSS Statistics 26 (IBM Inc., Chicago, IL, USA) and IBM SPSS 22 (IBM Inc., Chicago, IL, USA) software. Descriptive statistics were used for the demographic variables. Descriptive statistics such as percentages, frequency, and mean values were calculated. The mean scores of the RIPLS were compared between the demographics and other characteristics of the participants. A one-sample *t*-test and one-way ANOVA were used to compare the mean scores, and the results were considered statistically significant if the *p*-value was < 0.05.

TABLE 1 Demographic characteristics of participants.

Variable	Frequency (*n*)	Percentile (%)	Mean ± SD
Gender			
Male	236	45.6	
Female	281	54.4	
Age (years)			
18–20	159	30.8	
21–24	350	67.7	21.35 ± 1.46
>25	8	1.5	
Name of university			
King Saud University	273	52.8	
Taif University	117	22.6	
King Khaled University	127	24.6	
Academic level			
First level	46	8.9	
Second level	124	24	
Third level	37	7.2	
Fourth level	83	16.1	
Fifth level	60	11.6	
Sixth level	99	19.1	
Seventh level	31	6	
Eighth level	6	1.2	
Internship	30	5.8	
Do you have previous knowledge of Interprofessional learning?			
Yes	178	34.4	
No	338	65.4	
Source of knowledge			
No	279	54	
From KSU	67	13	
Out of KSU	9	1.7	
From TU	21	4.1	
Out of TU	7	1.4	
From KKU	66	12.8	
Out of KKU	8	1.5	

Results

A total of 517 participants responded to the questionnaires. A higher proportion ($n = 281$, 54.4%) of the participants were females and they were between the age of 21–24($n = 350$; 67.7%), (mean age 21.35 ± 1.46) while the majority of them were from king Saud university ($n = 273$, 52.8%), followed by

king Khalid university (n = 127, 24.6%) and Taif University (n = 117, 22.6%). Concerning the academic level, most of the students are in their second level (n = 124, 24%), sixth level (n = 99, 19.1%), fourth level (n = 83, 16.1%), Fifth level (n = 60, 11.6%), and internship (n = 30, 5.8%). Regarding previous knowledge of IPL 65.4 % of the students did not know about this. The summary of student information is presented in Table 1.

Table 2 illustrates the perception of knowledge of IPE among students. Out of 19 items, students disagreed with items no 10, 11, 12, and 18 which illustrated the gaining of knowledge from others. Of the participants, 80.4% agreed that learning with other students would help them to become more effective members of a healthcare team. In addition, 80.1% agreed with item 2 which is to solve patient problems, healthcare students should work together. While 64.3% agreed, shared learning with other healthcare students would increase their ability to understand clinical problems. When the students were asked about learning with healthcare students would improve their relationships after qualification (76.2%) agreed to this item.

In this study majority of the students (82%) agreed that Communication skills should be learned with other healthcare students. a large number of participants (76%) suggested that Shared learning will help them to think positively about other professionals. A majority of the students (86.5%) believed that for small group learning to work, students need to trust and respect each other. The majority of 76.8% agreed that Team-working skills are essential for all healthcare students to learn. About two-thirds (68.7%) of the students accepted item 9 which elucidated Shared learning helps them to understand their limitations. while (75.5%) of the participants agreed that Shared learning with other healthcare students would help them to communicate better with patients and other professionals. Most of the students in the study (73.1%) agreed that they would welcome the opportunity to work on small-group projects with other healthcare students.

Approximately (77.6%) of the students agreed that Shared learning will help them to clarify the nature of patient problems with a mean score of 4.05 (SD = 0.757). While (75.7%) agreed with Item 16 which stated that shared learning before qualification will help them become a better team worker with a mean score of 4.12 (SD = 0.850). About two-thirds (61.9 %) agreed that the function of nurses and therapists is mainly to provide support for doctors. Nearly three-quarters (72.5%) of students agreed that they have to acquire much more knowledge and skills than other healthcare students (45.3 %) of the students disagreed with the statement "I'm not sure what my professional role will be" (item 18). Detailed descriptions of the participant's responses to the perception of IPE were given in Table 2.

The overall mean score for RIPLS was 70.85 (SD = 6.611). The mean score for teamwork and collaboration was 37.19 (SD = 4.79), for professional identity, 23.23 (SD = 2.89), roles and responsibilities 10.42 (SD = 2.20) (Table 3). The mean score is significantly associated with the university type (p = 0.0001) and previous knowledge of IPE (p = 0.0001). However, there was no significant association between the mean score of IPE concerning gender and age group of the participants (p = 0.05). Furthermore, the association between the mean RIPLS score and with respected some characteristics of the students was given in Table 4.

Discussion

The educational system in Saudi Arabia has undergone an incredible transformation. Even though this is evidence that IPE is only used in academic courses in highly developed countries worldwide. In this new era of rapid development if the foundation of IPE and practice is established during students' campus years in classroom and simulation labs the healthcare system will gain high visibility of well-trained and well-qualified healthcare professionals (HCPs) that may have a great impact on health outcomes. This study is to determine the perception of IPE among students in Saudi Arabia. Our study results include the students of all academic levels from King Saud University, Taif University, and King Khaled University reported that only 34.4% of the students have previous knowledge of IPE whereas a study conducted among medical students of King Saud University Riyadh concluded that only 23.4% had a previous experience with IPE (11). Another study among health sciences faculties at the University of Sumatera Utara reported that 68% of the students stated that they had heard Interprofessional education (IPE) information (42). So, it makes a significant contribution that IPE should be made compulsory for all healthcare professionals.

It is noteworthy to mention that the Source of knowledge of IPE of the King Saud University students is only 13 %, while King Khalid university students scored 12.8 %. Our results concluded that a large proportion of the students believed that Learning with other students will help them to become more effective members of a healthcare team. This finding is consistent with a previous study published by King Abdul Aziz University (43). In this study, most of the students perceived that the Patients would ultimately benefit if healthcare students worked together to solve patient problems which are similar to a previous study published by Zechariah et al., in the United States (44), Hammick (4), Hammick (10). Overall, it is clear that healthcare professionals are the ones with whom patients interact most and will improve patient outcomes. So, there is a need for implementing IPE. Findings also reported that 64.3% of the students believed that Shared learning with other healthcare students will increase their ability to understand clinical problems. The results are consistent with studies conducted by Al-Qahtani in Dammam (45). In this study, we observed that most of the students support IPE.

TABLE 2 Frequency of responses toward perception of IPE among university students.

Items	Strongly disagree *n* %	Disagree *n* %	Neutral *n* %	Agree *n* %	Strongly agree *n* %	Mean ± SD
Q1. Learning with other students will help me become a more effective member of a healthcare team	2 (0.4)	9 (1.7)	90 (17.4)	163 (31.5)	253 (48.9)	4.27 ± 0.835
Q2. Patients would ultimately benefit if healthcare students worked together to solve patient problems	11 (2.1)	2 (2.0)	92 (17.8)	209 (40.4)	205 (39.7)	4.18 ± 0.794
Q3. Shared learning with other healthcare students will increase my ability to understand clinical problems	1 (0.2)	10 (1.9)	174 (33.7)	190 (36.8)	142 (27.5)	3.89 ± 0.834
Q4. Learning with health-care students before qualification would improve relationships after qualification	1 (0.2)	13 (2.5)	109 (21.1)	163 (31.5)	231 (44.7)	4.18 ± 0.863
Q5. Communication skills should be learned with other healthcare students	1 (0.2)	19 (3.7)	73 (14.1)	217 (42)	207 (40)	4.18 ± 0.822
Q6. Shared learning will help me to think positively about other professionals	1 (0.2)	17 (3.3)	106 (20.5)	223 (43.1)	170 (32.9)	4.05 ± 0.825
Q7. For small-group learning to work, students need to trust and respect each other	1 (0.2)	2 (0.4)	65 (12.6)	167 (32.3)	280 (54.2)	4.41 ± 0.741
Q8. Team-working skills are essential for all healthcare students to learn	4 (0.8)	19 (3.7)	97 (18.8)	205 (39.7)	192 (37.1)	4.09 ± 0.877
Q9. Shared learning will help me to understand my limitations	3 (0.6)	28 (5.4)	131 (25.3)	188 (36.4)	167 (32.3)	3.94 ± 0.919
Q10. I don't want to waste my time learning with other healthcare students	113 (21.9)	214 (41.4)	139 (26.9)	37 (7.2)	14 (2.7)	2.27 ± 0.971
Q11. Undergraduate healthcare students don't need to learn together	115 (22.2)	204 (39.5)	145 (28)	39 (7.5)	14 (2.7)	2.29 ± 0.983
Q12. Clinical problem-solving skills can only be learned with students from my department	121 (23.4)	169 (32.7)	148 (28.6)	46 (8.9)	33 (6.4)	2.42 ± 1.129
Q13. Shared learning with other healthcare students will help me to communicate better with patients and other professionals	0 (0)	21 (4.1)	106 (20.5)	187 (36.2)	203 (39.3)	4.11 ± 0.866
Q14. I would welcome the opportunity to work on small-group projects with other healthcare students	3 (0.6)	19 (3.7)	117 (22.6)	225 (43.5)	153 (29.6)	3.98 ± 0.850
Q15. Shared learning will help to clarify the nature of patient problems	0 (0)	10 (1.9)	106 (20.5)	250 (48.4)	151 (29.2)	4.05 ± 0.757
Q16. Shared learning before qualification will help me become a better team worker	0 (0)	17 (3.3)	109 (21.1)	188 (36.4)	203 (39.3)	4.12 ± 0.850
Q17. The function of nurses and therapists is mainly to provide support to doctors	41 (7.9)	43 (8.3)	113 (21.9)	209 (40.4)	111 (21.5)	3.59 ± 1.147
Q18. I'm not sure what my professional role will be	93 (18.0)	141 (27.3)	140 (27.1)	98 (19.0)	45 (8.7)	2.73 ± 1.209
Q19. I have to acquire much more knowledge and skills than other healthcare students	2 (0.4)	23 (4.4)	117 (22.6)	154 (29.8)	221 (42.7)	4.10 ± 0.926

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TABLE 3 The mean score of RIPLS domains.

Domains	Mean	Std	Range
Teamwork and collaboration	37.191	4.791	24.0
Professional identity	23.236	2.898	19.0
Roles and responsibility	10.423	2.206	11.0
Total RIPLS score	70.851	6.611	48.0

TABLE 4 Gender, university type, and knowledge of IPE association with RIPLS score ($n = 517$).

Variables	RIPLS-score							
	N	Mean	SD	SE	F	*t*	Mean square	*P*-value
Gender								
Male	236	70.47	7.29	0.474	7.188	−1.174	–	0.241*
Female	281	71.16	5.97	0.356				
Do you have previous knowledge of Interprofessional learning?								
Yes								
No	178	73.19	6.19	0.464	1.003	6.121	–	<0.001*
	338	69.57	6.46	0.351				
Age								
18–20	159	71.06	7.31	0.57				
21–24	350	70.63	6.24	0.33	2.719	–	118.05	0.067**
>25	8	76	6	2.12				
Name of university								
King Saud University	273	71.71	6.92	0.418				
Taif University	117	68.02	6.3	0.583	14.549		604.18	<0.001
King Khaled University	127	71.59	5.41	0.48				

*Independent sample *t*-test.
**ANOVA.

Learning with healthcare students before qualification would improve relationships after qualification IPE helps in for a successful professional career. The future health care is moving toward a more team-based approach so students will gain valuable clinical Interprofessional experience—working with students and providers from several disciplines to provide quality patient care and improve patient outcomes and experience and reduce workloads that cause burnout among healthcare professionals.

Our findings demonstrated that professional students, particularly those studying healthcare, benefit from collaborative learning since it improves their communication skills as well as their attitude toward other professionals. Similar results were reported by Ho JM et al., among nursing and physiotherapy students (46). Poor communication leads to errors and a negative patient experience. On the other hand, the psychological impact has a bigger impact on team-based learning collaboration (46, 47). However, the majority of students in the current survey (86.5%) felt that for small-group instruction to be successful, students needed to have mutual trust and respect. Team-based working will help students to address the emerging issues in health care, solve problems, and deliver services to population health which fosters a greater understanding of each profession's role in the care and health of patients as well as adds value and importance to each other and the patients. According to the current study, 72.5% of the students felt they needed to learn a lot more than other healthcare students did in terms of knowledge and abilities. According to other studies, medical students require a greater level of knowledge and expertise than nursing or pharmacy students (48). Overall, our data show that students' attitudes regarding IPE were favorable. Additionally, the goal of Interprofessional education was to offer a set of concepts and methods that could be evaluated, put into practice, and improved together.

Future implications and limitations

To prevent poor outcomes during graduation and to obtain more reliable health outcomes through sharing of their knowledge and practice toward healthcare, undergraduate nurses must be aware of IPE. Understanding IPE and its advantages in the provision of healthcare will help to advance rational healthcare in the future. Future research is necessary to bridge knowledge gaps and debunk misconceptions regarding Interprofessional learning among aspiring professionals. There are certain limitations to the current study. First, the findings were based on a self-administered online questionnaire, which could have increased the risk of biases such as social desirability bias or recall bias. Second, the findings were based on a specific profession focusing only on nursing in Saudi Arabia, making them non-representative of other professions at both national and international levels and therefore not internationally applicable. Despite these limitations, our research proposes that more emphasis be placed on raising individual awareness of the IPL provided by professionals to improve the health outcomes in the community.

Conclusion

In this study Students' perspectives on this IPE, experience is examined along with corresponding benefits and challenges. All participants in the study recognized the importance of Interprofessional teamwork in inpatient care and agreed that all healthcare education should include opportunities enabling them to develop the skills, behaviors, and attitudes needed for Interprofessional collaboration.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by college of medicine, King Saud University Riyadh, Saudi Arabia (Reference No. UQU-COP-EA #143706). The patients/participants provided their written informed consent to participate in this study.

Author contributions

AB designed the study, prepared the proposal, supervised data collection, analyzed and interpreted the data, and drafted and prepared the manuscript.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer WS declared a shared affiliation with the author to the handling editor at the time of review.

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Prevalence of psychosocial work factors and stress and their associations with the physical and mental health of hospital physicians: A cross-sectional study in Lithuania

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Background: A negative psychosocial work environment causes stress to the physicians of healthcare institutions, which affect their physical and mental health. This study aimed to evaluate the prevalence of psychosocial work factors and stress and their associations with the physical and mental health of hospital physicians in the Kaunas region of Lithuania.

Materials and methods: A cross-sectional study was performed. It was based on a questionnaire survey, which contained the Job Content Questionnaire (JCQ), three scales of Copenhagen Psychosocial Questionnaire (COPSOQ), and Medical Outcomes Study Short Form-36 (SF-36) health survey. The study was carried out in 2018. A total of 647 physicians completed the survey. Multivariate logistic regression models were performed by using the stepwise method. In the models potentially, confounding factors such as age and gender were controlled. In our study, the dependent variables were stress dimensions, and the independent variables were psychosocial work factors.

Results: The analysis showed that a quarter of surveyed physicians were classified as having low job skill discretion and decision-making authority, and the support of supervisors was weak. Approximately one-third of the respondents had low decision latitude, low co-worker support, and high job demands, and felt insecure at work. Job insecurity and gender were found to be the strongest independent variables for general and cognitive stress. The support of the supervisor was found as a significant factor in the case of somatic stress. Better evaluation of mental health was related to job skill discretion and co-workers' and supervisors' support, but it did not affect physical health.

Conclusion: The confirmed associations suggest that looking at work organization factors, reducing exposure to stress, and increasing perception of the psychosocial environment can be linked to better subjective health evaluation.

KEYWORDS

psychosocial risk, stress, mental health, physical health, physician

1. Introduction

According to the World Health Organization, one of the biggest current challenges is improving the health of workers and managing the psychosocial factors in the work environment of organizations (1). The European Agency for Safety and Health at Work estimates that 50–60% of all working days are lost due to stress at work and psychosocial risks (2).

According to WHO, the definition of health is a holistic approach to a worker's health. Attitudes toward work environment factors (from physical, chemical, ergonomic, and biological) have changed in recent years, and psychosocial work environment factors are increasingly being discussed (1). Psychosocial work factors include lack of time to do work, high requirements, low control at work, lack of support from co-workers and supervisors, and insecurity at work. They cause job strain, mental stress, and stress to employees, which result in physical and mental health problems. The term "physician wellbeing" refers to career opportunities, life satisfaction, a significant meaning in life, and a commitment both to direct patient care and clinical practice (3), but research on the occupational health of employees usually focuses on occupational risk factors, and more rarely on the creation of the positive working environment. For working people to be physically and mentally healthy and to feel satisfied with their work, it is important to take care not only of occupational safety and health but also of wellbeing at work. The quality of work–life is a major issue for the sustainability of career tracks among physicians (4).

Job strain is a stressful situation that occurs as a result of physical and psychological pressures that the employee feels in the process of fulfilling what is expected by the workplace. The physical expressions caused by job strain are digestive tract and sleep disorders. Health workers are considered to be at high risk. (5). The prevalence of job strain among physicians of different specialties is not widely studied. There are some scientific publications examining job strain and burnout among physicians of different specialties. For example, among French emergency physicians, the job strain was 17–32% (4), the job strain among physicians in Germany of the specialty of psychiatry was 58.5% (6), and the job strain in primary care was 30% of GPs in the United Kingdom (7). In Turkey, ∼24.5% of family physicians feel burnout (8). A study of Lithuanian anesthesiologists and intensive care specialists showed high rates of burnout, closely related to high workload and low salary (9, 10), and a study of family physicians showed a high level of bullying in the workplace (11).

Scientific publications emphasize that negative psychosocial work factors have a significant impact on the physical and mental health of workers. Working conditions in hospitals are often characterized as stressful and detrimental to health (12, 13). They cause the following physical and mental health problems: tension (14), exhaustion, anxiety (15), depression (16), suicidal thoughts (1), cardiovascular diseases (17), and longer post-discharge recovery times (17–19).

The improvement of working conditions should be systematically researched. There is still a lack of research in Lithuania on the psychosocial work environment of doctors, stress, and its impact on mental and physical health. Therefore, we focus on physicians of various sectors in six hospitals in the Kaunas region of Lithuania. This investigation aims to reveal hospital physicians' situations.

This study aimed to evaluate the prevalence of psychosocial work factors and stress and their associations with the physical and mental health of hospital physicians in the Kaunas region, Lithuania.

2. Materials and methods

2.1. Study design and participants

This cross-sectional study was carried out from September to December 2018 in six hospitals in the Kaunas region of Lithuania. Participation in the research of physicians was voluntary and anonymous. The study population (N = 2,353) included all physicians working in hospitals. The sample size calculation was based on the frequency with a 5% probability of error and 95% reliability, and 0.5 relative frequency (20), and this resulted in 330 participants needed to complete the study. A total of 830 questionnaires were distributed among physicians, and the final sample size was 647 respondents, (response rate −81.3%). In our study, purposive sampling was used. The six largest hospitals in the Kaunas region were selected. In these hospitals, questionnaires were distributed to every third department. A pilot study was conducted. A total of 109 respondents filled out the questionnaire correctly. Correctly completed questionnaires were included in the database of the main study. The dispersion of responses obtained after the pilot study met the statistical criteria.

All study variables were assessed *via* standardized questionnaires. The study protocol was approved by the Kaunas Regional Ethics Committee for Biomedical Research (Protocol No. BE-2-41).

2.2. Questionnaires

2.2.1. Assessment of sociodemographic characteristics

A four-part questionnaire was used in this study. The first part of the questionnaire revealed the sociodemographic characteristics of the respondents (gender, age, length of employment, workload, specialties, and night work).

2.2.2. Assessment of psychosocial factors

Information about work environment characteristics was obtained from the second part of the questionnaire: The Job Content Questionnaire (JCQ) (21). This instrument had been designed in 1979 by R. Karasek to measure work environment characteristics, is a well-established and widely used self-report instrument based on the demand-control-support model. The JCQ comprises five scales: job demand (five items), job control (nine items—the sum of two subscales: skill discretion measured by six items and decision authority measured by three items), supervisor support (four items), co-worker support (four items), and job insecurity (three items). Items are scored using a Likert scale in which 1 indicates that the respondent strongly disagrees and 4 indicates that he or she strongly agrees, except for the job insecurity scale's questions with different possible answers that are rated on a five-point scale. Work environment characteristics based on the demand-control-support model and its associations with burnout we presented in our previous publication (22), and this study is focused on associations between psychosocial work factors, stress, and physical and mental health among physicians.

2.2.3. Assessment of health outcomes

The third part of the questionnaire was a standardized Medical Outcomes Study Short Form-36 health survey (23, 24). It is a 36-item general health questionnaire designed to provide physical and mental health summary scores based on eight subscales: physical functioning, role functioning, bodily pain, general health assessment, vitality, social functioning, activity restriction on emotional disorders, and emotional state. In these questions, we sought to assess physicians' subjective health status over the past 4 weeks. In this study, we used only derived values—physical (PSC) and mental (MSC) health. PSC health consists of four subscales (physical functioning, role functioning, bodily pain, and general health assessment) summary scores. MSC health consists of four subscales (vitality, social functioning, activity restriction on emotional disorders, and emotional state) summary scores. According to the methodology of the questionnaire, the variants of the answers were transferred to the scoring system from 0 to 100. A higher score indicates a better quality of life. The evaluation of each scale corresponded to the calculated average of the scores on the score scale. It is divided according to the limits of terciles—high (100–66.7 points), medium (66.7–33.3 points), or low (33.3–0 points) levels of the observed phenomenon.

2.2.4. Assessment of stress in the work environment

The Copenhagen Psychosocial Questionnaire (COPSOQ) was used to assess physicians' perceived stress in the work environment. The COPSOQ was developed in Denmark in 2000 as a screening instrument for recording psychological stress and stress at work and revised in 2005. In this study, we used three scales of stress expression: general stress (eight questions), somatic stress (seven questions), and cognitive stress (four questions) (25). We replaced the answers to the questions with numbers from 0 to 100. The evaluation of each scale corresponded to the calculated average of the scale scores. These estimates were then divided into three parts according to the limits of the terciles—high (100–66.7 points), medium (66.7–33.3 points), or low (33.3–0 points) levels of the observed phenomenon.

2.3. Statistical analysis

All the statistical analyses were performed using the IBM SPSS 25.0 software package (IBM Inc., Armonk, New York, NY, USA). Descriptive data were expressed as a percentage, mean, median, standard deviation (SD), 95% confidence intervals (CIs), and min/max.

To find out associations between psychosocial work environment factors (such as job demand, job control, co-worker and supervisor support, and job insecurity) and stress dimensions, a multivariate logistic regression model using the stepwise method was applied. In the models, potentially confounding factors such as age and gender were controlled. Controlling the dependent variables were stress dimensions and the independent variables were job demand, job control, supervisor support, co-worker support, and job insecurity.

Finally, to determine the association between psychosocial work factors, stress, and physical and mental health, three models of the multiple stepwise regression analyses were performed for each self-rated health subscale (physical and mental). The bad health of each binary outcome variable (PSC and MSC) was chosen as a reference group in the model of logistic regression. Potentially confounding factors such as age and gender were controlled. In all three models, physical and mental health were dependent variables and the independent variables were in model I—psychosocial work environment factors, in model II—stress subscales, and in model III—both psychosocial factors and stress dimensions, respectively.

The results are presented as regression coefficients (B), odds ratios (ORs), 95% confidence intervals (CIs), and *P*-value. The accuracy and feasibility of multivariate logistic regression models were evaluated using the classification table and the Nagelkerke R^2 test (R^2_N).

A significance level of 0.05 was selected. Differences and relationships were considered to be significant if $p < 0.05$.

TABLE 1 The main sociodemographic and occupation-related characteristics of the study population.

Characteristic	*N* (%)
Gender	
Men	222 (34.3)
Woman	425 (65.7)
Age group (years)	
<=40	373 (57.7)
41–50	104 (16.1)
>50	170 (26.2)
Length of employment (year)	
<=10	343 (53.0)
11–30	212 (32.8)
>30	92 (14.2)
Workload	
<=1	171 (26.4)
>1	476 (73.6)
Specialties	
Surgical	163 (25.2)
Therapeutic	340 (52.6)
Other (not specified)	144 (22.2)
Night work	
Yes	455 (70.3)
No	192 (29.7)

3. Results

The main sociodemographic and occupation-related characteristics of participants are shown in Table 1. The biggest part (65.7%) of the study participants was female. The mean age of the study sample was 39.7 (SD = 13.58) years and (57.7%) ranged in age from 24 years to 40 years. Participants had been working at their current job for an average of 14 years (SD = 13.19). Approximately one-third (35.5%) of respondents were attributed to the work experience group for 4 years. The main proportion (51.3%) consisted of respondents living in partnership (married), more than a third (37.1%) were single, and others were divorced and widowed.

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TABLE 2 Descriptive statistics of psychosocial work environment and perceived health characteristics.

Characteristic	Mean (SD)	n (%)	Median	Min–max
Job skill discretion	36.18 (5.13)		36.00	20–48
Low		*149 (23.0)*		
Moderate		*212(32.8)*		
High		*286 (44.2)*		
Job decision-making authority	34.75 (6.54)		36.00	12–48
Low		*144 (22,2)*		
Moderate		*115 (17.8)*		
High		*388 (60.0)*		
Job demand	33.00 (4.80)		33.00	18–48
Low		*113 (17.5)*		
Moderate		*300 (46.4)*		
High		*234 (36.1)*		
Job decision latitude	70.00 (10.30)		68.00	32–96
Low		*187 (28.9)*		
Moderate		*202 (31.2)*		
High		*258 (39.9)*		
Co-worker support	12.00 (1.62)		12.00	4–17
Low		*187 (28.9)*		
Moderate		*306 (47.3)*		
High		*154 (23.8)*		
Supervisor support	11.53 (2.37)		12.00	4–18
Low		*168 (26.0)*		
Moderate		*54 (8.3)*		
High		*425 (65.7)*		
Job insecurity	5.38 (1.63)		5.00	3–12
Low		*195 (30.1)*		
Moderate		*217(33.5)*		
High		*235 (36.4)*		
General stress	34.37 (21.19)		34.37	0–96.9
Low		*318 (49.1)*		
High		*329 (50.9)*		
Cognitive stress	20.57 (15.25)		25.00	0–87.5
Low		*356 (55.0)*		
High		*291 (45.0)*		
Somatic stress	27.22 (19.33)		17.85	0–75.0
Low		*299 (46.2)*		
High		*348 (53.8)*		
Physical health	63.44 (10.39)		63.75	26.53–92.5
Good		*432 (66.8)*		
Poor		*215 (33.2)*		
Mental health	55.87 (10.32)		55.75	13.78–82.5
Good		*434 (67.1)*		
Poor		*213 (32.9)*		

TABLE 3 Relationships between psychosocial work factors and stress expressions (multivariate comparison).

		B	OR	95% CI	p
General stress*	Job decision-making authority	−0.044	0.957	0.932–0.982	<0.001
	Job demand	0.054	1.051	1.017–1.096	0.004
	Supervisor support	−0.158	0.85	0.791–0.922	<0.001
	Job insecurity	0.233	3.095	1.851-5.175	<0.001
	Gender	0.615	1.849	1.300-2.630	<0.001
	*Classification table 66.1%; Nagelkerke $R^2 = 0.17$				
Cognitive stress*	Job skill discretion	−0.035	0.96	0.935–0.998	0.03
	Job demand	0.054	1.056	1.018–1.095	<0.001
	Job insecurity	0.176	1.192	1.069–1.330	<0.001
	Gender	0.672	1.959	1.395-2.750	<0.001
	*Classification table 68.0%; Nagelkerke $R^2 = 0.20$				
Somatic stress*	Job decision-making authority	−0.103	0.902	0.845–0.964	0.002
	Job demand	0.084	1.087	1.046–1.131	<0.001
	Job decision latitude	0.043	1.043	1.000–1.088	0.048
	Supervisor support	−0.243	0.784	0.721–0.853	<0.001
	Job insecurity	0.155	1.167	1.040–1.310	0.008
	*Classification table 61.1%; Nagelkerke $R^2 = 0.09$				

*Logistic regression model accuracy and feasibility.

Slightly more than half of the respondents were therapeutic profile specialists, 25.2% were surgical, and 22% attributed to other specialties.

Descriptive statistics of all study variables are presented in Table 2. The analysis showed that the psychosocial work environment was quite negative in investigated physicians population—approximately a quarter of them were classified as having low job skill discretion and decision-making authority as well as the support of the supervisor was weak. Approximately one-third of respondents had low decision latitude, low co-worker support, high job demands, and felt insecure at work. The analysis of stress evaluation showed that the highest mean of scale scores was in the case of general stress, and the frequencies of low- and high-stress levels (cut point—median) showed that approximately half of the respondents were classified as perceived high-stress levels in all three stress evaluation scales. The scores of PSC and MSC health were categorized into two groups: high/intermediate (good/intermediate health) and low (poor health). A majority of respondents were classified as good and intermediate health in both dimensions of PSC and MSC health-−66.8 and 67.1%, respectively. Further analysis showed that the frequency of poor PSC was significantly higher in women compared with men (36.2% in women vs. 27.5% in men, $p < 0.05$).

At first, the association between psychosocial work environment factors and stress dimensions was assessed. As shown in Table 3, job decision-making authority and supervisor support significantly reduced general stress probability while job demand and job insecurity increased, the strongest variables for general stress were the controlled variables such as gender (women were more prone to have general stress) ($B = 0.615$) and job insecurity ($B = 0.23$). Job skill discretion, job demand, job insecurity, and gender were found as significant variables for cognitive stress in the studied population. As in the case of general stress and cognitive stress, the significant factors were gender and job insecurity (B, respectively, was 0.672 and 0.176). The support of the supervisor was found as the strongest factor in the case of somatic stress, and it was observed as a stress-buffering effect of this variable ($B = -0.243$). In addition, other factors such as job decision-making authority, job demand, job decision latitude, and job insecurity were significant variables of somatic stress. Gender was not significant for somatic stress, as seen in the model.

Second, three models of the multiple stepwise regression analyses were performed for each self-rated health subscale (PSC and MSC) (Table 4). Model I revealed that only job decision latitude was significantly associated with PSC—each one-unit increase of this variable reduced the probability of bad PSC by an average of 2.8%. Meanwhile, the model I for MSC shows that three psychosocial factors such as job skill discretion, co-worker support, and supervisor support were found to have a buffering effect and reduced bad MSC odds by an average of 3.5, 14.9, and 11.4%, respectively. In model II, somatic stress and general stress increased bad PSC probability by an average of 2.5 and 1%, respectively. The general stress was found as a significant factor for MSC and increased bad MSC probability by an average of 3.1%. The somatic stress was the strongest independent variable for PSC in the final model III, even though the beta coefficient was very low ($B = 0.023$)—somatic stress increased bad PSC probability by an average of 2.3%, and all other factors, which were found significant in the previous models remained significant as well as job decision latitude reduced the probability of bad PSC by an average of 2.3%, but general stress increased bad PSC by an average of 1.1%. The strongest variable for MSC was co-workers' support ($B = -0.153$), it reduced bad mental health probability by an average of 14.2%. Furthermore, job skill discretion and general stress remained significant in the final model. Job skill discretion was found as the

TABLE 4 Association between psychosocial work factors, stress, and physical and mental health (multiple stepwise regression analyses).

			B	OR	95% CI	*P*
PSC*	Model I	Age	0.017	1.017	1.005–1.030	0.007
		Gender	0.431	1.540	1.074–2.207	0.019
		Job decision latitude	−0.029	0.972	0.955–0.988	0.001
	***Classification table 66.8%; Nagelkerke R^2 = 0.04*					
	Model II	Somatic stress	0.025	1.025	1.013–1.037	<0.001
		General stress	0.010	1.010	1.001–1.019	0.026
	***Classification table 67.1%; Nagelkerke R^2 = 0.07*					
	Model III	Age	0.015	1.015	1.002–1.028	0.022
		Job decision latitude	−0.027	0.974	0.957–0.991	0.003
		Somatic stress	0.023	1.023	1.011–1.036	<0.001
		General stress	0.011	1.011	1.002–1.020	0.016
	***Classification table 67.7%; Nagelkerke R^2 = 0.1*					
MSC*	Model I	Age	−0.13	0.987	0.974–1.000	0.042
		Job skill discretion	−0.036	0.965	0.933–0.998	0.037
		Co-worker support	−0.161	0.851	0.754–0.961	0.009
		Supervisor support	−0.121	0.886	0.819–0.959	0.003
	***Classification table 66.8%; Nagelkerke R^2 = 0.08*					
	Model II	General stress	0.030	1.031	1.022–1.039	<0.001
	***Classification table 68.3%; Nagelkerke R^2 = 0.1*					
	Model III	Co-worker support	−0.153	0.858	0.767–0.961	0.008
		Job skill discretion	−0.051	0.950	0.917–0.985	0.005
		General stress	0.029	1.029	1.021–1.038	<0.001
	***Classification table 70.5%; Nagelkerke R^2 = 0.15*					

*A reference group bad health.

**Logistic regression model accuracy and feasibility.

factor, which reduced the probability of bad mental health by an average of 5%, and contrary to this, general stress was found as a bad MSC increasing factor (OR = 1.029 95% CI = 1.021–1.038).

4. Discussion

Physician burnout is an under-recognized and under-reported problem. In the scientific literature, the health of nurses is analyzed more often, and the links between the psychosocial work environment of physicians and physical and mental health are analyzed less often. The literature shows that patient care workers had significantly higher demands in comparison with other hospital staff. At the same time, a comparison of physicians and nurses shows different work environment elements and different stress levels. The differences are caused by the unequal level of responsibility for the patient's health, the role in patient treatment, the variety of work tasks, and patients with multiple pathologies. Stress is a constant element in the daily life of physicians. So, we used an instrument, which is measuring a wide range of psychosocial work environment aspects and also distinguished three types of stress. The main research question was to explore the prevalence of psychosocial risk factors at work and their relationship with stress levels. Second, we wanted to understand whether stress reactions are related to self-rated physical and mental health among hospital physicians. Our results suggest that measured psychosocial work environment factors are associated with hospital physicians perceived work-related psychosocial stress and strain. According to our results, we can see that several essential factors determine stress reactions. One of them is a personal factor—the female gender. In our study, women experience more stress than men. In the scientific literature, we can find contradictory opinions, which can be caused by a number of cultural factors. In the studies, Sharma et al. (26) and Faraji et al. (27) reported that men were likely to suffer from occupational stress could be due to the fact that men likely to assume more social or family responsibilities in traditional Asian cultures, and the managers of hospitals tend to assign more work to male medical workers. The principles of gender equality prevail in our country, and the differences could be caused by additional women's duties at home (28, 29) and the higher sensitivity of women to the factors of the work environment. A study by Jagsi et al. demonstrated that women were also more likely to experience gender bias and sexual harassment in their careers (28, 30). It may be an additional factor leading to higher stress levels in women.

However, we were trying to find the answer to the question: Which factor is most associated with overall stress and/or overall dissatisfaction with the work environment? According to our

evaluation, job insecurity is one of the essential factors in the work environment determining the development of stress. This supports the hypothesis that an increased workload and negative factors in the psychosocial environment can lead to more job-related stress and strain, which may manifest in changes in the physical and mental health of doctors (17, 19, 29).

However, it is still difficult to answer the main question: Which factor is fundamental in terms of overall stress and dissatisfaction in the psychosocial work environment? At the same time, we can see that factors work in the opposite direction. These are elements of the work environment that have a positive effect and reduce the likelihood of stress. In our study, there are two factors: supervisor support and job decision-making authority. We can state that the combination of favorable and unfavorable psychosocial factors for health is different for each individual. However, by summarizing them, it is possible to refine the organization's problems and management features and finds optimal solutions for improving the working environment.

The set of positive and negative stressors is different in each research study or healthcare facility evaluated (3, 4, 17, 18). However, it is necessary to identify, as it creates the conditions for successful interventions in the work environment for better occupational health of the staff. An unfavorable psychosocial climate leads to a number of other problems, which, at the same time, reduce the prestige of the institution and the quality of work (31, 32). A favorable psychosocial environment leads to better feedback from employees and patient satisfaction with the institution's health care services.

We found some differences in evaluating stress, psychosocial work environment, and physical and mental health dimensions. Age has a positive effect on subjective mental health but negative associations with physical health. The factor related to better subjective health evaluation (both physical and mental) was job decision latitude. Better evaluation of mental health was related to job skill discretion and co-workers' and supervisors' support, but it had no effect on physical health. General stress had a negative effect on subjective health in even four evaluation models. This is in line with data from other studies performed in educated, industrialized, rich, and democratic societies (23, 33), but the same findings present studies performed in developing countries (31).

In summary, we found that the psychosocial working environment was associated with subjective health. Looking at work organization factors, reducing exposure to stress, and increasing perception of the psychosocial environment can lead to better subjective health evaluation. However, our results can reveal the main factors in the development of stress in a specific physician work environment. The administration of healthcare facilities can create intervention systems in workplaces. This would be a tailored solid basis for the development of workplace interventions built on strengths in the psychosocial environment and overcoming negative stressors at work.

Our study is contributing to the literature on physician psychosocial work environment and stress. However, there are some limitations. First, it is regression results from a cross-sectional study and does not suggest causal relationships. It would be preferable to conduct a follow-up study to reveal the causal relationship between the psychosocial work environment, stress, and self-rated health. Second, the health of workers was assessed using the SF-36 subjective health questionnaire. However, this questionnaire is widely used and well-regarded by many researchers (24, 33, 34). Third, the representativeness of the study sample needs to be improved. This study cannot be applied to the whole of Lithuania because our study area is limited to Kaunas county. In the future, we plan to expand the scope of research by conducting a representative assessment of the country. The fourth limitation is related to the personal life of investigated persons. It was not possible to rule out the impact of other stressogenic factors on the respondents due to their lifestyle in the home environment and personal life. As we found in our study, the coefficients of determination in the presented models were quite small.

5. Conclusion

For Lithuanian physicians, general and somatic stress were negatively related to job decision-making authorities and supervisor support and cognitive stress to job skill discretion. The general and somatic stress were directly related to job demand, job insecurity, and female gender for general stress and job decision latitude for somatic stress. The aging, female gender, and general and somatic stresses increased the probability of PSC and the age (being younger), lowering job skill discretion, co-workers and supervisors support, and rising general stress increased MSC. By assessing the psychosocial factors of the work environment of physicians, they can be adjusted, which in the future can lead to a better health status for doctors and indirectly lead to a higher quality of health services for patients.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

RZ was responsible for methodology preparation, conduction of investigation, data analysis and validation, original draft preparation and supervision, and literature analysis. GK was responsible for methodology preparation, data analysis and validation, and original draft preparation and supervision. RU was responsible for the conceptualization of the manuscript, data analysis and validation, and reviewing and editing of the manuscript. RR was responsible for the conceptualization of the manuscript, data analysis and validation, reviewing and editing of the manuscript, and administration. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Frequency of needle stick injuries among healthcare providers during large-scale SARS-CoV-2 vaccination brigades

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The frequency of needle stick-related accidents in large-scale vaccination brigades during the COVID-19 pandemic is unknown. We determined the incidence of needle stick injuries (NIs) from the SARS-CoV-2 vaccination brigades in the Monterrey metropolitan area. We calculated the rate of NI by 100,000 doses administered from a registry of over 4 million doses.

KEYWORDS

needle stick and sharp injuries, COVID-19, vaccination, brigade, healthcare provider

Introduction

According to the World Health Organization, more than two million occupational exposures to sharp injuries occur among 35 million healthcare providers (HPs) annually (1, 2). Needle stick injuries among nurses were associated with three factors: nurses' sense of urgency, variable shift work, and lower skill level related to the years of experience, academic degree, and younger age (3).

The increased volume of vaccination campaigns during a pandemic scenario resulted in a considerable increase in needle stick injuries during mass vaccination programs compared to routine vaccination during the 2009 influenza A (H1N1) pandemic. Contributing factors such as a higher rate of vaccinations administered by HP, non-hospital settings, and a lack of formal training were considered (4).

The incidence of these needle stick-related accidents in large-scale vaccination brigades during the COVID-19 pandemic is unknown.

We sought to determine the incidence of needle stick injuries (NIs) in the SARS-CoV-2 vaccination brigades in the Monterrey metropolitan area. For this purpose, a cross-sectional analysis was carried out on a cohort of HP where every occupational exposure by puncture and/or splash exposure (SE) are recorded by all HP who participated in vaccination brigades. Variables were expressed as means and percentages, Wilcoxon rank test and chi-square test were employed. We used SPSS version 20.0 for analyses.

During this study period, 872 brigades encompassed 49,879 HPs with a total of 4,144,052 vaccine doses applied. Of these, 91 NI were reported, and 3 SEs from a total of 19,950 HPs actively participated in applying the vaccines with a constant shift rotation. We calculated the rate by 100,000 doses administered and classified the accidents by the age of the HP, the department where the HP was assigned, and the stage of the vaccination process in which the accident occurred. HPs, who did not apply vaccines, were not considered for analysis.

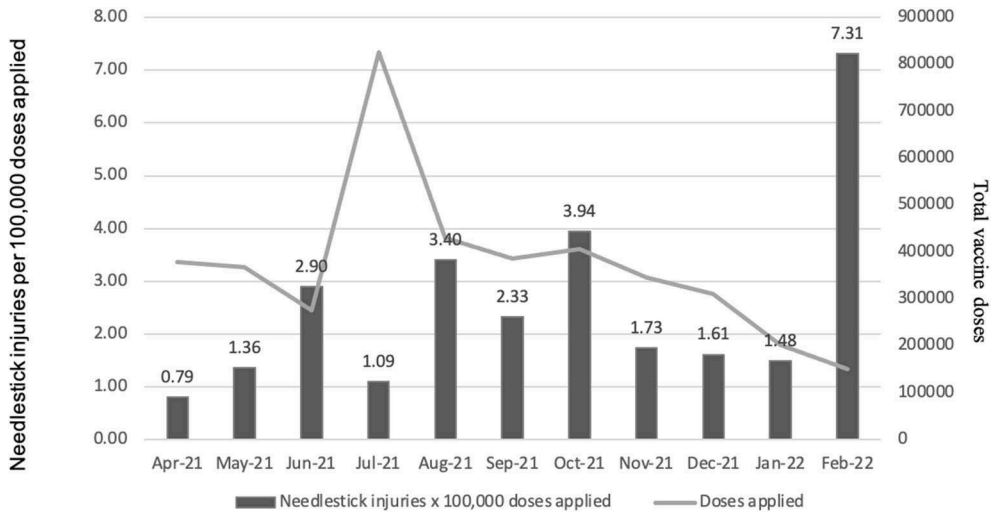

FIGURE 1
Rate of needle stick injuries × 100,000 doses among healthcare providers.

Only 6 NIs (6.3%) occurred in healthcare workers compared to 88 accidents (93.6%) that occurred in medical personnel in training ($p = 0.0001$). The age range of affected HP was between 19 and 21 years (42.5%), of which 59 cases (57.44%) were nursing students. Most of the accidents (27.5%) occurred during the puncture process. All NIs/SEs were notified and referred to the epidemiology department for evaluation and follow-up. Every HP was scheduled for sequential clinical and serologic follow-up during the initial 6-month period after the accident. However, the average follow-up was 80.6 days (0–272 days). All personnel who suffered an NSI/SE have sequential serologic tests and no seroconversion was detected.

The average rate of accidents was 2.79 per 100,000 doses (range 0.79–7.31), 2.54 NI per 100,000 doses (range 0.79–7.31) (Figure 1), 4.184 SE per 100,000 doses (range 2.59–5.78), and 1.24 per 100,000 doses (range 0.26–7.31) in medical personnel in training. There was a low correlation between the monthly number of doses applied and the number of accidents (*Kappa* 0.58). Continuous medical personnel training is a key element in preventing occupational accidents (5, 6). Factors such as a lack of formal training and the large volume of people who require a vaccine on a large scale seemed to be important factors for these accidents.

The massive SARS-CoV-2 vaccination campaigns have mitigated the burden of the pandemic; however, along with vaccination, the risk for healthcare personnel followed. Large-scale vaccination required the support of young medical and nursing personnel in training (7). our data suggest that this could be related to increased occupational accidents.

Furthermore, issues, such as healthcare coverage and legal responsibility for HP and employers during these brigades, are not clear-cut.

Since vaccination seems to be the strongest public health measure for reducing the morbidity and mortality of SARS-CoV-2 infection, there will continue to be a need to vaccinate most of the population. Large-scale brigades will continue in many regions for an indefinite period, with a high demand placed on HP to deliver these vaccinations (8).

Although in the United States, the Needle stick Safety and Prevention Act requires OSHA to emphasize the use of engineering controls, specifically, devices with sharp injury prevention features for a higher degree of protection,[1] these devices are rarely available in other countries where legislation and work safety is not a primary concern. Injuries from hypodermic needles used for SARS-CoV-2 vaccines are already the most prevalent type associated with NI. This fact, coupled with a high patient output, extended working hours, and stress, can further increase NI risk. On-the-field workplace safety, adequate health training, and raising awareness in HPs on preventing NI are fundamental.

Stress burden during the COVID-19 crisis has impacted NSI, which was demonstrated in a study conducted by Stojic et al. (9) where the burden placed on the health system by the pandemic resulted in a higher incidence of NI despite a lower total number of patients treated at the hospital dedicated to COVID-19 in addition to unprepared medical professionals who had to participate which may also have contributed to the higher rate of NI. We acknowledge that we could not calculate individual rates for each HP by doses applied and the vaccine brand associated with these accidents since that information was not clear. In the current study, most of the accidents occurred in medical personnel in training highlighting a lack of experience. We believe that the data expressed here will aid in the implementation of preventive measures, especially for medical personnel in training.

1 https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1030#1910.1030(d)(2)(i) (accessed August 20, 2022).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Comité de Ética del Hospital Universitario Dr. José Eleuterio González. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

JM-G gathered the information and prepared the draft. MP-O reviewed the manuscript, final version of the manuscript, and gathered information. AG-L and HO-B provided valuable information from the front line. AC-O contributed with the original idea, revised draft, and final version of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Association between lifestyle behaviors and health-related quality of life among primary health care physicians in China: A cross-sectional study

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Background: Primary health care (PHC) serves as the gatekeeper of health system and PHC physicians take on significant obligations to provide health care services in the pursuit of Universal Health Coverage (UHC). PHC physicians' health-related quality of life (HRQoL) can have a strong impact on patients, physicians and the health care system. Lifestyle interventions are found to be effective to improve HRQoL. The purpose of this study was to evaluate the association between lifestyle behaviors and HRQoL among PHC physicians, so that lifestyle intervention can be tailored by policy makers for health promotion.

Methods: A survey covering 31 provinces and administrative regions in China was conducted in 2020 using a stratified sampling strategy. Data on sociodemographic characteristics lifestyle behaviors and HRQoL were collected by a self-administered questionnaire. HRQoL was measured through EuroQol-five dimension-five level (EQ-5D-5L) instrument. A Tobit regression model was performed to evaluate the association between sociodemographic characteristics, lifestyle behaviors and HRQoL.

Results: Among 894 PHC physicians who completed the survey, Anxiety/Depression (AD) was the dimension with the most problems reported (18.1%). Regular daily routine ($\beta = 0.025$, 95%CI 0.004 to 0.045) and good sleep quality ($\beta = 0.049$, 95% CI = 0.029 to 0.069) were protective factors for HRQoL, while smoking ($\beta = -0.027$, 95% CI = −0.079 to −0.003) and frequency of eating breakfast ($\beta = -0.041$, 95%CI = −0.079 to −0.003) were negatively associated with HRQoL. Physical activity and alcohol drinking were not significantly associated with HRQoL.

Conclusion: These findings suggest that tailored interventions on daily routine, improving sleep quality, and tobacco control among PHC physicians may be effective strategies to improve their HRQoL.

KEYWORDS

health-related quality of life (HRQoL), lifestyle, primary health care, physician, China

1. Introduction

Primary health care (PHC) is defined as a whole-of-society approach to effectively organizing and strengthening national health systems to bring services for health and well-being closer to communities, from health promotion to disease prevention, treatment, rehabilitation, palliative care and more (1). PHC serves as the gatekeeper of health system (2)

and provides the foundation for the strengthening of the essential public health functions to confront public health crises such as COVID-19. Physicians, the backbone of the primary health care workforce (3), play a vital role in coordinating a person's care needs, from prevention to disease management to curative care (4). With the goal of Universal Health Coverage (UHC) and strengthening PHC system (5), primary health care physicians are expected to take on a heavier burden to provide health care services, particularly in times of crisis such as the COVID-19 pandemic. A number of studies have demonstrated a high prevalence of physical and mental illness, job burnout (6, 7), sleep disturbance (8) and even suicide (9) among physicians, concerning unsatisfactory health-related quality of life (HRQoL).

HRQoL is a multidimensional concept representing both positive and negative aspects of physical and psychological health, social functioning, and overall well-being (10). Poor HRQoL of physicians could have a negative impact on work performance and patient outcomes in addition to their individual health (11, 12). As a result, addressing HRQoL of physicians benefits patients, physicians and the health care system. In China, the total number of PHC physicians was 1.246 million and PHC institutions provided 50.2% of outpatient care (4.3 billion visits) and 14.5% of inpatient care (35.9 million hospital admissions) in 2021 (13). Given the great amount of health care service provided by PHC physicians, it is an urgent public health issue that HRQoL of PHC physicians should be improved in the light of enhancing PHC services and physicians' performance.

It is evidently identified that lifestyle behaviors affect people's health, HRQoL and life expectancy (14–17). Moreover, lifestyle interventions were found to be effective to improve HRQoL (18, 19) as well as the implementation of lifestyle interventions in the workplace has been proven to be cost-effective for both employers and society (20, 21). The occupational category should be considered when designing workplace health promotion programs in the belief that the occupational category produces significant differences in lifestyle behaviors (22–24). In addition, the association between lifestyle behaviors and HRQoL varies between occupations. For instance, smoking was not found to be associated with HRQoL among government employees (25) while current smoker had lower HRQoL in professional drivers (26). The result of a study suggested that breakfast, exercise, smoking and drinking should be given priority to health promotion at work for doctors (23). But it is unknown whether these lifestyle behaviors are risky or not for HRQoL of PHC physicians. Physicians are considered as a group with a higher level of health literacy (27), and their better perceived capacities in finding, understanding and applying health information could directly lead to better physical health and subjective well-being (28). For example, healthcare professionals are more likely to attend medical programs due to their work environment. A research found that smoking and alcohol consumption were not related to quality of life as anticipated among residents participating in the medical checkups (29). Considering the above, the influence of lifestyle behaviors on HRQoL of physicians may not be the same as that in the general population or other occupations. Moreover, despite knowledge of the significance of healthy lifestyle behaviors, healthcare workers do not adopt healthy lifestyle behaviors for various reasons (30–33), such as a false feeling of "protection" due to their medical knowledge, excessive workload, lack of time or motivation, and the tendency to prioritize their patients' health over their own. Knowledge of the relationship between lifestyle behaviors and HRQoL among physicians would help tailor more effective health-promoting interventions.

Prior work has documented the relationship between lifestyle behaviors and HRQoL in different population. However, these studies have primarily focused on patients with different diseases (14, 18, 34–36) and general populations including adolescents, adults and the elderly from different countries or regions (17, 20, 21). In research to date, few studies have examined such relationships in healthcare professional groups (37), especially little is known about that in primary health care physicians. A study investigated the relationship between lifestyle factors (smoking, BMI, cooking oil, meals out per week, total fruit and vegetable intake per day, physical activity level, and hours of TV, laptop, or internet use per day) and quality of life among 72 PHC physicians in Saudi Arabia (38) with limitation of small sample size. However, other important lifestyle behaviors' influence [e.g., alcohol consumption, sleep quality (16, 39–41)] on HRQoL of PHC physicians has not been properly studied yet. Combined consideration of both occupational characteristics of healthcare professionals (23, 30, 42) [e.g. atypical work schedules (43), heavy workload and stress (44)] and lifestyle behaviors which have been identified as potential factors affecting HRQoL in the Chinese population (39, 45–47), lifestyle behaviors including daily routine, breakfast, sleep quality, smoking, drinking and physical activity should be taken into account. The absence of relative research on the relationship between such lifestyle behaviors and HRQoL among PHC physicians, however, is an impediment to health policy consideration for improving their HRQoL.

The aim of this study was to evaluate the association between lifestyle behaviors and HRQoL among Chinese primary health care physicians. Such important information could be informative for local health care policy makers and researchers to consider at which levels effective lifestyle interventions should be implemented to improve the HRQoL of primary health care physicians.

2. Methods

2.1. Setting and study design

This cross-sectional study covering 31 provinces and administrative regions in China in 2020 was designed to investigate the associations between some lifestyle behaviors and HRQoL. PHC physicians were recruited and data were collected by a self-administered questionnaire. The inclusion criteria of respondents were: 18 years or older, able to fill in the questionnaire independently and employed in primary health care sectors as physicians in China. A stratified sampling strategy was adopted, and the detailed steps were as follows: (1) The sample of the study included 31 provinces and administrative regions in China. The cities or districts of each region were categorized into three groups (high, medium, and low) according to GDP per capita in 2018, forming a total of 93 groups. (2) At least two local PHC institutions including community health centers, township health centers, and community health stations were selected respectively

for convenience sampling in each group, forming a total of 558 samples of PHC institution. (3) In each PHC institution, at least two physicians selected by convenience sampling were willing to participate in and complete the investigation.

2.2. Instruments

2.2.1. Sociodemographic information

Sociodemographic information was collected including age, sex, height, weight, marital status, number of children, caregiving status, annual household income, educational level, job title, type of residence and chronic diseases. The sociodemographic characteristics mentioned above were included in the study as covariate. Age was divided into three groups: young adults (age 18–44 years), middle-aged adults (age 45–59 years), and older adults (age over 60 years) (48). Body mass index (BMI) was computed from self-reported weight and height and was divided into three groups: BMI $<$ 18.5, 18.5 $\leq$ BMI $\leq$ 24.9, BMI $\geq$ 25 (49). Annual household income was categorized into three levels (RMB): $<$ ¥80,000, ¥80,000 $\sim$ ¥1,50,000 and $>$ ¥1,50,000.

2.2.2. Lifestyle behaviors profile

The following health-related lifestyle behaviors were included in the study as independent variables: daily routine, sleep quality, breakfast, smoking, drinking and physical activity. The item "daily routine" was referred to as the established patterns of waking, eating, sleeping, and organizing one's time daily (50), which was evaluated into two statuses: irregular and regular. Sleep quality was answered by "not good" and "good" subjectively. Frequency of eating breakfast weekly means how many times individuals had breakfast in 1 week in the last 6 months, which was divided into two groups: <4 times and at least 4 times. Both smoking and drinking status were categorized by yes or no. Smoking was defined as at least one cigarette per day in the last 6 months and drinking was defined as at least once a week in the last 6 months. Physical activity was classified as to whether the respondent practice any sports, exercise or other physical activity for at least 30 min during a usual week.

2.2.3. Measurement of HRQoL

HRQoL was measured by the Chinese version of the EuroQol-five dimension-five level (EQ-5D-5L), consisting of a descriptive system and EQ- 5D visual analog scale (EQ-VAS) (51). EQ-5D-5L is one of the major self-reported instruments to evaluate HRQoL due to its simplicity, low respondent burden and high universal acceptance (52). It includes five dimensions: Mobility (MO), Self-Care (SC), Usual Activities (UA), Pain/Discomfort (PD), and Anxiety/Depression (AD). Each dimension has five levels. The responses for the five dimensions can be combined in a 5-digit number describing the respondent's health state (from 11111 meaning no problems at all to 55555 meaning extreme problems in all five dimensions). Then the responses obtained were converted to the EQ-5D utility index based on Chinese value sets (53) to represent HRQoL.

2.2.4. Questionnaire validation

The validity, rationality, comprehensibility, and readability of the questionnaire had been verified by experts and the results of a pilot survey in community health centers in Nanjing, Jiangsu province, China. Based on the feedback from the pilot survey, the research team revised the questionnaire and formulate the final version.

2.3. Data collection

A total of 500 undergraduate students majoring in clinical pharmacy or pharmacy were recruited as investigators. In order to ensure the survey quality, each investigator was strictly trained before the investigation, including understanding the principles and methods of survey design, and standardizing the definition. In the process of collecting data, investigators provided the participants with an electronic device—Interview Master, a survey app in WeChat, and gave them instructions about how to complete the questionnaire on the app. Then the responses were automatically converted into electronic data for analysis software. A total of 5 master students were recruited and trained as auditors. If auditors found obvious errors in the data, the data would be returned to the data collectors and then they would verify it with the respondents.

2.4. Data analysis

Data were analyzed by STATA 17 for Windows and IBM SPSS Statistics 26 for Windows. Means and standard deviations (SD) were used to describe continuous variable data as well as frequencies and percentages are used to describe categorical variable data. Differences in HRQoL based on categories of sociodemographic characteristics and lifestyle behaviors were explored using Mann–Whitney U (two groups) and Kruskal–Wallis one-way analysis of variance (multiple groups) due to the abnormal distribution of the EQ-5D utility index. The EQ-5D utility index was skewed and it was censored at 1 (54), so a Tobit regression model was chosen to explore the potential effects of sociodemographic characteristics and lifestyle behaviors on HRQoL. The level of statistical significance was set at $p < 0.05$ in all analyses. Variance inflation factor (VIF) was used to test the multicollinearity. Robust test was conducted by changing conversion formula to calculate HRQoL. The formula was as follows: 1 subtract the sum of the five dimensions scores divided by 25. The value represented HRQoL by a single index ranging from 0 (for 55555) to 0.8 (for 11111).

$$\text{HRQoL} = 1 - (\text{MO} + \text{SC} + \text{UA} + \text{PD} + \text{AD}) \div 25$$

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3. Results

3.1. Sociodemographic and lifestyle behaviors

A total of 1,227 participants answered the questionnaire, of which 894 (73%) provided valid information on all included variables (e.g., the measures of weight and height both were valid, current health status was consistent with chronic disease prevalence). Table 1 summarizes the sociodemographic characteristics and lifestyle behaviors of the participants. A total of 894 participants were included and had an average HRQoL of 0.978 (SD = 0.045). The mean age was 41.19 (SD = 9.15), among which the ratio of male to female respondents was around1: 1.05. Annual household income of respondents was ¥1,62,600 (SD = 1,15,500) on average. Majority of them were married (89.60%) and had at least one child (87.47%). Approximately 90.00% of participants reported not having any chronic diseases diagnosed in the hospital at the time of completing the survey. For their lifestyle behaviors, over half of them had regular daily routine (67.67%) and good sleep quality (58.17%). Almost all of them had breakfast at least 4 times a week (92.28%). Most of them did not smoke (78.97%) or consume alcohol (55.26%). The percentage of respondents who never participated in physical activity was 9.06%.

3.2. EQ-5D-5L dimensional profile and HRQoL

Five levels on the EQ-5D dimension included no problem, slight, moderate, severe, and extreme problems. Frequency of item response in each EQ-5D-5L dimension as follows: MO (97.8%, 2.0%, 0.2%, 0.0%, 0.0%), SC (99.6%, 0.4%, 0.0%, 0.0%, 0.0%), UA (98.2%, 1.8%, 0.0%, 0.0%, 0.0%), PD (83.2%, 16.1%, 0.7%, 0.0%, 0.0%) and AD (81.9%, 17.2%, 0.9%, 0.0%, 0.0%). In this survey, the largest number of participants reported problems in the AD dimension (18.1%), followed by the PD dimension (16.8%). Roughly 99% of participants had no problem in the other three dimensions. The least problematic dimension was the SC dimension accounting for only 0.4%.

The results of HRQoL for each factor were also shown in Table 1. Significant differences were found in the subgroups of age, BMI, and annual household income. Younger group (age < 45) had better HRQoL (0.982 ± 0.036) than the older group (0.971 ± 0.056, 0.953 ± 0.061 respectively). Highest BMI group (BMI ≥ 25) had the lowest HRQoL (0.966 ± 0.052), whereas lowest BMI group (BMI < 18.5) had the highest HRQoL (0.988 ± 0.028). HRQoL was progressively lower with an increase in income categories ($p = 0.016$), and lowest in those with an annual income over ¥1,50,000 (0.975 ± 0.050). Participants suffering from chronic diseases had lower HRQoL (0.925 ± 0.078) than those without chronic disease (0.978 ± 0.045). Regarding lifestyle behaviors, significant differences were found in some factors: daily routine ($p < 0.001$), sleep quality ($p < 0.001$) and physical activity ($p = 0.013$). In the case of daily routine, the average HRQoL of participants who answered "not regular" was 0.971 ± 0.046, while that of participants who answered "regular" was 0.981 ± 0.045. Participants who had

TABLE 1 Sociodemographic characteristics, lifestyle behaviors, and HRQoL.

Characteristics	*n* (%)	Mean (SD)	*p*-value
All	894 (100.00)	0.978 ± 0.045	
Sex			0.795
Male	458 (51.23)	0.976 ± 0.047	
Female	436 (48.77)	0.979 ± 0.043	
Age			0.023*
<45	558 (62.42)	0.982 ± 0.036	
45 ~ 59	312 (34.9)	0.971 ± 0.056	
≥60	24 (2.68)	0.953 ± 0.061	
BMI			0.014*
<18.5	53 (5.93)	0.988 ± 0.028	
18.5 ~ 24.9	686 (76.73)	0.979 ± 0.044	
≥25	155 (17.34)	0.966 ± 0.052	
Education			0.992
Below undergraduate	330 (36.91)	0.976 ± 0.049	
Undergraduate	458 (51.23)	0.978 ± 0.043	
Above undergraduate	106 (11.86)	0.978 ± 0.045	
Type of residence			0.076
Urban	579 (64.77)	0.979 ± 0.045	
Rural	315 (35.23)	0.975 ± 0.045	
Marital status			0.085
Single	84 (9.4)	0.986 ± 0.035	
Married	801 (89.6)	0.977 ± 0.046	
Others (e.g., Divorced)	9 (1.01)	0.952 ± 0.060	
Annual household income			0.016*
< ¥80,000	151 (16.89)	0.989 ± 0.030	
¥80,000 ~ ¥1,50,000	313 (35.01)	0.976 ± 0.044	
> ¥1,50,000	430 (48.1)	0.975 ± 0.050	
Number of children			0.301
0	112 (12.53)	0.984 ± 0.036	
1 ~ 2	516 (57.72)	0.976 ± 0.049	
>2	266 (29.75)	0.978 ± 0.041	
Caregiving status			0.300
Not caring for the elderly	642 (71.81)	0.978 ± 0.046	
Care for the elderly	252 (28.19)	0.976 ± 0.042	
Title			0.288
Below middle	393 (43.96)	0.981 ± 0.039	
Middle	383 (42.84)	0.976 ± 0.050	
Above middle	118 (13.2)	0.972 ± 0.049	
Enrolment			0.153
Contract	331 (37.02)	0.977 ± 0.041	
Permanent	563 (62.98)	0.978 ± 0.048	

(Continued)

TABLE 1 (Continued)

Characteristics	*n* (%)	Mean (SD)	*p*-value
Commercial insurance			0.921
No	561 (62.75)	0.978 ± 0.045	
Yes	333 (37.25)	0.977 ± 0.045	
Chronic diseases			<0.001**
No	804 (89.93)	0.983 ± 0.036	
Yes	90 (10.07)	0.925 ± 0.078	
Daily routine			<0.001**
Irregular	289 (32.33)	0.971 ± 0.046	
Regular	605 (67.67)	0.981 ± 0.045	
Sleep quality			<0.001**
Not good	374 (41.83)	0.968 ± 0.003	
Good	520 (58.17)	0.985 ± 0.002	
Breakfast			0.290
<4 times/week	69 (7.72)	0.982 ± 0.041	
≥4 times/week	825 (92.28)	0.977 ± 0.046	
Smoking			0.054
No	706 (78.97)	0.979 ± 0.042	
Yes	188 (21.03)	0.971 ± 0.054	
Drinking			0.095
No	494 (55.26)	0.981 ± 0.041	
Yes	400 (44.74)	0.974 ± 0.050	
Physical activity			0.013*
No	81 (9.06)	0.964 ± 0.057	
Yes	813 (90.94)	0.979 ± 0.044	

*$p < 0.05$ and **$p < 0.01$, respectively.

good sleep quality and participated in physical activity had better HRQoL. Differences in HRQoL based on other lifestyle behaviors (e.g., breakfast, smoking and drinking) did not reach a statistically significant level.

3.3. Regression analysis

The Tobit regression analysis revealed that several demographic characteristics and lifestyle behaviors were significantly associated with HRQoL in the adjusted model (Pseudo $R^2 = 0.6038$) (Table 2). Female ($\beta = -0.029$, $p = 0.014$, 95% CI = −0.052 to −0.006) and higher annual household income ($\beta = -0.052$, $p = 0.001$, 95% CI −0.083 to −0.021 and $\beta = -0.050$, $p = 0.002$, 95% CI = −0.082 to −0.019) were a risk factor for HRQoL among participants. Suffering from chronic diseases ($\beta = -0.118$, $p < 0.001$, 95% CI = −0.146 to −0.090) and rural residence ($\beta = -0.028$, $p = 0.011$, 95% CI = −0.049 to −0.006) were negatively associated with HRQoL of respondents. In addition, a negative correlation was identified between HRQoL and the frequency of eating breakfast ($\beta = -0.041$, $p = 0.036$, 95% CI = −0.079 to −0.003). A positive association was observed between HRQoL and regular daily routine ($\beta = 0.025$, $p = 0.018$, 95% CI = 0.004 to 0.045) as well as good sleep quality ($\beta = 0.049$, $p < 0.001$, 95% CI = 0.029 to 0.069). Smoking status was significantly associated with the HRQoL. Compared with non-smokers, smokers report significantly lower HRQoL ($\beta = -0.027$, $p = 0.043$, 95% CI = −0.079 to −0.003). Associations between other lifestyle behaviors (drinking and physical activity) and HRQoL did not reach a statistically significant level. Variance inflation factor (VIF) for each independent variable was well below the recommended threshold of 10 (55), suggesting that the models did not have a multicollinearity issue. Changing conversion formula to calculate HRQoL did not materially alter the conclusions of the original tobit model (Appendix Table 1). Associations between sleep quality ($\beta = 0.059$, $p < 0.001$, 95% CI = 0.037 to 0.081), breakfast ($\beta = -0.046$, $p = 0.029$, 95% CI = −0.087 to −0.005) and physical activity ($\beta = 0.035$, $p = 0.039$, 95% CI = 0.002 to 0.068) with HRQoL were significantly observed in the unadjusted model (Pseudo $R^2 = 0.1879$).

4. Discussion

The purpose of this study was to explore the relationship between lifestyle behaviors and HRQoL among Chinese primary health care physicians. Our results confirmed the significant association between daily routine, sleep quality, breakfast, smoking and HRQoL, while drinking and physical activity were not found to influence HRQoL of Chinese primary health care physicians.

We found that regular daily routine and good sleep quality were positively associated with HRQoL among Chinese primary health care physicians. Given the 24-h nature of medical care, shift work is common in the healthcare sectors, including evening, night, and early morning shifts, as well as fixed or rotating schedules (56). As a main cause to irregular daily routine, shift work appears to be a risk factor for overweight, obesity, type 2 diabetes, elevated blood pressure, sleep deprivation and the metabolic syndrome, all of which have a poor impact on HRQoL (57, 58). Workers during irregular daily routine will experience the negative influence of sleeping, waking, and eating at an inappropriate circadian phase (59). There is evidence that the circadian rhythms of individuals during an irregular daily routine may deteriorate mood and performance in the healthcare sectors (60, 61). This situation highlights the necessity for examination and intervention programs on negative health outcomes connected with shift work. According to a meta-analysis (8), the pooled prevalence of sleep disturbances among Chinese healthcare professionals was much higher than the general population in China, owing to the changes of lifestyle, increased work pressure, and deteriorating doctor-patient relationships. In addition, physicians are reported more caffeine consumption than the general population (62), which have several negative effects on sleep quality and quantity (63). Poor sleep quality, however, may have a negative impact on immune system and be related to depression and anxiety, which can affect both physical and mental health in HRQoL (64, 65) and result in high levels of burnout causing more medical errors (62, 66, 67). It is suggested that health care policy makers should implement

TABLE 2 Tobit regression analysis between sociodemographic characteristics, lifestyle behaviors and HRQoL.

Variables	HRQoL							
	Adjusted				Unadjusted			
	β	p	95% CI		β	p	95% CI	
Intercept	1.143	<0.001**	1.067	1.219	1.047	<0.001**	0.998	1.096
Daily routine (ref. = Irregular)								
Regular	0.025	0.018*	0.004	0.045	0.019	0.101	−0.004	0.041
Sleep quality (ref. = Not good)								
Good	0.049	<0.001**	0.029	0.069	0.059	<0.001**	0.037	0.081
Breakfast (ref. ≤ 4 times/week)								
≥4 times/week	−0.041	0.036*	−0.079	−0.003	−0.046	0.029*	−0.087	−0.005
Smoking (ref. = No)								
Yes	−0.027	0.043*	−0.053	−0.001	−0.016	0.238	−0.042	0.010
Drinking (ref. = No)								
Yes	−0.009	0.378	−0.031	0.012	−0.011	0.329	−0.033	0.011
Physical activity (ref. = No)								
Yes	0.025	0.094	−0.004	0.055	0.035	0.039*	0.002	0.068
Sex (ref. = Male)								
Female	−0.029	0.014*	−0.052	−0.006				
Age (ref. ≤ 45)								
45 ∼ 59	−0.004	0.726	−0.026	0.018				
≥60	−0.009	0.759	−0.065	0.047				
Marital status (ref. = Single)								
Married	−0.021	0.504	−0.082	0.040				
Others (e.g., Divorced)	−0.030	0.566	−0.133	0.073				
Number of children (ref. = 0)								
1 ∼ 2	0.012	0.671	−0.043	0.066				
>2	0.028	0.331	−0.028	0.084				
Annual household income (ref. ≤￥80,000)								
￥80,000 ∼￥1,50,000	−0.052	0.001**	−0.083	−0.021				
> ￥1,50,000	−0.050	0.002**	−0.082	−0.019				
Education (ref. = Below undergraduate)								
Undergraduate	0.002	0.845	−0.020	0.025				
Above undergraduate	0.004	0.820	−0.031	0.039				
Title (ref. = Below middle)								
Middle	−0.004	0.722	−0.027	0.018				
Above middle	−0.021	0.232	−0.054	0.013				
Enrolment (ref. = Contract)								
Permanent	0.019	0.057	−0.001	0.040				
Chronic diseases (ref. = No)								
Yes	−0.118	<0.001**	−0.146	−0.090				
BMI (ref. ≤ 18.5)								
18.5 ∼ 25	−0.016	0.464	−0.058	0.027				

(Continued)

TABLE 2 (Continued)

Variables	HRQoL							
	Adjusted				Unadjusted			
	β	p	95% CI		β	p	95% CI	
≥25	−0.042	0.081	−0.090	0.005				
Caregiving status (ref. = No need)								
Care for the elderly	0.006	0.565	−0.015	0.027				
Type of residence (ref. = Urban)								
Rural	−0.028	0.011*	−0.049	−0.006				
Commercial insurance (ref. = No)								
Yes	−0.004	0.687	−0.024	0.016				

*$p < 0.05$ and **$p < 0.01$, respectively.

measure to improve sleep quality of primary health care physicians, such as promoting physical activity, strategic naps, work hour reductions and environmental modifications in the workplace (56, 62). Maybe health care organizations can follow an example of some companies which provide rooms with nap pods or beds for the purpose of napping (68).

Our finding that smoking was a risky factor for HRQoL was in accord with earlier researches (45, 46). Physicians may be particularly at risk of smoking, due to heavy workload, work conditions, or nightshifts disrupting the circadian rhythm (69). The overall smoking prevalence among Chinese physicians ranged from 14 to 64% across studies and smoking rates of PHC physicians was 42% (70). On the one hand, smokers are more likely than non-smokers to develop cardio vascular disease, stroke, lung cancer and have higher risks of heart failure (71, 72). On the other hand, physicians who smoke have less knowledge and less favorable attitude toward tobacco control compared to non-smokers (73, 74). Consequently, they would provide less smoking cessation counseling for their patients (75). Furthermore, smoking may cause diminished overall health and increased absenteeism from work (76), which not only have negative impact on the delivery of the healthcare services to their patients but also cause substantial economic burden of sickness absenteeism (77). As a result, it is recommended to develop tailored smoking cessation training programs for primary health care physicians.

Interestingly, we discovered that the frequency of breakfast was inversely connected to HRQoL among primary health care physicians in the current study, whereas a study conducted in Taiwan (78) showed that breakfast skippers had significantly worse HRQoL than breakfast eaters. One possible explanation for this might be that participants are more inclined to skip breakfast for longer sleep durations, since sleep quality ($\beta = 0.049$) appears to have greater impact than breakfast ($\beta = -0.042$) on HRQoL. Although there are some evidence showed that skipping breakfast is negatively associated with obesity (78), diabetes mellitus (79) and dyslipidemia, the importance of breakfast remains controversial (80, 81). Breakfast skippers seemed to have lower risk for of chronic disease and skipping breakfast as a way for calorie restriction may have potential metabolic benefits including neuroprotective, anti-aging, and anti-inflammatory (81). In addition, there is a study indicating that breakfast skippers showed better HRQOL and lower levels of stress and depression than breakfast eaters who ate a poor or very poor quality of breakfast (40). According to the study, a good quality breakfast comprises of bread/toast/cereal and/or dairy products rather than commercially prepared goods. Moreover, compared with a nutrition-inadequate breakfast and no breakfast, a nutrition-adequate breakfast will significantly improve short-term cognitive function (82), emphasizing the importance of breakfast quality. Physicians may have limited access to healthy breakfast due to work commitments and lack of time in the workplace (83). Hence, the association between breakfast quality and HRQoL should be further studied in future.

Furthermore, an increasing number of studies have been conducted to examine the relationship between physical activity and HRQoL (47, 84, 85). It was evidently demonstrated that physical activity improved HRQoL and well-being when compared with minimal or no-treatment controls for adults aged 18–65 years (86). The typical primary health care physician works long hours and leads a sedentary lifestyle, thus they are encouraged to shift from being sedentary to doing some physical activity which has the greatest potential health gains (87). However, contrary to expectations, physical activity was not significantly associated with HRQoL based on our regression result and this finding was in line with a research among PHC physician in Saudi Arabia (38). Nonetheless, Mann–Whitney U analysis showed that participants who had a habit of physical activity (90.94%) got significantly better HRQoL. The insignificant regression results may be due to the fact that most of the participants had a habit of physical activity, which requires further research on a larger scale. Also, a recent study discovered that shift work seemed to hinder the beneficial effects of physical activity (88). Similarly to physical activity, drinking was not found significantly associated with HRQoL in line with some researches (39, 89) while some studies have demonstrated that drinking is a risk factor for HRQoL (46, 47, 90). By contrast, some studies have reported moderate drinkers tending to have better HRQoL than non-drinkers and heavy drinkers (16, 91, 92). Besides, drinking was found to effectively alleviate stress and be linked to improved mental health in healthcare professionals (93, 94). Such the existence of a causal relationship between alcohol consumption patterns

and HRQoL may be resulted from differences in consumption by sex, nationality, and individual characteristics (92). Moreover, a review indicated that alcohol consumption was an independent predictor of chronic conditions (95), which was a significantly negative factor of HRQoL in our study. Our result also could be partly explained by the inclusion of participants who refrain from alcohol consumption permanently or temporarily due to the presence of chronic disease, which consequently would decrease their HRQoL. Therefore, further studies including more specific drinking groups should be conducted in the future to determine the precise correlations between alcohol consumption and HRQoL in primary health care physicians.

Approximately 18.1% of the study participants reported problems in the Anxiety/Depression dimension which was higher than the other four dimensions. Many studies indicated that physicians can be affected by the full spectrum of mental disorders and the most common mental disorders reported among physicians are depression and anxiety (96–98). Workplace risk factors, such as high job demands, a work-family life imbalance and long working hours, are often important in explaining much of the variation in mental ill health among physicians (99). Working as a primary health care physician involves a heavy workload, and consequently they have little leisure time to spend with their family and friends. Furthermore, healthcare workers are always at the frontline of public health responses to major critical incidents and emergencies like COVID-19 (100, 101), causing increases in mental ill health among them. In this regard, it is high time that public health care policy makers should establish ways to mitigate mental health risks and tailor interventions, such as modifications to work processes, shortening of shifts (98) and mental health training, which effectively make an enhancement in some mental health outcomes among primary health care physicians. Another potential solution is eHealth interventions including Cognitive Behavioral Therapy, Stress Management, Mindfulness approaches and Cognitive training through Apps, which appears to be an effective and more feasible way than face-to-face sessions to deliver these types of interventions among PHC physicians (102, 103).

Several study limitations are worth mentioning. First, our results should be generalized with caution to other countries with different cultural backgrounds because this was a cross-sectional study in China. Second, physicians also might have reported underestimation of unfavorable lifestyle behaviors or overestimation of HRQoL in this study because of social acceptability bias. Third, dietary behaviors were not included. It should be fully studied in future. Lastly, we used a simple questionnaire of lifestyle behaviors for greater response by participants, which might result in missing important information. We suggest that future studies use standardized questionnaires to comprehensively measure daily routine, sleep quality, breakfast, smoking, drinking and physical activity. For example, physical activity can be assessed by International Physical Activity Questionnaire (IPAQ) (104).

5. Conclusions

This study evaluated association of lifestyle behaviors including daily routine, sleep quality, frequency of eating breakfast, physical activity, drinking, and smoking with HRQoL in a group of 894 Chinese primary health care physicians. Our study found that lifestyle behaviors including daily routine, sleep quality, frequency of eating breakfast, and smoking affected the HRQoL of Chinese primary health care physicians. However, this association was not observed for other lifestyle behaviors including drinking and physical activity. These findings may guide health policy makers to tailor interventions, such as adequate sleep, strategic naps, and smoking cessation training programs, to improve HRQoL of primary health care physicians effectively.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The research design was reviewed and approved by the Ethics Committee of China Pharmaceutical University, Nanjing city, Jiangsu Province, China (Project Number: CPU2014006). All methods were carried out in accordance with the relevant guidelines and regulations. Based on the principle of informed consent, all data were collected anonymously after obtaining the permission and informed consent signed by respondents.

Author contributions

YH and XX contributed to the conception and design of the study. YL and YH contributed to the data analysis. YL, YH, and XX contributed to the interpretation of data. YL contributed to writing manuscript. All authors had read and approved the final version of the manuscript for submission.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1131031/full#supplementary-material

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Evaluation of knowledge of risk factors and warning signs of stroke – An observational study among future health care professionals

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Background and objective: The role of healthcare professionals in society is unique since they are providers of health information and medication counseling to patients. Hence, this study aimed to evaluate Knowledge of Risk Factors and Warning Signs of Stroke among undergraduate health care Students (UHCS) at King Saud University (KSU), Riyadh, Saudi Arabia.

Methodology: An online cross-sectional study was conducted among UHCS at KSU, Riyadh, Saudi Arabia from September to November 2022, using self-administered 34-item questionnaires divided into five sections to assess participants' knowledge of stroke risk factors, warning signs, and management and source of information about the stroke. The Statistical Package for the Social Sciences version 26 was used to analyze the data (SPSS).

Results: Of the 300 questionnaires distributed, 205 students completed the questionnaires, giving a response rate of 68.3%. Of whom 63 (30.7%) were pharmacy, 81 (39.5%) were nursing and 61 (29.8%) were emergency medical services (EMS) Students. One hundred and eighty-two (88.8%) of the students agreed that stroke affects bodily movement. With regards to risk factors, students identified high blood pressure 182 (88.8%), followed by heart disease 175 (85.4%), advanced age 164 (80%), previous Stroke history 158(77.1%), and lack of physical activity 156 (76.1%). Difficulty in speaking or slurred speech 164 (80%), dizziness, and loss of balance 163 (79.5%) were identified as the warning signs of stroke. In this study, 41.3 % of the pharmacy students reported a good level of knowledge than nursing and EMS students. However, 32.2% ($N = 66$) of the healthcare undergraduates reported good knowledge. The knowledge score was significantly associated with the year of study, and educational degree ($p = 0.0001$). Furthermore, there were no differences between parents working in healthcare settings ($p = 0.99$).

Conclusion: In conclusion, the knowledge of stroke among healthcare students at King Saud University varied. The reported knowledge gap mostly relates to stroke risk factors and warning signs. Therefore, increasing public awareness of potential risk factors and stroke warning signs needs to receive more attention.

KEYWORDS

risk factor, pharmacy students, warning signs, stroke, health care professionals, nurses

Introduction

A stroke is often described as a brain attack and a cerebral accident (1). It's a medical emergency that occurs when the blood supply to the brain is interrupted. Brain cells start to degenerate in minutes (1). Stroke is a chronic disease that affects people of all races and all generations (1, 2). It is currently regarded as a worldwide health problem that causes functional impairment and mortality. Stroke prevalence has risen recently on a regional and international level, becoming a major public health concern that is anticipated to keep getting worse (1, 2). The WHO estimates that 70% of strokes, and 87% of stroke-related deaths and disability-adjusted life years, occur in low- and middle-income countries (2). Strokes were challenging to recover from strokes can be severely disabling. It is evidenced that the incidence of stroke-related complications increases treatment costs, repeated visits to clinics, disability, and early mortality (3, 4). Stroke has become a significant and growing problem mostly due to unhealthy food habits, lack of physical activity, uncontrolled urbanization, and sedentary western lifestyles all of which contribute to multiple comorbidities (2, 3).

In Saudi Arabia, studies indicated that the number of stroke-related fatalities is on the rise, with an estimated number of Saudis dying each year from stroke (3, 4). According to the WHO, stroke is the second leading cause of stroke-related impairments globally (3, 4). In recent years the prevalence of stroke has been increasing and emerging as a major health problem, and it is estimated that the mortality rate resulting from stroke would be doubled by 2030, in Saudi Arabia (5, 6). These numbers indicate that stroke will have a great economic burden in Saudi Arabia in the future. Earlier literature in Saudi Arabia revealed that hypertension and smoking age were the most common risk factors for stroke (5, 6).

Besides its complications, the prevalence of stroke is proliferating in both developed and developing countries worldwide (7). It is evidenced that the incidence of stroke can occur in people over the age of 65 and they can occur in much younger ages (7–10). Healthcare students must be aware of the clinical presentation of various diseases since this information may be useful to them when they begin practicing after graduation. It was evidenced that healthcare undergraduates reported variation in their knowledge about stroke (11–13). For example, earlier findings revealed that nursing students have good knowledge of some aspects of warning signs and risk factors for stroke (11). Similarly, another recent study among university students reported an incomplete understanding of the risk factors of stroke (12). On the other hand, a previous study among Saudi medical students in Saudi Arabia revealed sub-optimal knowledge of ischemic stroke (13).

Although it is generally known that today's undergraduates would become tomorrow's professionals, a thorough awareness of the clinical facts related to diseases will help them in their work and help them to give their patients the best care possible. (14–19). Additionally, awareness of stroke would have a significant impact on morbidity and mortality rates, as well as contribute to the promotion of healthy habits. To increase students' knowledge, attitude, and practice (KAP) regarding stroke, a more extensive education program is required. Earlier studies have examined students' understanding of and awareness of stroke up to this point (11–13). To the best of our knowledge, there is a dearth of literature about clinical presentations and awareness of stroke among the UHCS in Riyadh Saudi Arabia. Hence, such a study was required and would help in future research. This study aimed to evaluate Knowledge of Risk Factors and Warning Signs of Stroke among UHCS in KSU, Riyadh, Saudi Arabia.

Methods

Study design and settings

We conducted a cross-sectional paper-based survey study among male students in healthcare colleges at KSU, including the College of Pharmacy, Nursing, and Emergency medical services (EMS) between July 2022 and October 2022, over four months. The male undergraduates aged >18 years and older, who were willing to complete the questionnaires and currently enrolled in the courses, and undergraduates with regular visits to college were included. Before accessing the survey, a disclosure statement followed by consent and agreement to use filled-out information for publication purposes was highlighted. We excluded students from other disciplines. Furthermore, the study was approved by the ethics committee of the College of Medicine at King Saud University. Before data collection, informed consent was obtained from the participants. Respondent's anonymity and confidentiality were ensured throughout the study.

Sample size estimation

There were ∼350 residential students currently enrolled in Pharmacy, Nursing, and emergency medical services in the third and fourth years of courses at the KSU campus. Similar to the previous studies we calculated the required sample size using an online calculator (20–23) (http://www.raosoft.com/samplesize.html) with a 95% CI and a pre-determined margin of error of 5%. Because we were unaware of the potential results for each question, we assumed that the response distribution for each question would equal 50% (22). Although the sample size was projected to be 184, we opted to poll at least 300 students to assure greater reliability.

Questionnaire design

In this study, we developed a questionnaire based on previous research about the knowledge of stroke risk factors and warning signs among undergrads at health colleges (11–13). The questionnaire consisted of 34 questions divided into five categories. In the first section, there were a total of six questions about the student's background, including the type of health, college, year of study, and knowledge of stroke (3 items). The second and third sections include knowledge of risk factors and warning signs of strokes. All these questionnaires were graded on a three-point scale (Yes/No/I don't know), and the fourth section discusses the management of stroke with a total of 5-items, assessed on a binary scale (Yes/No), the last section of the study questionnaires ask participants about the sources of information for stroke on a

multiple choice. With the assistance of two prominent professors, the questionnaires underwent accuracy and content checks after initial compilation (one from the college of pharmacy and one professor from the college of nursing). An anonymous sample of students ($n = 30$) was surveyed for a pilot study. Pilot study results were not included in the final analysis. The reliability of the questionnaires was calculated by assessing the Cronbach's Alpha value (0.75) of the questionnaires, indicating it was reliable to carry out the study.

In the survey, nursing, EMS, and pharmacy students who were regular students at the colleges were included. During lecture periods, a researcher who was designated to collect data visited the students in their classrooms. A brief presentation was given to explain the purpose of the study and to assure students that their responses would be kept confidential. The students provided written informed consent. The questionnaire was given to participants with sufficient time to complete it. Data was collected using convenience sampling. Students who did not complete more than half of the study questionnaires were considered to have incomplete responses and were therefore excluded from the study, whereas students who did not complete 2 or 3 items in the survey were considered to have a treatable response and were thus included in the study. Non-respondents were students who did not return their questionnaires. The stroke knowledge score was computed by assigning a score of '1' for the correct answer, and a score of '0' for the wrong answer, likewise the total knowledge score was designed by computing the total knowledge items, which was further divided into good knowledge scores (who score of >50%) while poor knowledge score (a score < 50%) of the total score.

Statistical analysis

An evaluation of the data was conducted using the Statistical Package for Social Sciences (SPSS) version 26.0 software. Descriptive analysis such as frequencies (n) and percentages (%) were assessed. The knowledge score and standard deviations (SD) were calculated and presented in the form of tables and graphs. In addition, the associations between categorical variables were determined by performing chi-square and Fisher exact test. A p-value < 0.05 was considered statistically significant.

Results

Demographic information

Of all participating subjects ($n = 205$), 63 (45.3%) were pharmacy students, 81 (54.6%) were nursing students and 61 (29.8%) were EMS Students. Most of the respondents were between 18 and 22 years of age. Only 27.3 % of students' parents work in a healthcare setting. Hundred and eighty-two (88.8%) of the students agreed that stroke affects bodily movement, and the majority 93.7% of pharmacy 88.9% of nursing, and 91.7 % of EMS students, reported that stroke happens when blood flow to the brain stops. While One-third (38.5%) of the students reported, the window period of thrombolysis was between 0 and 4.5 h. The detailed responses were presented in Table 1.

TABLE 1 Demographic characteristics of the participant.

Variables	Frequency *n* (%)
Educational degree	
Pharmacy	63 (30.7)
Nursing	81 (39.5)
EMS	61 (29.8)
Do any of your parents work in a healthcare setting	
Yes	56 (27.3)
No	149 (72.7)
Level of education	
Third year	108 (52.7)
Fourth-year	97 (47.3)
A stroke or brain attack happens when blood flow to your brain is stopped	
Yes	188 (91.7)
No	05 (2.4)
I don't know	12 (5.9)
A stroke affect ability to move eat and other body function	
Yes	182 (88.8)
No	08 (3.9)
I don't know	15 (7.3)
What is the window period of thrombolysis in hours?	
0–4.5 h	79 (38.5)
4.5–6 h	78 (38.0)
12–24 h	33 (16.1)
>24 h	15 (7.3)

Knowledge of risk factors and warning signs among participants ($n = 205$)

Of the participants, most of them (88.8%) identified high blood pressure as one of the most common risk factors for stroke, followed by heart disease (85.4%), advanced age (80%), previous Stroke history (77.1%) and lack of physical activity (76.1%). Taking each college separately, high blood pressure was more prevalent among EMS, pharmacy, and nursing students (93.4, 90.5, and 84.5% respectively). A large majority of all groups of pharmacy, nursing, and EMS (90.5, 84, and 82%) students identified heart disease as one of the risk factors for stroke. While 85.2 % of EMS, 84.1% of pharmacy, and 72.8% of nursing students reported older age as the risk factor for stroke. Interestingly, only a small percentage of all group students reported that gender is also a risk factor for stroke. More details can be found in Table 2. In this study, 41.3 % of the pharmacy students reported a good level of knowledge than nursing (33.3%) and EMS (21.3%) students. The detailed descriptions of the individual knowledge score among the healthcare undergraduates were given in Figure 1.

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TABLE 2 Participant's knowledge of risk factors of strokes ($n = 205$).

Risk factors	Pharmacy ($n = 63$) n (%)	Nursing ($n = 81$) n (%)	EMS ($n = 61$) n (%)	Total ($n = 205$) n (%)
Diabetes				
True	43 (68.3)	60 (74.1)	44 (72.1)	147 (71.7)
False	10 (15.9)	13 (16.0)	10 (16.4)	33 (16.1)
I Don't Know	10 (15.9)	08 (9.9)	7 (11.5)	25 (12.2)
Hypertension				
True	57 (90.5)	68 (84.0)	57 (93.4)	182 (88.8)
False	5 (7.9)	8 (9.9)	2 (3.3)	15 (7.3)
I don't know	01 (1.6)	5 (6.2)	2 (3.3)	8 (3.9)
Hyperlipidemia				
True	58 (92.1)	49 (60.5)	36 (59.0)	143 (69.8)
False	2 (3.2)	13 (16.0)	6 (9.8)	21 (10.2)
I don't know	3 (4.8)	19 (23.5)	19 (31.1)	41 (20.0)
Heart disease				
True	57 (90.5)	68 (84.0)	50 (82.0)	175 (85.4)
False	3 (4.8)	11 (13.6)	5 (8.2)	19 (9.3)
I don't know	3 (4.8)	2 (2.5)	6 (9.8)	11 (5.4)
Alcohol				
True	39 (61.9)	55 (67.9)	39 (63.9)	133 (64.9)
False	10 (15.9)	15 (18.5)	8 (13.1)	33 (16.1)
I don't know	14 (22.2)	11 (13.6)	14 (23.0)	39(19.0)
Tobacco				
True	44 (69.8)	48 (59.3)	42 (68.9)	134 (65.4)
False	9 (14.3)	15 (18.5)	7 (11.5)	31 (15.1)
I don't know	10 (15.9)	18 (22.2)	12 (19.7)	40 (19.5)
Birth control pills				
True	19 (30.2)	31 (38.3)	26 (42.6)	76 (37.1)
False	18 (28.6)	18 (22.2)	20 (32.8)	56 (27.3)
I don't know	26 (41.3)	32 (39.5)	15 (24.6)	73 (35.6)
High red blood cell count				
True	21 (33.3)	43 (53.1)	37 (60.7)	101 (49.3)
False	22 (34.9)	12 (14.8)	9 (14.8)	43 (21.0)
I don't know	20 (31.7)	26 (32.1)	15 (24.6)	61 (29.8)
Older age				
True	53(84.1)	59 (72.8)	52 (85.2)	164 (80.0)
False	6(9.5)	15 (18.5)	3 (4.9)	24 (11.7)
I don't know	4(6.3)	7 (8.6)	6 (9.8)	17 (8.3)
Gender				
True	31 (49.2)	35(43.2)	23 (37.7)	89 (43.4)
False	14 (22.2)	28(34.6)	24 (39.3)	66 (32.2)
I don't know	18 (28.6)	18 (22.2)	14 (23.0)	50 (24.4)

(Continued)

TABLE 2 (Continued)

Risk factors	Pharmacy ($n = 63$) n (%)	Nursing ($n = 81$) n (%)	EMS ($n = 61$) n (%)	Total ($n = 205$) n (%)
Heredity or genetics				
True	37 (58.7)	42 (51.9)	39 (63.9)	118 (57.6)
False	7 (11.1)	19 (23.5)	11 (18.0)	37 (18.0)
I don't know	19 (30.2)	20 (24.7)	11 (18.0)	50 (24.4)
History of prior stroke				
True	55 (87.3)	54 (66.7)	49 (80.3)	158 (77.1)
False	3 (4.8)	15 (18.5)	6 (9.8)	24 (11.7)
I don't know	5 (7.9)	12 (14.8)	6 (9.8)	23 (11.2)
Lack of exercise				
True	48 (76.2)	60 (74.1)	48 (78.7)	156 (76.1)
False	5 (7.9)	10 (12.3)	7 (11.5)	22 (10.7)
I don't know	10 (15.9)	11 (13.6)	6 (9.8)	27 (13.2)

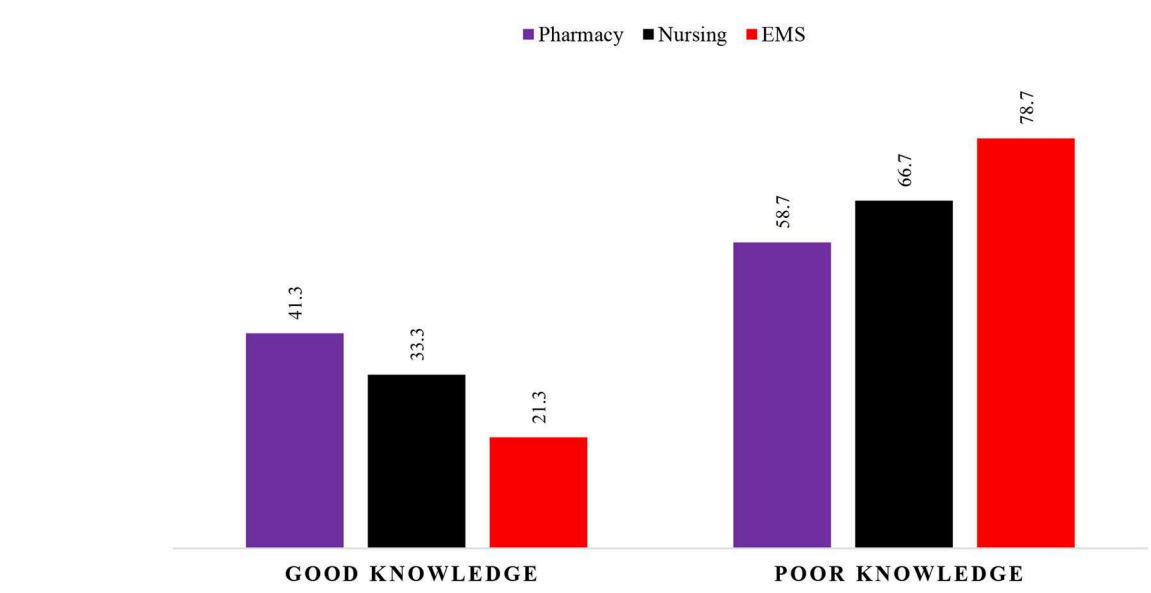

FIGURE 1
Level of knowledge according to educational degree.

Regarding the warning sign of stroke, the majority of the respondents 164 (80%) identified difficulty in speaking and understanding or slurred speech, while 163 (79.5%) identified dizziness and loss of balance. On the other hand, 159 (77.6%) students, followed by chest pain or heart palpitations and difficulty in walking respectively, reported blurred vision. Focusing only on one of the highest warning signs of stroke, when students were compared on that basis, pharmacy students represented the highest proportion of 85.7%, while others were EMS and Nursing (80.3 and 75.3%) (Table 3). Additionally, when the same approach was used concerning the loss of balance, pharmacy, dental, and medical students' results were comparable, whereas nursing students had the lowest proportion of 72.8%. While 86.9% of EMS students had a higher proportion of dizziness and a similar percentage was found in both groups pharmacy and nursing (~76.5%). More details can be found in Table 4.

In the case of a suspected case of stroke, the majority of the students (70.2%) agreed that they would call an ambulance. On the other hand, 40.5% of them agreed to take the patient to the hospital immediately when the patient is suffering from a stroke. Detailed information about the management of stroke among undergraduates was given in Table 4.

With regards to the source of information about stroke hundred and fourteen 114 (55.6%) reported physicians followed by lectures and presentations 74 (36.1%) and textbooks 73 (35.6%) respectively. More detailed information about the source of information for the stroke was given in Figure 2.

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TABLE 3 Participants responses toward warning signs of strokes.

Warning signs	Pharmacy ($n = 63$) n (%)	Nursing ($n = 81$) n (%)	EMS ($n = 61$) n (%)	Total ($n = 205$) n (%)
Blurred vision in 1 or both eyes				
True	48 (76.2)	60 (74.1)	51 (83.6)	159 (77.6)
False	3 (4.8)	8 (9.9)	3 (4.9)	14 (6.8)
I don't know	12(19.0)	13 (16.0)	7 (11.5)	32 (15.6)
Chest pain or heart palpitations				
True	50 (79.4)	63 (77.8)	46 (75.4)	159 (77.6)
False	8 (12.7)	9 (11.1)	8 (13.1)	25 (12.2)
I don't know	5 (7.9)	9 (11.1)	7 (11.5)	21 (10.2)
Difficulty in speaking and understanding or slurred speech				
True	54 (85.7)	61 (75.3)	49 (80.3)	164 (80.0)
False	3 (4.8)	14 (17.3)	8 (13.1)	25 (12.2)
I don't know	6 (9.5)	6 (7.4)	4 (6.6)	16 (7.8)
Difficulty in walking				
True	55 (87.3)	55 (67.9)	49 (80.3)	159 (77.6)
False	3 (4.8)	17 (21.0)	5 (8.2)	25 (12.2)
I don't know	5 (7.9)	9 (11.1)	7 (11.5)	21 (10.2)
Dizziness				
True	48 (76.2)	62 (76.5)	53 (86.9)	163 (79.5)
False	4 (6.3)	8 (9.9)	2 (3.3)	14 (6.8)
I don't know	11 (17.5)	11 (13.6)	6 (9.8)	28 (13.7)
Loss of balance				
True	54 (85.7)	59 (72.8)	50 (82.0)	163 (79.5)
False	4 (6.3)	10 (12.3)	5 (8.2)	19 (9.3)
I don't know	5 (7.9)	12 (14.8)	6 (9.8)	23 (11.2)
Numbness or weakness of the face and or limb of the body				
True	53 (84.1)	55 (67.9)	48 (78.7)	156 (76.1)
False	3 (4.8)	9 (11.1)	5 (8.2)	17 (8.3)
I don't know	7 (11.1)	17 (21.0)	8 (13.1)	32 (15.6)
Severe headache with unknown cause				
True	47 (74.6)	58 (71.6)	49 (80.3)	154 (75.1)
False	6 (9.5)	11 (13.6)	6 (9.8)	23 (11.2)
I don't know	10 (15.9)	12 (14.8)	6 (9.8)	28 (13.7)
Shortness of breath				
True	38 (60.3)	54 (66.7)	36 (59.0)	128 (62.4)
False	8 (12.7)	6 (7.4)	9 (14.8)	23 (11.2)
I don't know	17 (27.0)	21 (25.9)	16 (26.2)	54 (26.3)

Table 5 shows the Association between the knowledge score of the participants concerning demographic characteristics of participants. We did not find any significant association between knowledge score and educational degree ($p = 0.057$). Similarly, the knowledge score of the undergraduates was not significantly associated with parents working in healthcare settings ($p = 0.992$). However, there was a significant association between knowledge score and year of study ($p = 0.020$) as shown in Table 5.

TABLE 4 Participants responses toward management of stroke.

Basic information	Pharmacy ($n = 63$) n (%)	Nursing ($n = 81$) n (%)	EMS ($n = 61$) n (%)	Total ($n = 205$) n (%)
I will call the ambulance				
Yes	41 (65.1)	47 (58.0)	56 (91.8)	144 (70.2)
No	22 (34.9)	34 (42.0)	5 (8.2)	61 (29.8)
I will give home remedies				
Yes	7 (11.1)	9 (11.1)	2 (3.3)	18 (8.8)
No	56 (88.9)	72 (88.9)	59 (96.7)	187 (91.2)
I will give the patient the first painkiller to control the pain				
Yes	3 (4.8)	8 (9.9)	5 (8.2)	16 (7.8)
No	60 (95.2)	73 (90.1)	56 (91.8)	189 (92.2)
I won't do anything to let the patient recover by him/herself				
Yes	0 (0)	1 (1.2)	1 (1.2)	2 (1.0)
No	63 (100)	80 (98.8)	80 (98.8)	203 (99.0)
I will take the patient to the hospital immediately				
Yes	1 (1.2)	34 (42.0)	24 (39.3)	83 (40.5)
No	80 (98.8)	47 (58.0)	37 (60.7)	122 (59.5)

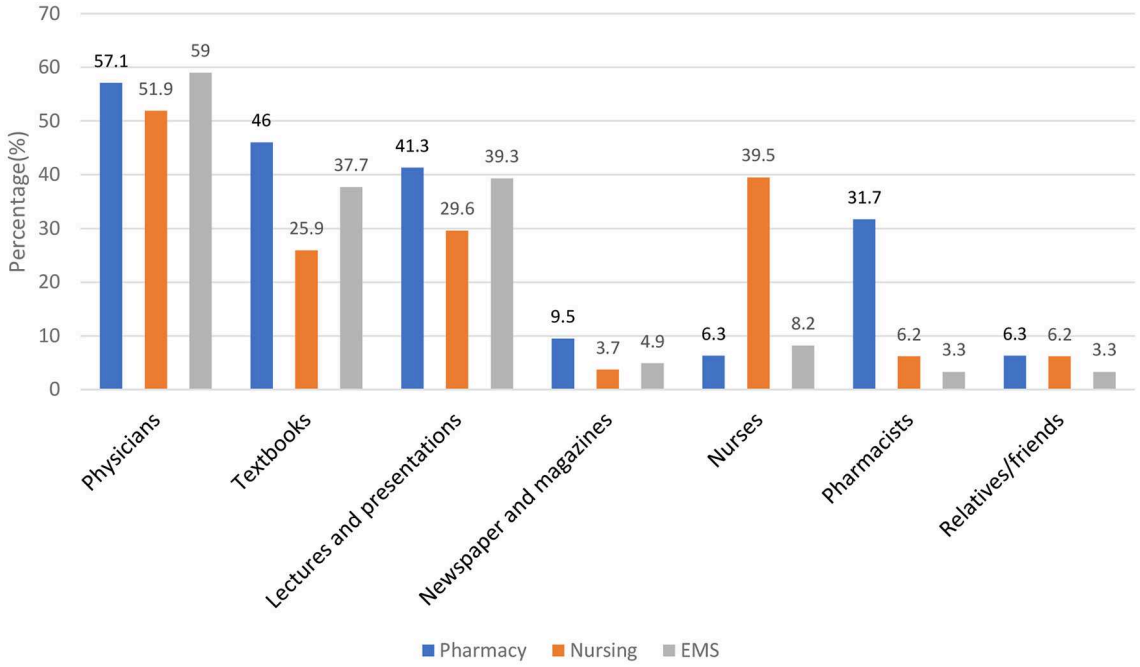

FIGURE 2
Source of information.

Discussion

This survey assessed the knowledge of Risk Factors and Warning Signs of Stroke among future healthcare professionals (pharmacy, nursing, and EMS) at KSU, Riyadh Saudi Arabia. The current findings reported 32.2% of the UHCS from KSU found knowledge about the stroke, while the majority of them reported poor knowledge. On the other hand, data on the health care undergraduates about the clinical presentation of stroke is limited, however, some studies exist on this issue, but most of the studies were conducted in other populations (11, 12, 24, 25). This study would add a significant contribution to enhancing the health care

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TABLE 5 Association between knowledge score of the participants concerning demographics.

Participants characters	Number of respondents	Knowledge score		*P*-value
		Good ($N = 66$; 32.2%)	Poor ($N = 139$; 67.8%)	
Educational degree				0.049
Pharmacy	Count	26	37	
	% Within Educational degree	41.3%	58.7%	
	% Within knowledge levels	39.4%	26.6%	
Nursing	Count	27	54	
	% Within Educational degree	33.3%	66.7%	
	% Within knowledge levels	40.9%	38.8%	
EMS	Count	13	48	
	% Within Educational degree	21.3%	78.7%	
	% Within knowledge levels	19.7%	34.5%	
Do any of your parents work in a healthcare setting				0.992
Yes	Count	18	38	
	% Within parent's work in healthcare settings	32.1%	67.9%	
	% Within knowledge levels	27.3%	27.3%	
No	Count	48	101	
	% Within parent's work in healthcare settings	32.2%	67.8%	
	% Within knowledge levels	72.7%	72.7%	
Level of education				0.020
Third year	Count	27	81	
	% within the Level of education	25.0%	75.0%	
	% within knowledge levels	40.9%	58.3%	
Fourth-year	Count	39	58	
	% within the Level of education	40.2%	59.8%	
	% within knowledge levels	59.1%	41.7%	

professionals, patients, and individuals' knowledge about stroke, thereby helping in some aspects of the management of the diseases in Saudi Arabia, and other countries and would serve as a reference for the much-needed upcoming studies. The research findings may also be used by healthcare and educational organizations to create effective training programs to increase the clinical presentation of stroke understanding by healthcare workers.

The current findings were inconsistent with previous findings (11–13, 24). For example, the previous study by Kankaya and Yesilbalkan among Nigerian nursing undergraduates reported 53.2% of the studied population were knowledgeable about risk factors, while 53.2% of them were knowledgeable about warning signs (53.8%) of stroke (11). However, another similar study reported 62.6% of the students were knowledgeable about various aspects of the stroke (24). It is commonly known that practicing healthcare professionals would be found to have good knowledge, followed by student professionals or the public. Even though knowledge may vary from study to study and may be influenced by many factors including the study method, the nature of respondents, and demographics.

A previous study by Alam et al. among university students of Dhaka evaluated the awareness about stroke and reported that 74.2% of the students identified stroke as a brain disorder (12). While in our findings 91.7% of the UHCS identified stroke as a brain disorder. Similarly, in another recent study in the United States, 50.1% of the students recognized stroke as a brain disorder (26). With regards to the meaning or definition of stroke, 91.7 % of UHCS in the current study recognized correctly as stroke occurs when blood flow to the brain is stopped. On the other hand, a similar previous study reported 36.7% of the medical students correctly identified that both thrombotic and hemorrhagic represent a stroke (13). Healthcare students' awareness of such important disease knowledge during their graduation would help at their practice site, which could save the lives of individuals who suffered or admired with history of stroke. Additionally, this research revealed that there were discrepancies in students' understanding of certain aspects of stroke, demonstrating the need for additional educational initiatives to raise students' awareness of various chronic diseases and their pathophysiology.

The current findings identified hypertension (88.8%) as a risk factor for stroke, followed by heart disease (84.5%), older age (80%), and history of prior stroke (77.1%). These results were similar to many previous studies conducted around the world (13, 24, 27). For instance, a previous study by al-Malki et al. identified high blood pressure followed by high cholesterol and smoking as the risk actors of stroke (13). In contrast, a study in southwestern Nigeria among undergraduate students concluded that hypertension (82.6%), old age (74.9%), hypercholesterolemia (42.8%), diabetes (35.9%) and smoking (27%) were the commonly identified stroke risk factors (24). Conversely, a recent study by Mirghani et al. (27) in Saudi Arabia reported that 90.4% of female medical students and 88.8 % of male medical students identified hypertension as a risk factor for stroke (27). Previous studies conducted among the public identified hypertension as the most common stroke risk factor in line with our findings (25). Furthermore, the American heart association and WebMD reported that constant stress is also another potential risk factor for stroke. The stress causes hypertension, which may cause constant strain on the heart arteries. When blood vessels are overinflated, too much force damages the walls of the arteries and makes them weaker. High blood pressure makes both main types of stroke more likely. Diabetes, high cholesterol, obesity, and older age were the vital factors that can cause a stroke (28, 29). Increased awareness about early signs of stroke can improve overall disease diagnosis and treatment, morbidity, and death rates.

In our study, according to students' perception toward warning signs of stroke, commonly identified symptoms were difficulty in speaking/understanding or slurred speech, dizziness and loss of balance, blurred vision, chest pain or heart palpitations, and difficulty in walking respectively. These findings were consistent with similar studies conducted in Saudi Arabia and other countries (11, 27, 30). Other reports revealed numbness or weakness, difficulty in understanding speech, trouble in speaking or seeing, and walking and headache are important signs and symptoms of stroke (31). According to our findings, more than half of the students believed that physicians were the most knowledgeable healthcare professionals to provide the source of information about stroke. While a previous study showed that textbooks (37.0%) and the internet (18.5%) were the most commonly cited resources (11). It is known that the best source of information about stroke and better interventions can only be provided by the physician.

Lastly, the action to be taken in case of stroke is vital during emergency cases. However, in a study by Almalki et al. (13) study, more than two-thirds (69.7%) of the students would call an ambulance and this was followed by driving to the nearest hospital (51.8%) and telling the patient's family member (47.8%). In addition, calling an ambulance (95%) was also the prime action among the nursing students which was reported by Kanaya et al. (11). Furthermore, a previous study conducted among university students reported (85.7 %) would take a patient to a hospital for any potential stroke, (12) while our study reported 70.2% reported calling an ambulance would be the first appropriate action. In this current research, we emphasize the importance of further studies that can evaluate the perceptions of HealthCare students. This study provides a good platform for others to conduct research within the domains.

In this study, the knowledge level of the stroke is significantly associated with the course, being pursued and the year of study. Studies examining the variation between knowledge of stroke and characteristics of UHCS are currently lacking. There have been some studies about the evaluation of knowledge of clinical presentations of stroke among prospective students (11–15), but those earlier studies did not look at the relationship between the knowledge score and the characteristics of undergraduates. The fact is that senior undergraduates consistently demonstrate a higher level of theoretical knowledge than juniors. Additionally, prior exposure to clinical knowledge during the graduation process (through a course, congress, seminar, etc.) may have affected this circumstance.

However, the current study has some limitations. Firstly, the results were based on a self-completed questionnaire, Secondly, the results were derived from a single institute in Saudi Arabia, therefore, the findings of this study cannot be generalized to the whole Saudi Arabia, studnets population. Thirdly, the study did not involve junior students as it was conducted among senior healthcare students of the university, given the more accessible access to students found while spreading the questionnaire. Despite these limitations, our study lays more emphasis on increasing the awareness toward knowledge of risk factors and warning signs/symptoms of stroke and its complications to make them more competent in raising public health.

Conclusion

This study depicts that one-third of the undergraduate healthcare students were found to have good knowledge. The knowledge score was significantly higher among pharmacy undergraduates compared to nursing and EMS healthcare students. Furthermore, the knowledge was significantly associated with the year of study whereas there were no significant differences between educational degrees. Thus, health education programs might help the students to understand clinical presentations of stroke. Incorporating more advanced topics about stroke and various chronic diseases in clinical practice will undoubtedly enhance treatment outcomes, reduce adverse medication effects, and have a favorable impact on patient care in the future.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

WS, OQ, AB, EA, and MBAA: conceptualization of research and editing and review of manuscript. WS: data collection. OQ, AB, EA, and MBAA: data analysis and drafting the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer AB declared a shared affiliation with the authors to the handling editor at the time of review.

Publisher's note

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Work-family conflict and its related factors among emergency department physicians in China: A national cross-sectional study

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Background: Work-family conflict is common among emergency department physicians. Identifying the factors associated with work-family conflict is key to reducing its negative impact on mental health and work attitudes. However, the work-family conflict of Chinese emergency department physicians and the related factors have been scarcely studied.

Objective: This study aimed to investigate the current status and related factors of work-family conflict among Chinese emergency department physicians.

Methods: A national cross-sectional study was conducted among emergency department physicians in China from June 2018 to August 2018. A standard questionnaire was used to investigate the demographic characteristics, work-related factors, and work-family conflict of emergency department physicians. The generalized linear regression analysis was used to identify the related factors of work-family conflict.

Results: A total of 10,457 licensed emergency department physicians participated in the study. The average score of work-family conflict among the enrolled emergency department physicians was 19.27 ± 3.94, and the prevalence of high levels of work-family conflict was 69.19%. The multivariable regression analysis showed that emergency physicians who were female (linear regression coefficient, −0.25; SE, 0.08; $P = 0.002$), older than 40 years (linear regression coefficient,−0.53; SE, 0.14; $P < 0.001$), and earning more than 4,000 CNY per month (e.g., 4,001∼6,000 vs. ≤4,000 CNY: linear regression coefficient, −0.17; SE, 0.09; $P = 0.04$) had lower work-family conflicts. However, emergency department physicians who were married (linear regression coefficient, 0.37; SE, 0.11; $P < 0.001$), highly educated (linear regression coefficient, 0.46; SE, 0.10; $P < 0.001$), had a high technical title (e.g., intermediate vs. junior technical title: linear regression coefficient, 0.61; SE, 0.09; $P < 0.001$), worked in a high-grade hospital (e.g., tertiary hospital vs. emergency center: linear regression coefficient, 0.38; SE, 0.11; $P < 0.001$), had a higher frequency of night shifts (e.g., 6∼10 night shifts per month vs. 0∼5 night shifts per month: linear regression coefficient, 0.43; SE, 0.10; $P < 0.001$), self-perceived shortage of physicians in the department (linear regression coefficient, 2.22; SE, 0.08; $P < 0.001$), and experienced verbal abuse (linear regression coefficient,

1.48; SE, 0.10; $P < 0.001$) and physical violence (linear regression coefficient, 0.84; SE, 0.08; $P < 0.001$) in the workplace had higher work-family conflict scores.

Conclusion: Most emergency department physicians in China experience a high-level work-family conflict. Hospital administrations are recommended to develop family-friendly workplace policies, establish a scientific shift system, and keep the number of emergency department physicians to meet the demand to reduce work-family conflict.

KEYWORDS

work-family conflict, emergency department physicians, related factors, China, cross-sectional

Introduction

Work-family conflict is an inter-role conflict that results from the incompatibility of role pressures between work and family domains (1). According to scarcity theory, personal resources, such as time and energy, are limited. The devotion of more resources to work role will inevitably lead to a reduction in the devotion of resources to family role (2, 3). Emergency department physicians are the first line of defense in hospitals (4). In addition to work at a fast pace and with high intensity (5, 6), they are required to respond to unforeseen medical situations around-the-clock (7, 8), making them devote more resources to work role and prone to work-family conflict. The existing studies also reported that the work-family conflict among emergency department physicians was significantly higher than that of physicians in other departments (4, 9).

The work-family conflict has a series of negative impacts on both physicians and hospitals. At the individual level, work-family conflict has been reported to be related to psychological distress (10). For example, work-family conflict was found to be associated with mental stress among German physicians (11) and anxiety symptoms among Chinese doctors (12). A prospective study in the United States found a significant relationship between work-family conflict and a higher prevalence of depressive symptoms among physicians (13). Furthermore, conflict between work and family is known to increase the risk of both acute and chronic physical health issues (14). At the hospital level, work-family conflict positively correlates with job burnout (15) and turnover intention (16), which can reduce physicians' productivity and increase hospital operating costs (17, 18). Given these unfavorable outcomes, it is necessary to identify the related factors of work-family conflict among emergency department physicians.

However, most of the studies on physicians' work-family conflict have mainly focused on its negative consequences (11, 19–22), and few studies have explored the factors associated with work-family conflict (23). Moreover, there is a lack of research on the related factors of work-family conflict among emergency department physicians. In China, there is a severe shortage of emergency department physicians, making them more vulnerable to work-family conflict than in other countries. Therefore, we aimed to conduct a national survey in China to explore the current status and related factors of work-family conflict among emergency department physicians, so as to provide a scientific basis for the hospital administrations to formulate interventions.

Methods

Ethics statement

The study was approved by the Research Ethics Committee in Hainan Medical University (approval number: HYLL-2018-035). All participants volunteered to take part in this survey and all private information of them was kept confidential.

Participants and data collection

A nationwide cross-sectional study of emergency department physicians was conducted in China from July 2018 to August 2018 under the coordination of the Medical Administration Bureau of the National Health Commission. Data were collected through a widely used online survey platform, Questionnaire Star (website: https://www.wjx.cn). The link of electronic questionnaire was posted on the emergency department physicians' work platform of the prehospital emergency facility configuration monitoring department. Emergency department physicians from 2,965 public hospitals that provided pre-hospital emergency care in 31 provinces could click the link. Survey link was re-posted to the work platform every 7 days during the survey period. All respondents were required to complete an informed consent form before answering the questionnaire. Also, each questionnaire could only be submitted if all questions were answered, so there was no missing data for each variable. In this study, 15,288 emergency department physicians clicked the link of the electronic questionnaire, and 10,457 submitted it. The completion rate was 68.4%.

Measurements

The questionnaires covered demographic characteristics, work-related factors, and work-family conflict. Demographic characteristics included gender, age, educational level, and marital status. Work-related factors included technical titles, monthly

income, years of service, frequency of night-shift per month, and self-perceived shortage of physicians in the emergency department. The question "Do you think the number of physicians in the emergency department meets the demands of daily work?" was used to measure the perceived shortage of physicians in the emergency department. If the respondents answered that the number of physicians could meet daily needs, it represented no self-perceived shortage of physicians; on the contrary, it represented a self-perceived shortage of physicians.

Work-family conflict was measured by the 5-item Work-family Conflict scale developed by Netemeyer et al. (24). The items were rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicated higher levels of work-family conflict. Furthermore, the average scores of the five items were re-classified into three categories, those who scored <2.5 were re-classified into the "low work-family conflict" group, those who scored between 2.5 and 3.6 were re-classified into the "medium work-family conflict" group, and those who scored more than 3.6 were re-classified into the "high work-family conflict" group (4). In this study, Cronbach's α for the scale was 0.934.

Statistical analysis

SPSS 25.0 for Windows was used to perform data analyses. In descriptive analyses, continuous variables were represented by mean and standard deviation (SD), while categorical variables were represented by frequency and percentage. *T*-test and one-way ANOVA were performed to examine the differences of work-family conflict scores among groups with diverse characteristics. Spearman correlations were used to test multicollinearity among independent variables. We started with univariable analysis to screen for candidate variables associated with work-family conflict using a cutoff value of $P < 0.1$. A generalized linear regression model was used to identify the related factors of work-family conflict. All comparisons were two-tailed and the significance threshold was $P < 0.05$.

Results

The basic characteristics of the participants are shown in Table 1. Among 10,457 emergency department physicians, 72.98% were males. Nearly two-thirds of the participants were younger than 40 years old. Most of them were married, accounting for 84.42%. About five-sixths of participants obtained a bachelor's degree. Nearly half of the participants had junior technical titles, worked in secondary hospitals, engaged in emergency work for 6 years or more, and worked 6∼10 night shifts per month. Only 29% of physicians earned more than 6,000 CNY per month. Approximately 70% of physicians perceived a shortage of emergency department physicians. 81.81 and 27.63% of physicians experienced verbal abuse and physical violence in the workplace, respectively.

The average score of work-family conflict among the enrolled emergency department physicians was 19.27 (SD = 3.94). Moreover, 7,235 participants (69.19%) were in the "high work-family conflict" group, 2,741 participants (26.21%) were in the "medium work-family conflict" group, and 481 participants (4.60%) were in the "low work-family conflict" group.

The univariate analysis results are shown in Table 1. There were significant differences in work-family conflict scores in gender, age, marital status, educational level, technical title, type of hospital, monthly income, years of service, frequency of night-shift per month, self-perceived shortage of physicians, verbal abuse and physical violence at workplace.

Based on the results of the Spearman correlation analysis (Supplementary Table S1), we excluded length of service from the multivariable analysis to minimize multicollinearity among independent variables. The findings for the multivariable analyses are presented in Table 2. Emergency physicians who were female (linear regression coefficient, −0.25; SE, 0.08; $P = 0.002$), older than 40 years (linear regression coefficient, −0.53; SE, 0.14; $P < 0.001$), and earning more than 4,000 CNY per month (e.g., 4,001∼6,000 vs. ≤4,000 CNY: linear regression coefficient, −0.17; SE, 0.09; $P = 0.04$) suffered less work-family conflicts. However, emergency department physicians who were married (linear regression coefficient, 0.37; SE, 0.11; $P < 0.001$), highly educated (linear regression coefficient, 0.46; SE, 0.10; $P < 0.001$), and with a higher technical title (e.g., intermediate vs. junior technical title: linear regression coefficient, 0.61; SE, 0.09; $P < 0.001$) scored more points for work-family conflict. Physicians who worked in secondary hospital (linear regression coefficient, 0.33; SE, 0.10; $P = 0.001$) and tertiary hospital (linear regression coefficient, 0.38; SE, 0.11; $P < 0.001$) had higher work-family conflict scores compared to physicians working in emergency center. In addition, emergency department physicians with a high frequency of night shifts (e.g., 6∼10 night shifts per month vs. 0∼5 night shifts per month: linear regression coefficient, 0.43; SE, 0.10; $P < 0.001$), self-perceived shortage of physicians (linear regression coefficient, 2.22; SE, 0.08; $P < 0.001$), and experienced verbal abuse (linear regression coefficient, 1.48; SE, 0.10; $P < 0.001$) and physical violence (linear regression coefficient, 0.84; SE, 0.08; $P < 0.001$) at the workplace scored higher on work-family conflict.

Discussion

This study investigated the work-family conflict and related factors of emergency department physicians in China. The results showed that ∼70% of emergency department physicians were in the high work-family conflict group, which is higher than that of French emergency department physicians (50.1%) (4). It may be attributed to the differences in the emergency department working environment in different countries. A previous report revealed that the average annual income of Chinese physicians was lower than that of developed countries (25), and our results indicated that participants with high monthly incomes had lower scores of work-family conflict.

Gender difference of work-family conflict has always been a concern in the world (13, 26). This study revealed that male emergency department physicians had significantly higher work-family conflict scores than females. However, in Japan, females were reported to be more easily to experience work-family conflict (26). This may be caused by cultural differences in different countries and regions. In traditional Chinese social culture, men, as the

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TABLE 1 Participants' characteristics and their associations with work-family conflict.

Variables	*n*	%	WFC ($M \pm SD$)	*F/t*	*P*
Total	10,457		19.27 ± 3.94		
Gender					
Male	7,632	72.98	19.48 ± 3.89	8.81	<0.001
Female	2,825	27.02	18.71 ± 4.02		
Age (year)					
≤29	1,925	18.41	18.63 ± 4.19	34.56	<0.001
30∼34	2,728	26.09	19.53 ± 3.91		
35∼39	2,463	23.55	19.72 ± 3.92		
≥40	3,341	31.95	19.09 ± 3.76		
Marital status					
Unmarried/widowed/divorced/separated	1,629	15.58	18.62 ± 4.21	−6.92	<0.001
Married	8,828	84.42	19.39 ± 3.88		
Educational level				−9.53	<0.001
Junior college degree or less	1,684	16.10	18.41 ± 4.06		
Bachelor degree and above	8,773	83.90	19.44 ± 3.90		
Technical title					
Junior	4,972	47.55	18.92 ± 4.11	42.26	<0.001
Intermediate	4,112	39.32	19.69 ± 3.78		
Senior	1,373	13.13	19.28 ± 3.68		
Type of hospital				17.34	<0.001
Emergency center	1,681	16.08	18.97 ± 4.11		
Primary	748	7.15	18.46 ± 4.18		
Secondary	4,442	42.48	19.39 ± 3.85		
Tertiary	3,586	34.29	19.44 ± 3.89		
Monthly income (CNY)					
≤4,000	3,862	36.93	19.24 ± 4.00	2.34	0.10
4,001∼6,000	3,562	34.06	19.38 ± 3.84		
≥6,001	3,033	29.00	19.18 ± 3.97		
Years of service					
<1	1,448	13.85	18.51 ± 4.10	48.65	<0.001
1∼5	3,965	37.92	19.12 ± 3.92		
≥6	5,044	48.24	19.61 ± 3.87		
Frequency of night shift (per month)					
0∼5	2,033	19.44	18.09 ± 3.91	174.41	<0.001
6∼10	5,633	53.87	19.24 ± 3.87		
≥11	2,791	26.69	20.20 ± 3.87		
Self-perceived shortage of physicians					
No	2,790	26.68	17.22 ± 3.97	−32.59	<0.001
Yes	7,667	73.32	20.02 ± 3.65		
Verbal abuse in the workplace				−24.77	<0.001
No	1,902	18.19	17.18 ± 4.15		
Yes	8,555	81.81	19.74 ± 3.74		

(Continued)

TABLE 1 (Continued)

Variables	*n*	%	WFC ($M \pm SD$)	*F/t*	*P*
Physical violence in the workplace				−19.99	<0.001
No	7,568	72.37	18.81 ± 3.91		
Yes	2,889	27.63	20.47 ± 3.75		

WFC, work-family conflict.

primary breadwinners, are asked to dedicate more time and energy to work (27). At the same time, they are allowed to take on less responsibility in the home (28). However, with the increase in dual-earner families, a new fathering ideal has emerged in recent years in which fathers are expected to be involved in child care and domestic responsibilities (29). Because men are expected to not only take responsibility for raising a family, but also share care work with their partners at home, they are more likely to experience work-family conflict in China nowadays.

Our findings showed that emergency department physicians over 40 years old had a lower work-family conflict. This may be due to the fact that most participants in this age group were in a relative balance of work and family (30). They are more capable of dealing with the role conflict between the two fields. Besides, married emergency department physicians scored higher on work-family conflict than physicians in single or other marital status, which is consistent with the previous study (21). The probable reason may be that the married ones have more opportunities to share family responsibilities, such as parenting and doing housework (31). Hospital administrators should pay more attention to aged <40 years old and married physicians on the issue of work-family conflict.

In terms of work-related factors, emergency department physicians with higher educational level and technical title had higher work-family conflict scores. As we all know, these physicians have accumulated more medical knowledge and professional skills, and they undertake heavier emergency tasks in department (32). Their work takes up a greater proportion of time and is prone to conflict with their family roles (33). Therefore, the work-family conflict of emergency department physicians with highly educated and higher professional titles also needs extra attention.

Regarding to the hospital environment, the type of hospitals significantly associated with emergency department physicians' work-family conflict. The more serious the work-family conflict faced by physicians working in high-level hospitals, except in primary hospitals. It is reported that the number of hospital visits in descending order in China was tertiary hospital (1,854.79 million), secondary hospital (1,284.93 million), primary hospital (224.64 million), and other hospitals (213.01 million) (34). Therefore, physicians in high-level hospital are more easily to suffer from time-conflict between work role and family role. Moreover, physicians who experienced workplace violence, whether verbal abuse or physical violence, had higher scores on work-family conflict in this study. This may be because workplace violence can increase the psychological strain of emergency department physicians and negatively influence their family life with partners (35). It is recommended to develop friendly workplace policies for emergency department physicians, especially for tertiary hospitals.

This study also revealed that variables reflecting workload, such as the frequency of night shifts and self-perceived shortage of physicians in department, were significantly associated with work-family conflict of emergency department physicians. Participants with a high frequency of night shifts were more likely to experience work-family conflict, which was consistent with previous studies (36, 37). This is because more night shifts per month mean more time spent at work, which inevitably conflicts with family obligations. In addition, long-term irregular work schedules can affect physicians' moods, which in turn affects their family life (38, 39). In addition, respondents who perceived a shortage of emergency department physicians experienced a higher level of work-family conflict. The possible reason could be that a shortage of physicians leads to an increased workload for the physician on staff. As the work takes up more and more time and energy, it will interfere with the emergency department physicians' family life (23). Therefore, hospital administrators are suggested to establish a scientific shift system and keep the number of emergency department physicians to meet work demands.

Strengths and limitations

This is the first nationwide study to explore the current situation and related factors of work-family conflict among emergency department physicians in China. What's more, the work-related factors identified in this study are of importance in reducing work-family conflict among emergency department physicians. However, there are still some limitations. First, this was a cross-sectional study, which is limited in establishing a causal relationship between dependent and independent variables. Prospective studies are needed in further studies. Second, this study was conducted in China, and thus, the generalizability of our conclusion to other countries may be limited. Third, there are possibly more factors associated with work-family conflict among emergency physicians than explored in this study; therefore, we could not explore them all.

Conclusion

Most emergency department physicians experience high levels of work-family conflict in China. Hospital administrations should pay more attention to emergency department physicians who are male, younger than 40 years, married, highly educated, highly titled, working in a high-level hospital, earning <4,000 CNY per month, working a high number of night shifts, perceived understaffing, and experiencing verbal abuse and physical violence in the workplace. To reduce work-family conflict in the emergency department

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TABLE 2 General linear regression analysis of related factors of work-family conflict.

Variables	Coefficient	SE	*t*	*P*	95%CI	
Constant	14.74	0.18	81.09	<0.001	14.38	15.09
Gender						
Male*	0.00	–	–	–	–	–
Female	−0.25	0.08	−3.12	0.002	−0.41	−0.09
Age (year)						
≤29*	0.00	–	–	–	–	–
30∼34	0.14	0.12	1.20	0.23	−0.09	0.37
35∼39	−0.05	0.13	−0.36	0.72	−0.31	0.21
≥40	−0.53	0.14	−3.73	<0.001	−0.81	−0.25
Marital status						
Unmarried/widowed/divorced/separated*	0.00	–	–	–	–	–
Married	0.37	0.11	3.44	<0.001	0.16	0.59
Educational level						
Junior college degree or less*	0.00	–	–	–	–	–
Bachelor degree and above	0.46	0.10	4.34	<0.001	0.25	0.66
Technical title						
Junior*	0.00	–	–	–	–	–
Intermediate	0.61	0.09	6.51	<0.001	0.43	0.80
Senior	0.68	0.15	4.64	<0.001	0.39	0.96
Type of hospital						
Emergency center*	0.00	–	–	–	–	–
Primary	0.30	0.16	1.86	0.06	−0.02	0.61
Secondary	0.33	0.10	3.23	0.001	0.13	0.54
Tertiary	0.38	0.11	3.45	<0.001	0.16	0.59
Monthly income (CNY)						
≤4000*	0.00	–	–	–	–	–
4001∼6000	−0.17	0.09	−2.01	0.04	−0.34	−0.004
≥6001	−0.45	0.09	−4.75	<0.001	−0.63	−0.26
Frequency of night shift (per month)						
0∼5*	0.00	–	–	–	–	–
6∼10	0.43	0.10	4.42	<0.001	0.24	0.62
≥11	1.18	0.11	10.72	<0.001	0.97	1.40
Self-perceived shortage of physicians						
No*	0.00	–	–	–	–	–
Yes	2.22	0.08	26.86	<0.001	2.06	2.38
Verbal abuse in the workplace						
No*	0.00	–	–	–	–	–
Yes	1.48	0.10	15.05	<0.001	1.29	1.67
Physical violence in the workplace						
No*	0.00	–	–	–	–	–
Yes	0.84	0.08	10.04	<0.001	0.67	1.00

*Reference; $R^2 = 0.170$; F = 119.10, P < 0.001.

physicians, hospital administrators should develop family-friendly workplace policies, like job sharing, maternity or paternity leave, and parental leave, establish a scientific shift system, and keep the number of physicians to meet work demands.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Research Ethics Committee in Hainan Medical University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SJY, CJL, JWZ, and NJ were responsible for the conception, design, and writing of the manuscript. JLZ, YFW, and MGT were responsible for the acquisition of data and literature research. NJ, CJL, LL, and XZ were responsible for the analysis and interpretation of data. All authors read and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

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Occupational stress and associated factors among nurses working at public hospitals of Addis Ababa, Ethiopia, 2022; A hospital based cross-sectional study

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Background: By its very nature, the nursing profession involves a lot of stress. Working in this field includes interacting with individuals who are already under a great deal of stress. Workplace stress affects the quality of services provided and also causes staff burnout, departure, and absenteeism.

Objective: This study is to determine occupational stress and associated factors among nurses working at public hospitals, Addis Ababa, Ethiopia, 2022.

Materials and methods: An institutional based cross sectional study was conducted among 422 nurses working at public hospitals from March 1 to April 1/2022. Simple random sampling technique was used to select public hospitals. The calculated sample size was allocated proportionally to each hospital based on the number of nurses. Finally, systematic sampling method was used to approach the study participants. The data was collected by using a self-administered structured questionnaire (Expanded Nursing Stress Scale). The collected data was entered by Epi-data version 3.1 and analyzed by SPSS version 23. Descriptive analysis such as frequency distribution and measure of central tendency and variability (mean and standard deviation) was computed to describe variables of the study. Binary logistic regression was used to assess associations between dependent and independent variables. The degree of associations was interpreted using odds ratio (OR) and 95% confidence interval (CI) and statically significance at value of $p<0.05$. The result was presented using text, tables, and graphs.

Result: The study finding showed that 198 (47.8%) of nurses were occupationally stressful. Factors significantly associated with occupational stress among nurses were having children (no: AOR=0.46, 95% CI: 0.22, 0.96) and work shift (rotating: AOR=2.89, 95% CI: 1.87, 4.45).

Conclusion: In this study, job stress affected over half of the nurses. The presence of children and respondents' work shifts were personal characteristics that were significantly linked to job stress. Therefore based on this result the government policy makers, different stakeholders and hospitals need to collaborate to reduce nurses job related stress.

KEYWORDS

occupational stress, nurses, public hospitals, Addis Ababa, Ethiopia

1. Introduction

A common way to define stress is as a feeling of being overburdened, wound up tight, tense, and concerned (1). It is a disruptive condition that develops in reaction to harmful effects from the internal or external settings (2).

Occupational stress is defined by the National Institute for Occupational Safety and Health (NIOSH) as "the negative physical and emotional reactions that occur when the requirements of the job do not match the worker's talents, resources, or needs" (3). Occupational stress is sometimes referred to as job stress and/or work-related stress (WRS) in an organizational environment. In organizations, both phrases are frequently used interchangeably, but their meanings are the same (4).

One of the most significant sources of occupational stress is the workplace (5). Stress at work is a topic that psychologists, counselors, and employers are all quite concerned about (6).

In general, nursing is seen as a difficult and stressful career (7). Numerous studies have shown that working in nursing is stressful, which can have an adverse effect on one's physical and mental health as well as their professional performance (8).

Occupational stress can have a number of detrimental effects on both the individual and the company. Poor physical and mental health as well as organizational costs was documented at the individual and organizational levels (9). Additionally, stress has a cost in terms of one's health, wellbeing, and job satisfaction. It also has a cost for companies in terms of absenteeism and turnover, which may have an effect on the standard of patient care (10).

In organizations, stress has become a bigger issue over time (11). Stress varies in intensity depending on the circumstance and the person, and if it is not well managed, it can prevent people and organizations from reaching their objectives. The consequences of stress on medical workers, and nurses in particular, have drawn a lot of attention (12). Due to the nature of their occupation and the system in which they operate, nurses are perceived to be under more stress than the majority of individuals (13). The first of 40 stressful professions identified by the National Association of Safety Professionals is nursing (14).

In any healthcare facility, nurses make up the majority of the workforce and play a crucial role in patient care. Nurses provide direct care, and providing care is an interpersonal activity characterized by expert nursing, interpersonal sensitivity, and close connections, as well as by effective communication and the use of professional knowledge and abilities. Nursing staff members are occasionally asked to work lengthy hours without getting enough rest (15, 16). Consequently, the nursing profession is highly stressful. Furthermore, the occupation requires interacting with individuals who are under a great deal of stress themselves. Patients can occasionally be challenging, scared, or angry, and nurses may find themselves responding with an increasing irritation and anger that may result in quitting the profession (17, 18).

The major causes of stress among nurses at work include working shifts, long hours, a lack of control, poor relationships with coworkers, low pay, and unfavorable working conditions (19).

According to research, nurses who experience high levels of job-related stress and physical and mental health issues are more likely to quit their jobs, clash with coworkers, experience intense displacement, suffer from poor health and be unable to complete tasks, exhibit vulnerabilities in professional communication, and, as a result, provide lower-quality care and become dissatisfied with their careers. The influence could also have detrimental effects on patient care, such as medication errors and inadequate care for those receiving it (20).

Depending on research carried out in several nations, stress in particular in the nursing profession has been a significant global issue. A research conducted among staff members of a health authority in the United Kingdom revealed that nurses are under the most pressure out of all medical professionals (21). According to a research done in India, 87.4% of Indian nurses reported feeling stressed (22). Based on a research done in the Greater Accra Region of Ghana, the number of hours that nurses work, their financial situation, and patient deaths are all sources of stress (23).

In comparison to other African nations, Ethiopia has one of the lowest ratios of health personnel to population. One healthcare professional was assigned to every 4,050 people, according to a report from the World Health Organization. Resources shortages, macroeconomic problems, and governmental factors are the causes of Ethiopia's human resource crisis (24, 25). However, the final report of the Health Sector Development Program (HSDP) IV in Ethiopia indicated that there was a lack of nursing staff on a national level, with a nurse to population ratio of 1:3,870 (26). In Ethiopia, a study conducted in the Jima Zone in the southwest of the country revealed an average total job-related stress level of 58.46 ± 12.62, while in the East Gojjam Zone Public hospitals in the northwest, 57.3% of nurses reported experiencing occupational stress (15, 18).

The recent acceleration in the rate of COVID-19's spread resulted in a heavy workload, physical exhaustion, a high risk of infection, and ethical conflicts regarding decisions about which patients should be given priority. These factors led to significant psychological stress in healthcare professionals. Given that they spend more time with COVID-19 patients than any other healthcare provider, nurses are disproportionately impacted by the pandemic (27, 28).

The findings of this study will provide information on the prevalence and associated factors of occupational stress to nurses, hospital managers, and health policymakers. It also help health care institutions; particularly hospitals to recognize factors related to stress & help them to take corrective measures in attempt to create conducive environment and to improve the health status of their employees as well as efficiency and quality of care. In addition to this the data gathered will aid in the development of appropriate interventions for stress reduction strategies and programs. Furthermore, this research will create knowledge that may be used as input for future research in the same field.

Although study on the topic of work-related stress among nurses in developed countries has been documented, there is currently little data backed by studies conducted in developing nations, such as

Abbreviations: AOR, Adjusted odd ratio; CI, Confidence Interval; COR, Crude odd ratio; COVID-19, Coronavirus disease 2019; ENSS, Expanded nursing stress scale; HSDP, Health sector development program; ICU, Intensive care unit; NIOSH, National institute for occupational safety and health; OR, Odd ratio; SPSS, Statistical package of social sciences; SD, Standard deviation; WRS, Work related stress.

Ethiopia. Thus, this study determines the prevalence of stress among nurses in the study area as well as its contributing elements.

2. Materials and methods

2.1. Study setting and design

This study was conducted in Addis Ababa which is the capital city of Ethiopia. It is located at the center of the country with an estimated area of 527 square kilometers (29). Currently, Addis Ababa has 12 state run and more than 40 private hospitals (29). Five public hospitals namely, Menelik II, St. Paul, St. Peter, Yekatit 12 and Zewditu memorial hospitals was included in this study. The study was done from March 1 to April 1/2022. Institution based cross sectional study was conducted.

2.2. Source population and study population

The source population was nurses who were working at public hospitals of Addis Ababa and the study population was nurses who were working at selected public hospitals of Addis Ababa.

2.3. Inclusion criteria and exclusion criteria

Nurses who had experience of working for at least 6 months at public hospitals were included whereas nurses who were ill or on leave (annual, maternal, or sick) during data collection period were excluded.

2.4. Sample size and sampling technique

A single population proportion calculation was used to get the sample size. The previous research's 49.2% prevalence rate of occupational stress is used to compute the sample size (30). Five hospitals were selected by simple random sampling technique. The calculated sample size was allocated proportionally to each hospital based on the number of nurses. Finally, simple random sampling method was used to approach the study participants.

2.5. Data collection tools

Data was collected using self-administered structured questionnaire. There are three sections in the questionnaire. Socio-demographic information, working place data, and Modified Expanded Nursing Stress Scale make up Parts 1 through 3. An instrument for measuring work-related stress is the Expanded Nursing Stress Scale (31). The ENSS measures occupational stress by using 54 items over eight subscales. The response options on the ENSS questionnaire, which is often created using a likert scale format, typically suggest that stress levels are (1 = never stressful, 2 = occasionally stressful, 3 = frequently stressful, and 4 = always stressful). The responder agreed that the scenario was stressful to a greater extent the higher the score. An overall chronbach's alpha score of 0.9 indicates that the instrument is reliable (31).

2.6. Data collection procedure

Five BSc nurses one for each hospital as data collector and two BSc nurses as supervisor working outside the selected hospitals was recruited. On the day of data collection, the data collectors explained the purpose of the study to the participants before data collection. Then self-administered structure questioner was distributed by giving appropriate instruction to assist respondents how to fill the questions. The study was done from March 1 to April 1/2022.

2.7. Data quality control

A pre-test was conducted using 5% of the sample size among nurses working at Ras Desta Damtew hospital 2 weeks prior to data collection and necessary amendment was made. To ensure quality of data training was given for data collectors and supervisors on data collection tool and data collection procedure. Data completeness was checked by data collectors and principal investigator.

2.8. Data processing and analysis

Data was coded, cleaned and entered to Epi-data version 3.1 and exported to Statistical Package for Social Science (SPSS) version 23 for analysis. Descriptive analysis such as frequency distribution and measure of central tendency and variability (mean and standard deviation) was computed to describe variables of the study. Binary logistic regression was used to assess associations between dependent and independent variables. The degree of associations was interpreted using odds ratio (OR) and 95% confidence interval (CI) and statically significance at value of $p < 0.05$. The result was presented using text, tables, and graphs.

3. Results

3.1. Socio demographic characteristics of the respondents

This study had a response rate of 414 (98.1%). In all, 178 (43%) men and 236 (57%) women took part in the study. The respondents' average age was 27.85 ± 4.28 years. According to this study, 350 (84.5%) of individuals had a BSc degree. Nurses with 5 to 10 years of professional experience made up more than 50% of the participants. Additionally, 179 (43.2%) respondents had children, while 190 (45.9%) respondents were married (Table 1).

3.2. Work place characteristics of the respondents

Majority of participants 239 (57.7%) reported working shift of them were rotating. Most of participants 250 (60.4%) had a daily work schedule of no more than 8 h (Table 2).

TABLE 1 Socio-demographic characteristics of nurses working at public hospitals of Addis Ababa, Ethiopia, 2022 (*N*=414).

Variables	Categories	Frequency	Percent
Age	<25 years	43	10.4
	25–30 years	217	52.4
	>30 years	154	37.2
Gender	Male	178	43
	Female	236	57
Marital status	Single	220	53.1
	Married	190	45.9
	Divorced	4	0.96
Children	Yes	179	43.2
	No	235	56.8
Level of education	Diploma holder	25	6
	Bachelor degree	350	84.5
	Master degree	39	9.4
Experience	<5 years	105	25.4
	5–10 years	268	64.7
	>10 years	41	9.9
Monthly salary (in birr)	<5,000	35	8.5
	5,000–9,000	326	78.7
	>9,000	53	12.8

TABLE 2 Work place characteristics of nurses working at public hospitals of Addis Ababa, Ethiopia, 2022 (*N*=414).

Variables	Categories	Frequency	Percent
Working unit	Medical ward	116	28.0
	Surgical ward	58	14.0
	Obstetrics and Gynecology	36	8.7
	Pediatrics	67	16.2
	Other	137	33.1
Work shift	Fixed	175	42.3
	Rotating	239	57.7
Hours worked per day	≤8 h	250	60.4
	>8 h	164	39.6

3.3. Prevalence of occupational stress among nurses

In order to assess the prevalence of occupational stress, participants who scored below the mean value were labeled as "Not stressed," while those who scored the mean value or higher were categorized as "Stressed." As a result, 198 (47.8%) of nurses reported having occupational stress (Figure 1).

The mean score of the occupational stress subscales was computed. According to this research, the least stressful aspects of nurses' jobs were problems with peers while the most stressful aspects were death and dying, uncertainty about treatment, and conflict with physician (Table 3).

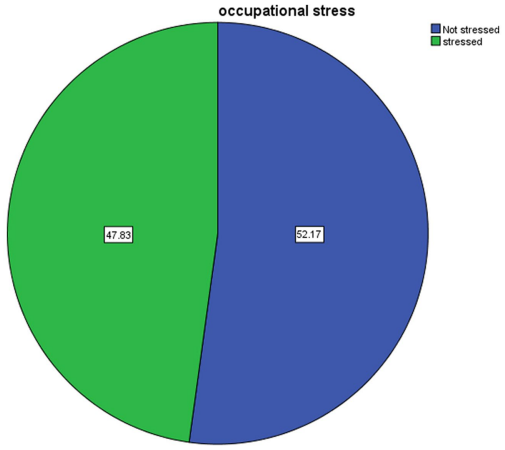

FIGURE 1
Prevalence of occupational stress among nurses working at Addis Ababa public hospitals, Ethiopia, 2022.

TABLE 3 Mean score of response of nurse to ENSS in Addis Ababa public hospitals, Ethiopia, 2022 (*N*=414).

Subscales	Number of Items	Mean
Psychological factors		
Death and dying	7	2.87
Uncertainty concerning treatment	9	2.53
Inadequate emotional preparation	3	2.36
Physical factors		
Workload	9	2.476
Social factors		
Conflict with physician	5	2.478
Problems with peers	6	2.29
Problems with supervisors	7	2.40
Patient and family	8	2.46

3.4. Factors associated with occupational stress

The relationship between the independent variables and the dependent variable was examined using binary logistic regression. The multivariate analysis included all independent variables with *p*-values less than 0.25 in the bivariate analysis, and *p*-values less than 0.05 in multiple logistic regressions were regarded as significant. The results of the multivariate analysis showed that working shifts and having children were both strongly related to job stress.

According to the findings, nurses without children were 54% less anxious than nurses with children (AOR: 0.46, 95% CI: 0.22, 0.96). Working rotating shifts increased respondents' risk of occupational stress by 2.8 times compared to working fixed shifts (AOR = 2.89, 95% CI: 1.87, 4.45) (Tables 4, 5).

TABLE 4 Socio demographic results of bivariate and multivariate binary logistic regression of factors associated with occupational stress among nurses working at public hospitals of Addis Ababa, Ethiopia, 2022 (*N*=414).

Variables	Categories	Occupational stress		COR (95% CI)	AOR (95% CI)
		Yes, *N* (%)	No, *N* (%)		
Age	<25 years	23 (53.5%)	20 (46.5%)	1.00	
	25–30 years	106 (48.8%)	111 (51.2%)	0.83 (0.43, 1.6)	
	>30 years	69 (44.8%)	85 (55.2%)	0.70 (0.35,1.39)	
Gender	Male	81 (45.5%)	97 (54.5%)	1.00	
	Female	117 (49.6%)	119 (50.4%)	1.17 (0.79, 1.73)	
Marital status	Single	119 (29.71%)	101 (24.39%)	1.00	1.00
	Married	72 (37.9%)	118 (62.1%)	0.51 (0.34, 0.76)*	0.54 (0.34, 0.84)
	Divorced	2 (50%)	2 (50%)	0.84 (0.11, 6.13)	1.69 (0.21, 13.56)
Children	Yes	78 (43.6%)	101 (56.4%)	1.00	1.00
	No	120 (51.1%)	115 (48.9%)	1.35 (0.91, 1.99)*	0.46 (0.22, 0.96)**
Level of education	Diploma holder	12 (48.0%)	13 (52.0%)	1.00	
	Bachelor degree	163 (46.6%)	187 (53.4%)	0.94 (0.41, 2.12)	
	Master degree	23 (59.0%)	16 (41.0%)	1.55 (0.56, 4.28)	
Experience	<5 years	58 (55.2%)	47 (44.8%)	1.00	1.00
	5–10 years	125 (46.6%)	143 (53.4%)	0.70 (0.45, 1.11)*	0.77 (0.46, 1.28)
	>10 years	15 (36.6%)	26 (63.4%)	0.46 (0.22, 0.98)*	0.89 (0.34, 2.36)
Monthly salary (in birr)	<5,000	17 (48.6%)	18 (51.4%)	1.00	1.00
	5,000–9,000	166 (50.9%)	160 (49.1%)	1.09 (0.54, 2.20)	1.59 (0.74, 3.40)
	>9,000	15 (28.3%)	38 (71.7%)	0.41 (0.17, 1.02)*	0.63 (0.23, 1.73)

CI = confidence interval, COR = crude odds ratio, AOR = adjusted odds ratio. *$p < 0.25$; **$p < 0.05$.

TABLE 5 Work place results of bivariate and multivariate binary logistic regression of factors associated with occupational stress among nurses working at public hospitals of Addis Ababa, Ethiopia, 2022 (*N*=414).

Variables	Categories	Occupational stress		COR (95% CI)	AOR (95% CI)
		Yes, *N* (%)	No, *N* (%)		
Working unit	Medical unit	60 (51.7%)	56 (48.3%)	1.00	1.00
	Surgical unit	28 (48.3%)	30 (51.7%)	0.74 (0.32, 1.72)	0.47 (0.18, 1.21)
	Obstetrics and Gynecology	20 (55.6%)	16 (44.4%)	0.85 (0.40, 1.81)	0.73 (0.31, 1.68)
	Pediatrics	28 (41.8%)	39 (58.2%)	0.57 (0.25, 1.3)*	0.63 (0.24, 1.62)
	Other unit	62 (45.3%)	75 (54.7%)	0.66 (0.31, 1.38)	0.60 (0.26, 1.39)
Work shift	Fixed	60 (34.3%)	115 (65.7%)	1.00	1.00
	Rotating	138 (57.7%)	101 (42.3%)	2.61 (1.74, 3.92)*	2.89 (1.87, 4.45)**
Hours worked per day	≤8 h	127 (50.8%)	123 (49.2%)	1.00	1.00
	>8 h	71 (43.3%)	93 (56.7%)	0.73 (0.49, 1.09)*	0.75 (0.48, 1.16)

CI = confidence interval, COR = crude odds ratio, AOR = adjusted odds ratio. *$p < 0.25$; **$p < 0.05$.

4. Discussion

The prevalence of occupational stress among nurses was found to be 47.8% in this study, which is higher than the studies conducted in Isfahan, Iran, which found that the prevalence of stress was 34.9% (32) and Addis Ababa, Ethiopia, which found that the prevalence of occupational stress among nurses was 37.8% (33). The difference could be a result of the different tools used and the sample size, but another explanation could be that Isfahan, Iran, had stronger occupational health and safety practices implemented.

However, the results of this study are less significant than those of earlier research done in Delhi, which found that 87.4% of nurses experienced job-related stress, and in Jima Zone South West Ethiopia, which found that the average level of job-related stress was 58.46 ± 12.62 (15, 34). When compared to the study conducted in Jima, this may be related to sample size, however in Delhi, the discrepancy may be caused by study tools and the study location.

According to this study, the four main sources of stress for nurses are "death and dying," "uncertainty regarding patient treatment," "conflict with physician," and "work load." The biggest source of stress,

in respondent's opinions, was death and dying. The current study found that dealing with death and dying situations is a significant source of stress, which is consistent with studies conducted in Sudan, where dealing with death and dying situations had the highest mean scores of ENSS, mean = 2.23, Standard deviation = 0.56, and in Jima, where the highest stressful condition that nurses rated as always stressful was the death and dying of a patient with 62.94%, followed by uncertainty regarding patient treatment with 57.72% (15, 35). The study participants' cultural and humanitarian sympathy may be the cause of their emotional problems with relation to the patient's death or dying.

Uncertainty regarding the treatment subscale was the second cause of work-related stress in this study. Similar findings were found in a research conducted among 135 ICU nurses at the Children's University Hospital at El-Shatby (Egypt), which demonstrated "death and dying" followed, by uncertainty concerning the treatment (36). This could be as a result of a lack of knowledge, experience, or expertise in dealing with unforeseen and challenging issues.

The third source of stress had a mean score of 2.47 and was conflict with physician subscale. Conflict with physician was identified as a source of work-related stress in studies conducted in Spain, which is consistent with this finding (37). This may be due to a lack of relationships, communication, and cooperation.

Many of socio-demographic and workplace factors in this study had no statistically significant relationships with overall occupational stress. This may be the tool's strongest attribute. In multivariate logistic regression, the only significant predictors of occupational stress were having children and working a shift.

According to this study, there is a significant association between having children and workplace stress. Nurses who did not have children reported being 54% less stressed than those who did (AOR: 0.46, 95% CI: 0.22, 0.96). This may be because raising children increases the workload for these nurses. This study is in line with one done in Kampala, Uganda, which found that nurses in Ugandan hospitals deal with a fair amount of occupational stress. Additionally, the findings revealed that nurses without children experienced much less occupational stress than those with children (38).

A significant relationship between work shift and stress at work was also discovered in this study; rotating shift nurses reported higher levels of stress than fixed shift nurses (AOR = 2.89, 95% CI: 1.87, 4.45). This result was in line with a study conducted in Addis Ababa, which found that nurses working rotational shifts experienced higher levels of stress than those working fixed shifts (39). Additionally, this result was consistent with study conducted in Egypt that found the work shift was the strongest predictor of nurses' stress (36) and that revealed nurses working the rotating shift were more stressed than those who worked the morning shift (40).

5. Limitations of the study

Since stress is mainly subjective and psychological, the qualitative approach would provide rich and meaningful information about the nurses' experiences with stress and related concepts.

6. Conclusion

In this study, about half of the nurses reported experiencing occupational stress. The presence of children and respondents' work shifts were personal characteristics that were significantly linked to job stress. The biggest drivers of work-related stress for nurses were death and dying, treatment uncertainty, conflict with physician, and problem with peers.

According to these findings, Ministry of Health and Addis Ababa Health Bureau and Nursing stake holders should collaborate to design stress management programs for nurses that include the proactive identification and evaluation of stressors in work areas. All hospitals and nursing administrators must take responsibility for the health and well-being of their staff by reducing stressful situations. They should reschedule shifts and recruit adequate nurses, decreasing workloads. Furthermore, support systems such as counseling services and self-help groups should be made available to nurses.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical clearance was obtained from Addis Ababa Health Bureau before data collection. Supportive letter was obtained from Kotebe University of Education, Menelik II College of Medical and Health Science. Oral consent was obtained from each study participants during data collection. Right was given to study participants to refuse, stop, or withdraw from the interview at any time. Confidentiality was maintained throughout the study.

Author contributions

EW wrote the proposal, participated in data collection, analyzed the data, wrote the manuscript, and approved the manuscript for publication. ZW reviewed and approved the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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"You knew you had to be there, it had to be done": Experiences of health professionals who faced the COVID-19 pandemic in one public hospital in Spain

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Introduction: The COVID-19 pandemic highlighted the lack of a government contingency plan for an effective response to an unexpected health crisis. This study uses a phenomenological approach to explore the experience of healthcare professionals during the first three waves of the COVID-19 pandemic in a public health hospital in the Valencia region, Spain. It assesses the impact on their health, coping strategies, institutional support, organizational changes, quality of care, and lessons learned.

Methods: We carried out a qualitative study with semi-structured interviews with doctors and nurses from the Preventive Medicine, Emergency, and Internal Medicine Services and the Intensive Care Unit, using the Colaizzi's 7-step data analysis method.

Results: During the first wave, lack of information and leadership led to feelings of uncertainty, fear of infection, and transmission to family members. Continuous organizational changes and lack of material and human resources brought limited results. The lack of space to accommodate patients, along with insufficient training in treating critical patients, and the frequent moving around of healthcare workers, reduced the quality of care. Despite the high levels of emotional stress reported, no sick leave was taken; the high levels of commitment and professional vocation helped in adapting to the intense work rhythms. Healthcare professionals in the medical services and support units reported higher levels of stress, and a greater sense of neglect by their institution than their colleagues in managerial roles. Family, social support, and camaraderie at work were effective coping strategies. Health professionals showed a strong collective spirit and sense of solidarity. This helped them cope with the additional stress and workload that accompanied the pandemic.

Conclusion: In the wake of this experience, they highlight the need for a contingency plan adapted to each organizational context. Such a plan should include psychological counseling and continuous training in critical patient care. Above all, it needs to take advantage of the hard-won knowledge born of the COVID-19 pandemic.

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KEYWORDS

COVID-19 pandemic, health professionals, contingency plan, organizational changes, quality of care provision, coping strategies, qualitative research

1. Introduction

On 30 January, the WHO declared a COVID epidemic—caused by SARS-CoV-2 (1). Since then, the pandemic has had an unstable evolution, with peaks and troughs in cumulative incidence that have varied by country, and by region within individual countries. In Spain, the National Epidemiological Monitoring Network (Red Nacional de Vigilancia Epidemiológica) defined the first wave: from January to 21 June 2020; the second wave: from 22 June to 6 December 2020, and the third wave: from 7 December 2020 to 14 March 2021 (2). The onset of the pandemic highlighted the lack of contingency planning by governments and the health system. In most countries, prevention and tracking systems failed, there was a shortage of personal protective equipment (PPE), respirators, hospital beds, knowledge of diagnostic tests, and drug treatment (3, 4). Spain lacked a national plan to respond effectively to this health crisis, to address not only the organizational changes required at all levels of care, but also such aspects as leadership and links between organizations (5, 6). Results from several reviews of the experiences of healthcare workers coping with the COVID-19 pandemic show that front-line staff, especially nurses, and staff with little work experience, were at higher risk of anxiety, depression, stress, and insomnia (7–10). Also, factors such as female gender, level of responsibility within the service, and whether the hospital was in a severely affected area also played a role (8). Similarly, factors that reduced the impact were social and psychological support and regular physical exercise (9). A review of qualitative studies (11) identified factors that affected the experience of healthcare workers and their support needs during the pandemic using a comprehensive model that assesses the interaction of individual, interpersonal, institutional, social, and political domains. There are few studies analyzing the interaction of these different domains and comparing the experience of healthcare workers in different hospital services, with different responsibilities and roles (face-to-face care, management) during the pandemic.

The present study was carried out in response to the following objectives: (1) to explore the experiences of healthcare workers from different hospital services who worked during the first three waves of the COVID-19 pandemic in a hospital in the public network of the Valencian Community; (2) To assess the impact of the work and the support received on the quality of care and the health of these healthcare workers; (3) To examine the coping strategies that developed; and (4) To identify proposals for improvement in management, quality of care, and quality of work in the face of a pandemic. In the geographical area covered by our study, the first wave did not have a major impact on the volume of patients. In fact, all interviewees agreed that it was a period of preparation for future waves. The third wave is described as having the greatest impact on work overload due to the number of patients and the emotional strain experienced by the vast majority of the healthcare professionals. Indeed, in the Valencian Community, the third wave was the most severe, with death rates per 100,000 inhabitants of 51.17 compared to 17.65 in the Community of Madrid autonomous region (12). Moreover, it was the only region of Spain where the third wave exceeded the previous two in deaths (13).

2. Materials and methods

2.1. Design

This is a qualitative study with a phenomenological approach using a semi-structured interview technique. The phenomenological approach employs modes of discourse that try to merge cognitive and non-cognitive factors. By these terms, we mean that not only do we understand things intellectually or conceptually, but we also experience things in corporeal, relational, enactive, and situational modalities (14). This study follows the principles of qualitative research and used the COnsolidated criteria for REporting Qualitative research (COREQ) (15).

2.2. Participants, scope of study, and recruitment

The study population consisted of healthcare professionals: doctors, nurses, and auxiliary nursing care technicians (ANCs) from a public university hospital in the Valencian Community (Spain), part of the National Health System (Sistema Nacional de Salud—SNS), which serves a population of more than 200,000 people. Participants had to meet the following inclusion criteria: (1) to have been working during the first three waves of the COVID-19 pandemic in one of the following services or units: the Preventive Medicine, Emergency, and Internal Medicine Services and the Intensive Care Unit. For a more heterogeneous discourse, it included an equal number of male and female participants, having different ranks and roles (heads/supervisors/management, senior doctors, junior doctors, and residents). Participants were recruited by means of purposive sampling using the snowball technique between 31 May and 15 July 2021.

A heterogeneous sample of 14 healthcare professionals was recruited, of diverse demographic characteristics in terms of age, gender, functions performed, and years of experience.

2.3. Data collection

A script for conducting the semi-structured interview was developed based on the literature review, the results of a previous study, and consultation with experts (Supplementary Appendix 1). Participants

were selected and contacted by telephone through key informants. For those who accepted to participate in the study, their personal email address was requested. Next, an interviewer trained in semi-structured interviews sent them an email and offered detailed information about the project, answering doubts and questions. After obtaining informed consent, a date was set for the interview, which was conducted through video conference using the google meet platform, outside hospital working hours. The interviews lasted 43 min on average and were recorded in their entirety with prior authorization having been obtained.

2.4. Analytical procedure

The Colaizzi's 7-step method was used for data analysis (16, 17). The first three steps were: verbatim transcription of the interviews; verbatim reading of the texts; and annotations based on analytical intuitions. The fourth step consisted of the disclosure analysis using the NVivo 12 program (18), classifying the information into the categories and subcategories of nodal analysis set out in Table 1. These were established before starting the classification, based on the questions in the questionnaire. This framework obtains for each of the different sections of this study. Briefly, the discourse analysis took into account the interpretations of the discursive positions according to the characteristics of the participants. In this sense, the discourses were segmented whenever possible by: type of service, work role, and function performed. The focus was on perceptions, feelings/sensations, excuses, explanations, and/or justifications. The initial premise was based on prior knowledge, linguistic resources, points of view, silences, contradictions, and opinions, whether shared or not with the reference group of which they were part. The symbolic configurations and semantic spaces within and between the different texts were also analyzed. The fifth step included the description of the phenomenon, integrating all the resulting ideas. This was achieved by combining all the theme clusters, emergent themes and formulated meanings into a description to create an overall structure. The next step (six) described the fundamental structure of the phenomenon, with a synthesis of the main findings according to the objectives. The analysis was performed independently and triangulated between the interviewer and another member of the research team, followed by discussion, and consensus as a procedure for validation and quality control of the results obtained. Finally, in the 7-step, results were returned to the participants to validate the findings.

2.5. Ethical aspects

The present study followed the guidelines set out by the Declaration of Helsinki and conformed to the principles of medical research ethics. Prior to interview, all participants signed an informed consent form. Their participation was voluntary and

TABLE 1 Analysis of categories.

Categories	Subcategories	Headings
Experiences, feelings, initial concerns	First reactions	1. How did they react on hearing the news: initial feelings and concerns
	Initial feelings	
	Higher concerns	
	Increased impact	
Management of the pandemic in the first and subsequent waves	Changes in usual work performance	2. Organizational changes to the services during the first and successive waves
	Coordination with other services.	
Impacts	On the provision of care	3. Impacts of the pandemic on care provision
	On the health of health professionals	4. Impacts of the pandemic on the health of healthcare professionals.
Aid and support	At the institutional level: - Facilitating factors and inhibitors of the level of emotional overload.	5. Institutional sources of support, coping strategies, and feelings of support
	At the personal level: - Coping strategies, - Feelings of support,	
Assessment of the experience	Level of personal satisfaction (success, challenge, failure…)	6. Recovery level
	Organizational aspects that have, - improved, - worsened, - remain the same Positive and negative organizational aspects	7. Proposals for improvement
Other emergent themes		

anonymous, and they could withdraw from the study at any time without explanation. During the interview, the privacy and comfort of the participants was a priority at all times, as was confidentiality. The research was approved by the ethical committee of the hospital. However, due to a confidentiality agreement between the participants and the research team, the name of the hospital cannot be disclosed.

2.6. Rigor

The results of the analysis were presented to the participants, obtaining their agreement, with both parties deciding to remove identifiable information from the verbatim quotes that feature in this article.

3. Results

3.1. Study sample

The sample constitutes 14 health professionals: eight women and six men, with professional experience ranging between 4 and 22 years, and included a Family Medicine doctor who moved from the health center to work in the hospital's Emergency Service at the start of the pandemic. Some healthcare professionals who usually carried out healthcare tasks were involved in management tasks (organization of human and material resources, updating of action protocols) and others, with exclusive usual management tasks were involved in patient care or search for effective treatments, working, at the same time, both tasks. Table 2 describes the detailed characteristics of the healthcare professionals who participated in the study.

3.2. Initial experiences, feelings, and concerns: How the news was received

In general, the healthcare professionals in the services consulted responded to the news of the epidemic unrealistically and inconsistently. In the Internal Medicine Service, the news was received as simply another health alert, and in Preventive Medicine with skepticism and disbelief, while in Emergency Services and the Intensive Care Unit it was perceived as an opportunity for recognition of their specialty.

> "…one person told me: have you heard? It looks like it's pneumonia, … and I said to myself that it was just a routine case, wasn't it? And, towards the end of January, that's when we started to get scared. I remember we had a meeting … we had a meeting between the IDU and the Emergency Services, the management. And in that meeting I remember (laughs) saying that the risk was low, that we were going to have one or no cases in our country …! That's how it all started."

> "For me, in terms of work, it was good because thanks to the pandemic I had a contract as a normal person [better]. There was a lot of expectation …, it was the first time I'd heard so much talk about my specialty, about my work, […] I had a feeling of contentment, of feeling useful in a pandemic …"

In the first wave, the combination of lack of leadership and of information led to feelings of helplessness and uncertainty due to the

TABLE 2 Job profile characteristics of the participants.

Service	Male	Female	Job title	Role	Cod_ Number **
Preventive medicine		X	Nursing professional (hospital)	Management	3
		X	Head of service/section	Management	5
Emergency Service		X	Head of service/section	Management	10
	X		Physician	Patient care	13
	X		Nursing professional (hospital)	Management	8
Internal medicine service, infectious diseases unit (IDU)	X		Nursing professional (HHU*)	Management	2
		X	Nursing professional (HHU)	Patient care	9
		X	Physician	Patient care	4
	X		Physician	Department Head	6
Intensive care unit (ICU)	X		Physician	Management	7
		X	Nursing professional (hospital)	Patient care and management	12
		X	Nursing professional (hospital)	Patient care	14
	X		Nursing professional (hospital)	Patient care	1
		X	Physician	Patient care	11

*Home Hospitalization Unit (HHU), modality of healthcare focused on providing specialized hospital care to patients at home. **Identification's number of each participant, assigned according to the date of the interview.

impossibility of carrying out adequate planning. This was most evident in Emergency, and Internal Medicine Services, and ICU.

> "… fundamentally, the problem in the first wave was the uncertainty, that nobody was taking the reins. Many times you knew what you had to do, but it wasn't contemplated in the guidelines, you knew what you had to do, but you didn't have the means to do it."

All healthcare professionals involved in direct patient care repeatedly expressed feelings of fear of infection and of transmission to household members and/or at-risk family members, aggravated by the lack of protective equipment.

> "… we lacked material …, the first month and a half was horrible because we knew we were going into battle, that we would be coming under fire, and we didn't have bulletproof vests."

Healthcare professionals in coordination and management roles expressed fear over safety conditions at work and of reactions from colleagues and/or workers' representatives at having to implement guidelines that were unfeasible given the lack of equipment.

> "In the first wave, I was very afraid, with the whole equipment issue, … everything was uncertain and the daily fear of being left without equipment. And the pressure from other groups …, from the nursing staff, the trade union, we needed answers, and they weren't coming. But, of course, the guidelines said: you need this. But there's nothing left!"

3.3. Organizational changes in the services during the first and subsequent waves

The first task of the Preventive Medicine Service was to manage and continuously update the operational guidelines of the other services. A technical commission was set up for the coordination of the pandemic, composed of physicians from preventive medicine, infectious diseases, the microbiology service, occupational hazards, medical management, and the hospital management. The professionals emphasized that they sometimes had to draw on the experience of colleagues from other centers.

> "We had no contact with the patient, but there was contact with the coordination, authorisation, review of guidelines. We did not know what we were facing, … in the first wave we had doctors, but they were not well deployed, there was no organisation to help those who were overwhelmed, we had no one to do PCRs, there was a lack of information, resources of all kinds … someone would say I have a friend in the other hospital who is doing it this way. Let's give it a go. […]"

Polymerase Chain Reaction, diagnostic test that detects a fragment of the genetic material of a pathogen.

The first three actions in Emergency Services were: the relocation of healthcare professionals based on safety criteria and risk profiles; the setting up of separate incoming and outgoing care circuits to avoid contact with non-COVID patients, and the organization of a "nursing kit," which consisted of prescribing medication in a single visit, and coordinating with colleagues to minimize contact with the patient.

> "At the beginning of March we had already established two care circuits, one for respiratory patients and one for non-respiratory patients. … and we did a little bit of distribution of professionals […]. We made kits for … nursing …, for when we had to [assist] a patient with everything: with compressors, with IVs, with tubes for blood tests, trying to expose the patient as infrequently as possible."

During the second wave, the Internal Medicine Service set up the Intermediate Respiratory Care Unit (IRCU) with the aim of reducing admissions to the ICU by acting as a retention filter to reduce admissions to the Intensive Care Units. On-call duty was reinforced, and specific units were created with auxiliary/support teams made up of healthcare professionals with no direct link to the disease, thus extending the traditional work teams and strengthening the much-needed spirit of collaboration and synergy between specialties.

> "…in the hospital, in the third wave, the unit that we set up in intermediate respiratory care. … was a success, because we were able to get a lot of people through it without their having to go to the ICU."

> "Being able to collaborate between specialties was very important, […] specialties such as rehabilitation, anaesthesia, neurology, psychiatry … the care teams were greatly expanded; in addition to nursing, which has a very important role, especially in critical care, there was a spirit of collaboration and synergy that helped a lot."

In the Intensive Care Unit, due to the reduced pressure of care in the first wave, they were able to focus on the procurement of protective equipment and hospital beds. The training of other healthcare professionals was carried out informally, sharing knowledge focused on "day-to-day" experiences. This collaboration was highly appreciated by the healthcare professionals of this service, as both parties were more receptive and motivated.

> "The first wave was quite gentle, the difficult part came later, then what we did was to prepare beds, material, purchases, just in case, […] in the first wave professionals from other specialties came to train in the ICU, people were more receptive, they were not tired … people were up for it; I think that was the difference in a way, to start strong, you were going into the unknown, but you knew you had to be there, it had to be done."

3.4. Impacts of the pandemic on care provision

From the start of the pandemic, routine health services were reorganized or disrupted, and this undoubtedly had an impact on the

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delivery of care, which was a challenge for staff. Maximizing the number of patients who got through the disease was the biggest challenge and one of the most satisfying successes described by the healthcare professionals interviewed. Internists highlighted the challenge of finding effective treatments, showing great concern when patients did not respond to treatment. They also pointed out how they managed high-stress situations appropriately, given the limited resources available.

> "What worried me most was not being able to offer patients the quality of care they needed, not being able to diagnose them in time, treating them with drugs that you often knew were ineffective; after 20 years of experience in the field of infectious diseases, the biggest challenge for me was looking for effective treatment alternatives …"

During the first wave, one aspect highlighted was the low level of infection among health workers in the workplace, despite the ignorance around preventive measures to curb transmission of the disease. Moreover, HHU professionals pointed out that working in an out-of-hospital environment facilitated the arrival of protective material from private sources.

> "We spent the whole of the first wave without masks. Masks were stipulated at the beginning when you were with a patient who had a cough and was ill. And now that we know that air is one of the means of transmission … Well, we've been lucky …! Here in the department very few of us have had it, very few."

> "Honestly, we managed because of outside help … They phoned us to say, do you need us to get you masks? … And we got them from the relatives of the patients, how is it that relatives can get them and the management and the hospital can't procure them for me?!"

Over time, during the second and third waves, the quality of care has been referred to as one of the main concerns for Internal Medicine Service, ICUs, ERs, and professionals in management roles, with the lack of physical space to accommodate patients being one of the major challenges. In the Emergency Service, this problem occurred earlier, as it is the gateway to the hospital care circuit. Also, the nursing staff of the HHU underlined the lack of time for proper care of non-COVID patients, especially palliative care patients and their families.

> "The challenge in the ward was trying to organise everyone coming in, the incoming avalanche, we had nowhere to admit those patients!"

> "Being unable to devote time to our palliative patients. […] We try to provide support over the phone and in a hurry … that made me think: 'I'm not doing my job properly."

In the Intensive Care Unit, the lack of specialized training in treating critically ill patients was a constant problem.

> "ICU staff are trained in this, but the rest of us? It's like being thrown headlong into something I know nothing about."

Two further sources of problems are described: (1) the new incorporations to Intensive Care, mainly of Resuscitation and Anesthesia professionals, which led to conflicts, due to the continuous demand for help by these professionals from ICU professionals overwhelmed by the workload they were facing; and (2) the contents of the training courses on offer, which are described as very basic, and not focused on the professional profile required.

> "As the waves became longer and bigger, all kinds of professionals came […] they couldn't be trained because we couldn't keep up, they came to work, but in the wards straight away, because there wasn't enough time. It was a bit chaotic."

> "And then we had to work outside the ICU with anaesthetists in their spaces, in operating theatres, in rehabilitation. And there the relationship was more difficult, because they, the anaesthetists, demanded, quote unquote, much more support … for us to be constantly at their side. […] But, what we faced was so unmanageable that it was impossible, we just couldn't cope!"

> "In the second and third waves, there were some training courses … lots of people signed up, but in the end, these were not the people for whom the course was intended …, the course was very basic for people in the Emergency Service, ward doctors who came to be trained were few and far between. This means that there have been patients who have been treated differently, and who have had different outcome chances, […] in the end it was the patient who lost out."

Coordination between Internal Medicine, Emergency, ICU, and other support services was essential. This required standardization of all procedures, treatments, and preventive measures to facilitate the adaptation of external professionals. Teamwork was a key factor in improving quality of care results.

> "Everything had to be done by the book, which was updated on a daily basis. We tried to standardise everything."

> "The success … was the result of everyone's work; day after day, shift after shift, colleague after colleague …, for a very long time […] you'll have seen it on TV, when the patients were being discharged from the ICU, how everyone joined them … you can't imagine the amount of work and the number of hours, and the amount of effort, that lay behind it all …!"

The only Primary Care healthcare professional in the sample reported his helplessness and even the occasional clash with colleagues when he offered in-person assistance at the health center, instead of by phone, in breach the service's guidelines.

> "Dealing with someone on the phone and trying to guess if they're unwell, is very complicated. You do things that you wouldn't be … quite comfortable with in other situations. […] We had express orders that, if you had a Covid patient and they were unwell, then straight to the hospital without seeing him. I can't do that. […] Patients don't like it either… I've had the odd clash with colleagues along the lines of 'Never mind what happens, I want to explore further' […] because the orders that came from above were different from what many of us wanted to do."

3.5. Impacts of the pandemic on the health of healthcare workers

The major psychological impact reported was due to the increase in deaths, the application of "war triage" in the selection of patients, and the fall in the age profile of COVID patients. All this was in a context of scarce material/human resources and restrictive rules that prevented face-to-face communication with relatives.

> "The biggest impact … above all, we weren't used to seeing so many people die, because when the ICUs became very busy with beds, a war triage was applied. […] A limit was set for entry to the ICU, because you had to keep the beds for the younger people who were going to arrive, … those older patients stayed on the ward, they were the ones we saw and we had to try to get them through with the means we had, […] people couldn't have visitors, they died in the company of the health staff, without their family around them, that was also hard and complicated."

All the healthcare workers reported emotional stress at some point during the period under study. In the first wave, situations of anxiety and worry are described. In the third wave, events are described as being accompanied by distress and high stress, the main health problems being: hypertension, hair loss, headaches, back pain, and insomnia.

> "It was mostly anxiety, a lot of nervousness. Insomnia from time to time."

> "I was unwell, I had backache, headaches … There were moments of anxiety, of stress, maybe of bad language, I think that … we were all almost the same …, because we were all very tense."

> "I had a hypertensive crisis … My hair fell out. People are exhausted and worn out."

Despite this, no healthcare professional took sick leave due to the situation of stress or overwork; adapting to the intense workload was the standard coping method, leading to a period of mechanical work which became gradually routine. Moments of de-escalation or deceleration allowed physical exhaustion to manifest itself, especially persistent psychological fatigue. During these periods, the dialogs once again reveal a sense of uncertainty as to the future evolution of events.

> "I think there has been a very great deal of work and we have had to address very complicated situations, and I personally have not missed a single day of work."

> "… when the plateau was reached, when no more patients were arriving, there was a sense of relief, but the tiredness was there."

Differences in perceived stress were observed according to functions and services. Preventive Medicine healthcare workers acknowledge that they have "*suffered*" less pressure than colleagues on the front line (ICU, Emergency, and Internal Medicine Services), who spoke in the third person to highlight that it entailed a collective collapse rather than that of individuals.

> "I have been fortunate enough not to be with patients, but I have suffered."

> "As for very tired colleagues, they said yes to everything, but always when saying yes, they added: 'but we're tired'. I understand, I understand, but we must carry on, come on, this is going to end."

3.5.1. Institutional sources of support, coping strategies, and feelings of support

The restructuring of work shifts was a source of institutional support that was seen as important and was highly valued. It was based on patient volume and staff safety, enabling rest breaks during de-escalation. Shared shifts with healthcare professionals in the same specialty also reduced the emotional burden of sharing knowledge and responsibilities in therapeutic decision-making. "Bubble groups" were created to reduce interactions and the risk of transmission. However, this measure was insufficient, as staff shortages have been a constant obstacle to better results.

> "We went from doing our 8-hour shifts plus on-call duty to 12-hour shifts. You'd spend the whole day at the hospital. We practically lived there, and this was done precisely so that we didn't coincide with others, to make bubble groups."

At institutional level, teamwork was encouraged, helping to foster solidarity among "colleagues" as a collective coping strategy, reducing the workload, enhancing feelings of loyalty, security, self-esteem, and enabling coordination-cooperation in the tasks to be performed. Indeed, these informal support networks, in the work context, have fostered friendly relationships and camaraderie, especially among nursing staff, and the expression "hacer una piña" ("becoming a pine cone," meaning all pulling together) was often used in this context.

> "For me, fortunately, we are a team, we were eight nurses and six doctors. We all pulled together [hicimos piña], especially the nursing staff, and we protected one other. One colleague would take on more work so that two of us could leave together, to help each other get dressed and undressed … among colleagues we did group therapy, we tried to take positives from the day, … always looking at the funny side […] in bad times we supported each other and we helped each other a lot."

The psychological counseling for healthcare workers introduced at the end of the third wave was valued positively, especially by the Intensive Care Unit staff; however, they point out its limited effectiveness and use, due to time constraints, and to its not having been implemented from the beginning. Management nursing staff had to offer this support to the members of their team, and consider it part of their daily routine.

> "A psychologist was hired by the hospital towards the end and there were mindfulness sessions, all late in the day to my mind, but anyway, it was done, though I personally didn't go to any."

> "what I saw was that morale was … I was there sort of to help everyone! My office was open, I had an hour of psychology, they went in and cried, I had to listen to them, because it was part of the job, until the psychologist came, so I did what I could."

At the same time, social support strategies developed in the private/personal context were mentioned frequently by all personnel. Sports activities were highlighted by more men than women as a means of escape and distraction in times of stress, especially in the third wave.

> "Well, I relied on my family, of course … when I got home, when my husband and my son were at home, […] which might be 9 pm, I would sit down with them, have a beer, and talk."

> "Well, I channel it all pretty much through sport. That does it for me."

In general, the use of medication was rarely mentioned as a regular source of relief, and there was some reluctance when it came to communicating this, suggesting contradictions and even rejection; just three women explicitly mentioned the use of medication at times of increased stress. Insomnia was one of the problems that gave rise to the prescription of medication.

> "Well, since the first wave, it's true that I was on medication to sleep at first, for the anxiety and the pace we were going at, I couldn't sleep at home."

> "No, no, no, no, no medication, but I did take valerian, camomile. But, hey, not sleeping pills or benzodiazepines, at least at the beginning. I prescribed them for myself in April, but in the third wave I didn't need them […] we've talked about it, there have been colleagues, yes, who have self-medicated, to get to sleep and to feel calmer…"

In general, healthcare professionals in management roles felt institutionally supported, although there are contradictions in what they say.

> "What we asked for was granted, you always have to fight for it a little, but well, I felt that they supported me […] to fight for it in the sense that it was part and parcel of the functioning of the health system."

However, healthcare workers with direct care roles, mainly ICU, Emergency, and Internal Medicine staff, have felt more unprotected, unheard, and neglected by the hospital management. The overload and fatigue have been overcome by the high levels of vocational commitment and professional dedication they have shown and the challenge of "saving as many lives as possible" from the very beginning. The search for support outside the hospital environments was a solution that most healthcare workers saw as the only effective option at that time.

> "I think the management should have had a little more dialogue with us. What do you need? You need something, but nothing was forthcoming. In other words, what you can't do is ask the question and not provide. […] And then they want you to go back to normal and go back to work, as if nothing had happened […] undervalued or not appreciated by management, who left us to our own devices, you do a job and on top of that they don't thank you for it. That's about the size of it. That's how it feels […] We were used when we were needed and then goodbye."

> "My husband said to me, why don't you take a leave of absence? I CAN'T! I need to work, because I was overwhelmed, but at the same time I felt fulfilled to be helping all those people [patients] […] those at the top don't care about how you feel. You have to look for … your relaxation techniques, your own way."

ICU, Emergency, and Internal Medicine staff have described, more than others, emotional control coping methods, such as: relaxation techniques, emotional distancing, apathetic behavior, and acceptance.

> "… some people tell me I'm uncaring, if you're not uncaring in the ICU, you die of grief within a week…!"

> "I saw from the first minute that people were going to die because I wasn't going to take care of them as one would a sick person in other situations. […] But in general, on a personal level, I handled it well, I was very, very cold in that aspect, and so I managed to be efficient."

3.5.2. Recovery levels

Feelings of frustration, weariness, exhaustion, and fear are still present in all the healthcare workers interviewed, so the need for rest is repeatedly highlighted. More women than men (4 vs. 1) have explicitly noted a failure to recover their health. Also, the reference exclusively to the professional environment is unanimous among the men (4 vs. 1) who claimed complete recovery. In fact, the only woman who said that she had recovered had some doubts as to the psychological consequences that this experience may have left her with.

> "I don't think I've recovered, there's still something there, because I haven't recovered, because what I do think is that I'm afraid, although I don't say so (laughter)."

> "The doubt that stays with me is whether it has left me with some kind of after-effects … on a psychological level …"

3.6. Proposals for improvement

An increase in trained personnel to avoid work overload and to facilitate rest has been the measure, broadly, most frequently mentioned by all healthcare workers to avoid a repeat situation should the pandemic re-emerge.

Staff of the Preventive Medicine Services have suggested not dismissing trained personnel, echoing the collective feeling. They referred to the need for a contingency plan for future pandemics with further training of existing personnel to address the lack of human resources in these specialties.

> "I think there should be contingency plans and think that, if we need more intensive care staff and they're not there, maybe the anaesthetists need to be trained in this type of patients."

The Intensive Care Unit pointed out the need for training in pandemics and the importance of continuous training. They particularly underlined the need for specialized training in critical care for staff at all levels who join the service.

> "What I would improve …, the most vital thing, is that people are trained, that they're people with experience, people who've worked in an ICU, people who don't need supervising or teaching. […] we're looking into the issue of the specialty of critical care nursing, which is still not recognised, it would be good…"

Most professionals agree that psychological help should be established as a regular resource of special importance. Despite its implementation, they were pessimistic about it being retained.

> "In the critical care unit there should always be a psychologist because … it would help us to talk to each other more, to communicate, because communication is a bit so-so in the ICUs, you don't need to laugh every day."

> "The psychologist has been a great help for the last two months, and if she'd been there before, she could have helped a lot more. I'm afraid that when the pandemic is over, her contract will expire."

The Internal Medicine Service proposes avoiding the excessive moving around of work teams, which made it difficult to establish stable work teams with the requisite training.

> "I'd have left the same people on the same floor, not rotating; one minute I'm going to the 3rd floor…, tomorrow, we'll see …"

This last discourse identifies both criticism and areas for improvement by assessing the elements that have failed not only from the point of view of hospital organization, but also at national and international level. This section highlights the lack of foresight of human and material resources, the lack of assertiveness of WHO recommendations, the confusing and unsubstantiated messages in the media, and finally the lack of social awareness of universal responsibility to adhere to the restrictive rules put forward by the WHO.

> "Aspects to improve, foresight […] the WHO warnings weren't taken seriously, because the WHO didn't believe in them either [laughs]. The technicians believed them, but the politicians didn't believe them. I think the WHO should have been much more assertive in its recommendations. The countries that closed early in the first wave were less impacted and other countries like Spain [weren't] … you just knew what was coming! The logistics parameters also failed. The media failed, I think they didn't offer a clear message; in other countries they were more in your face, the corpses, inside the hospitals, the care homes, the people who lived on the streets, the extent of the economic impact, it's all very well, but doesn't help. […] And then another area that undoubtedly needs improvement relates to the awareness levels of many people. We have seen infected people who have not followed quarantine. It's true that if we had a legislative system that allowed these people to be sanctioned, to be properly quarantined, a large proportion of cases would have been avoided."

4. Discussion

This study offers important findings about the experiences of healthcare professionals based on their service and role during the first three waves of the COVID-19 pandemic. First, the news was received very differently by different services, in some with disbelief, and in others as an opportunity for professional development and job improvement. The lack of leadership and widespread misinformation during the first wave generated feelings of helplessness, uncertainty, and fear relating to job security, contagion, and/or transmission to family members. Even so, the initial response saw organizational changes often driven by the services themselves, which in itself proved very positive, although in some cases limited by scarce resources

(material and human). The quality of care throughout the three waves was a constant concern of these healthcare professionals, mainly due to the lack of effective treatments, of sufficient physical space, of adequate training in treating critical patients, and to the lack of human resources together with a lot of moving from one area to another. Despite this, in the third wave, which brought the greatest overload in our sector, the health problems of the healthcare workers did not lead to sick leave; we believe that the high level of commitment and vocation observed were factors that helped people adjust to the intense work patterns. We did observe a growing psychological fatigue that became chronic due to the perception of being faced with a long process with no end in sight.

At an institutional level, the organization of work shifts facilitated rest and reduced overload, although the psychological help offered was not useful, as it was late in coming. The coping strategies referred to were varied, with the following standing out: family support, support from work colleagues, and sporting activities. It is worth highlighting the greater use of emotional control techniques by ICU, Emergency, and Internal Medicine staff, who, after expressing higher levels of stress and feeling "poorly supported" by hospital management, opted to seek the help they needed outside the hospital environment. At the time of the interviews, healthcare staff noted that they were in the process of recovery, albeit with negative feelings and a lot of fatigue.

Other studies have found similar results to ours: constant changes in guidelines, lack of institutional foresight, lack of clear information, prolonged use of PPE, fear of infection, and infecting family members all adversely affected an adequate response, causing uncertainty and increasing the stress of healthcare professionals (19–23).

The adaptive capacity of the health system has been one of the factors that determined the greater or lesser success of the response to the COVID-19 pandemic (6). In Spain, the ENCOVUR study of the organizational impact on the management of the pandemic noted that, during the first wave, one of the main problems in caring for COVID patients was the lack of adequate physical space, more frequent in small- or medium-sized hospitals, and in those in areas with higher incidence levels (24). A study carried out in 31 European countries indicates that during the first wave, there was an inefficient response by health systems in most western countries, including Spain. Additionally, the complexity of the COVID patient and the lack of specific treatments worsened the quality of care (25). Subsequently, in the relaxation phase, those states that were severely affected at the outset began to take appropriate measures and improve the efficiency of their health systems (26).

A systematic review of 40 studies mostly conducted in the USA and the UK highlighted that the best training for healthcare professionals in the treatment of COVID patients was gleaned from more experienced workers (27). In our study, this was hampered by its low incidence during the first wave, and in the following waves by the high turnover of healthcare staff.

Professional vocation, inner strength, and peer support are also cited in numerous studies as a source of motivation and adaptation in responding to intense, unrelenting working hours (28–32).

Institutional and psychological support has also been referred to in other studies. In one study, nurses "took the initiative to be altruistic and sought team support" as a coping strategy (22). Strong institutional guidance and committed leadership were positive initiatives for mental health described in a study conducted in 13 countries in different healthcare settings, including Spain (33). In another study, psychological support relieved nurses' anxiety. This support was even more appreciated when it was adapted to shift work, was informal, and based on individual or small group dynamics (34). However, in some Chinese hospitals where a detailed psychological intervention plan consisting of counseling courses, individual supervision, and group interventions was developed, doctors were reluctant to participate and nurses rejected it, most of them arguing that they did not need a psychologist, but rather a break and sufficient protective equipment (35).

Family, social, institutional, and peer support to reduce the negative impact on healthcare workers' health during the pandemic was significantly associated with individual performance, sleep quality, motivation, and better mental health (32, 36, 37). However, perceptions of institutional support have varied across countries: Whereas in China (38) and/or Jordan (37), healthcare professionals reported confidence in their organization, in North America (39), the Mental Health America (MHA) survey concluded that 39% of health professionals in the United States did not feel emotionally supported, with the level for nurses being as high as 45%. Family and friends accounted for more than half the support received, followed by work colleagues with 38%, while supervisors and therapists accounted for around 15%.

The perception of greater psychological distress in more caring roles has also been described (40–42). In Spain, a higher prevalence of PTSD was found in front-line healthcare workers (43), especially in nurses (10). Finally, the results of the present study may be constrained by the lack of face-to-face interaction between interviewers and interviewees, which restricts information from non-verbal communication and context observation for the researcher. Nevertheless, we believe that our results provide a rich insight into the experiences of healthcare professionals from different services.

5. Conclusion

Despite the high levels of emotional stress reported, no sick leave was taken. Health professionals showed a strong collective spirit and sense of solidarity. Family, social support, and camaraderie at work were effective coping strategies. The direct experience of professionals suggests the need for a contingency plan adapted to each organizational context, which includes psychological support, the provision of adequate materials and effective organizational measures learned during this pandemic. Proposals for improvement include the need for continuous training in critical patient care at all levels of care, as well as the use of existing staff who gained training and experience during this pandemic.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The research was approved by the ethical committee of the hospital. However, due to a confidentiality agreement between the participants and the research team, the name of the hospital cannot be disclosed. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MP-V, EA-L, and GP-M conceptualized and designed the study. MNR-M conducted the semi-interviews. MNR-M and MP-V carried out data analysis. MNR-M produced a first draft of the results section and wrote the first draft of the document that was extensively refined by all authors until its final version. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer AM declared a past co-authorship with the author MP-V to the handling editor.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1089565/full#supplementary-material

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Corrigendum: "You knew you had to be there, it had to be done": experiences of health professionals who faced the COVID-19 pandemic in one public hospital in Spain

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COVID-19 pandemic, health professionals, contingency plan, organizational changes, quality of care provision, coping strategies, qualitative research

A corrigendum on
"You knew you had to be there, it had to be done": experiences of health professionals who faced the COVID-19 pandemic in one public hospital in Spain

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In the published article, there was an error in Table 2 as published [We have included interviews 7,12,14,1,11 in Internal Medicine Service, Infectious Diseases Unit (IDU) and this is not correct. They all belong to the Intensive Care Unit (ICU), as is clearly shown in the text].

The corrected Table 2 and its caption appear below.

In the published article, there was an error in Supplementary material [Table 1. Analysis of categories and Table 2. Job profile characteristics of the participants are shown wrongly in this section. They are repeated, since they have been shown in the text. In the Section 2.4 Analytical procedure is referred Table 1; and Section 3.1 Study sample is referred Table 2].

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In the published article, Supplementary [Appendix 1. Semi-Structured Interview] was mistakenly not included in the publication. The missing material appears below.

The CORRECT Supplementary material statement appears below.

The authors apologize for these errors and state that this does not change the scientific conclusions of the article in any way. The original article has been updated.

Publisher's note

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TABLE 2 Job profile characteristics of the participants.

Service	Male	Female	Job title	Role	Cod_Number**
Preventive medicine		X	Nursing professional (hospital)	Management	3
		X	Head of service/section	Management	5
Emergency service		X	Head of service/section	Management	10
	X		Physician	Patient care	13
	X		Nursing professional (hospital)	Management	8
Internal medicine service, infectious diseases unit (IDU)	X		Nursing professional (HHU*)	Management	2
		X	Nursing professional (HHU)	Patient care	9
		X	Physician	Patient care	4
	X		Physician	Department Head	6
Intensive care unit (ICU)	X		Physician	Management	7
		X	Nursing professional (hospital)	Patient care and management	12
		X	Nursing professional (hospital)	Patient care	14
	X		Nursing professional (hospital)	Patient care	1
		X	Physician	Patient care	11

*Home Hospitalization Unit (HHU), modality of healthcare focused on providing specialized hospital care to patients at home. **Identification's number of each participant, assigned according to the date of the interview.

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Appendix

TABLE A1 Semi-structured interview.

Motivation and professional vocation
- What led you to take up this profession? - Do you feel fulfilled by it?
Care provision and pandemic management
- How did you receive the news of the pandemic? - What was your reaction? - How did you feel the first day? - What were the main differences in your usual work performance before and during the first wave? - What prior training/information did you have on health care in pandemic situations? - How do you feel now? Next, think about your day-to-day experience during these 3 waves: - What everyday situations had the greatest impact on you? - What were the main concerns during this period? - Tell us about a challenging professional experience you faced during this period. Also an experience that has been a success for you.
State of health
Did you catch the disease? or If you did, how did you manage the situation? or If you did not catch it, were you afraid of catching it? Were you afraid of infecting those close to you? - Do you believe that working in a hospital during the COVID-19 pandemic has had an impact on your health? - What kind of symptoms did you experience or are you experiencing? - Do you think you reached the point of breakdown/emotional overload? - Could you identify the factors or circumstances that caused you the greatest levels of emotional distress? - Did you require assistance of any kind, if so what kind, did you request it at this stage? or If you requested it, was it easy to obtain? - Did you require treatment of any kind at this stage? What type of treatment?
Sources of support at institutional level
- Did you feel supported by the hospital management? - Did you feel that the hospital organisation emphasised self-care for healthcare professionals? - Was there continuous training and education of health professionals in response to new scientific evidence as it became available? If the answer is yes, then: - What kind of support did you receive from your hospital during this period? - Was the support helpful? - How did it help you? - How was the relationship with your co-workers? - Did you have to work with professionals from other services who though it was not their specialty worked alongside you in the treatment of COVID patients, was that situation stressful, or did you manage to function well as a team and maintain the quality of care? - In your view, what elements facilitated or would have facilitated the management of stress and burnout situations for healthcare workers in your specialty? - If you could implement preventive measures in the hospital to lessen the psychological impact of a situation like COVID 19, which would be the most effective in your view? - And of these measures you mention, which do you consider the most important?
Self-management and coping strategies
- Could you explain what your personal coping strategies were for dealing with breakdown/emotional overload? - To what extent have you recovered or do you feel that you are still suffering from the physical or psychological effects of the pandemic? - Do you think this experience has improved you as a professional?

(Continued)

TABLE A1 (Continued)

Responsibility for the provision of care
- Are you satisfied with the work you have done from the beginning of the pandemic until now? - Tell us about the positive and negative aspects of your work during this period. - Over the last year, which aspects of your work have improved, got worse and remained unchanged? - What did you think of the interview? - Do you have any suggestions for improvement, what are they? - Is there anything about this subject that I have not asked you and that you would like to tell me?
THE END

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Burnout and resilience at work among health professionals serving in tertiary hospitals, in Ethiopia

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Background: The quality of healthcare service is strongly affected by the health professionals' levels of burnout and resilience at work (RaW). Developing resilience is a key component of medical professionalism. Although burnout and resilience are indicators used to assess the level of workplace hardship, there is a dearth of information in most developing countries, including Ethiopia.

Objective: To assess the levels of burnout and 'resilience at work' among health professionals who work in the surgical care departments in teaching Ethiopian hospitals.

Methods: A cross-sectional study design was applied among health professionals employed in surgical, gynecologic, and obstetric (Gyn/Obs) departments of two acute-care hospitals (n=388). A structured self-administered English version questionnaire, consisting of validated scales to measure RaW and burnout, was used to collect the data;22 items of Maslach's burnout inventory human service survey tool and 20 items of Win wood's resilience at work' measuring tool" was employed to assess the health professionals' burnout level and Resilience at work, respectively. Linear logistics regression was employed for inferential statistical analysis to identify factors that predict RaW and burnout.

Results: Burnout syndrome was shown among 101 (26.0%) study participants. Furthermore, 205 (52.8%), 150 (38.7%), and 125 (32.2%) participants presented high emotional exhaustion, high depersonalization, and low personal accomplishment, respectively. Emotional exhaustion was predicted by the participants' profession, the hope of promotion, professional recognition, and workload. Depersonalization was predicted by age, profession, and perceived workload of the participants. The predictors for personal accomplishment were profession, relationship at work, professional recognition, and having a managerial position in addition to clinical duty. The participants' mean RaW score was 78.36 (Standard deviation $\pm$17.78). A negative association was found between RaW and emotional exhaustion and depersonalization. In contrast, a positive association was identified between RaW and personal accomplishment. The type of profession and marital status were positive predictors of RaW.

Conclusion: A substantial amount of health professionals experience high burnout in one or more burnout dimensions. Level of RaW is more affected by burnout syndrome. Therefore, promoting activities that increase the level of professional RaW and recognition in their professional practice is needed to reduce job burnout. These findings are especially important concerning low

socio-economic countries, as resilience is a vital component of the development of healthcare systems.

KEYWORDS

health personnel, burnout, professional, resilience at work, Ethiopia

1. Introduction

Globally, the health workforce crisis is a common phenomenon that challenges the healthcare systems' function (1, 2). Shortage of health workers, poor training modalities, maldistribution of human resources, and poor management of health professionals turnover constitutes a serious challenge for hospitals (1, 3). Workplace hardship in the health delivery set-up may result in professional burnout and poor 'resilience at work' (RaW), significantly challenging the health care system's functioning (4). Clinical personnel who lack self-compassion and mindfulness frequently suffer from burnout and lower levels of RaW that impair the capacity to overcome difficulties (5).

Although there are no generally accepted definitions of burnout, the most commonly agreed definition is an extended exposure to chronic personal and interpersonal stressors on the job as characterized by three dimensions: exhaustion, depersonalization, and professional inefficacy (6). According to Christina Maslach et al., "emotional exhaustion" (EE) is described as the feeling of not being able to offer any more of oneself at an emotional level; "depersonalization" refers to a distant attitude toward work, the people being served by it and among colleagues; and "professional inefficacy" describes the feeling of not performing tasks adequately and of being incompetent at work (7).

Many medical professionals suffer from burnout, which is the psychological syndrome involving emotional exhaustion, feelings of helplessness, depersonalization, negative attitudes toward work and life, and reduced personal accomplishment (PA) (8). Burnout affects the quality-of-service delivery and exacerbates professional shortages in the health system by causing dropout from the place of work and/or profession (9–11).

Burnout is a protracted response to chronic and interpersonal stressors on the job (12), that has negative implications for job performance and social relationships (13). The level of burnout among medical professionals is nearly twice that of non-physician professionals (14). Burnout occurs when health professionals use ineffective coping strategies to protect themselves from work-related stress (15). Developing professional resilience may become an important strategy to minimize emotional distress, burnout, and work dropout. Many personal and demographic factors affect the medical personnel's level of RaW.

According to Cooper et al., "resilience" is the ability of an individual to positively adjust to adversity, and can be applied to building personal strength (16). According to King et al. (17), resilience is the way individuals, groups/teams, and organizations respond to facing challenges and adversity. Southwick et al. (18) also defined resilience as "the capacity of a dynamic system to withstand or recover from significant disturbances." It includes the steady trajectory of healthy functioning after an extremely hostile event.

In reliance on varied definitions of resilience, the term 'resilience at work', was also described as a dynamic capability that can allow individuals to thrive on challenges, given appropriate social and personal dimensions in their workplace (19). These dimensions include self-efficacy, self-control, the ability to engage in support and help, learning from difficulties, and persistence despite blocks to progress (20). Another definition of 'resilience at work' defined by Milton, was a "positive developmental trajectory characterized by demonstrated competence in the face of, and professional growth after, experiences of adversity in the workplace" (Page 3) (21). Resilience at work' is an important attribute and one which can be learned and improved upon (22, 23).

Burnout is associated with health professionals facing unprofessional behavior, thoughts of suicide, retirement prematurely from their work, and errors during patient care (24). High stress and burnout reduce working performance and recovery from challenges, while highly resilient employees were found to be less affected by variations in working recovery (25, 26).

Ethiopia has been affected by a shortage of health professionals as well as high levels of professional burnout and low levels of resilience among healthcare workers. In response to the critical shortage of human resources in the healthcare system, the Government of Ethiopia invested significant resources in the effort to increase the quantity of the healthcare workforce, utilizing a 'flood-and-retain strategy'. This strategy involves an accelerated and voluminous increase in the number of students studying health professions. In this regard, the number of health science colleges, as well as the enrollment of health professionals into higher institutions, has been increasing in the last 15 years (27). However, how many of those health professionals are resilient at work is to date not well known.

Therefore, this study is aimed to examine the level of burnout and 'resilience at work' among health professionals who are working at the obstetric/gynecologic and surgical care departments inTibebe-Ghion and the University of Gondar comprehensive Specialized referral Hospital (UoGSRH) in Ethiopia. The measurement will enable both the scientific realm and policymakers to understand the current level of burnout and RaW in the setting of a low socio-economic society and highlight components that should be managed to enhance the development of a more resilient healthcare system.

Abbreviations: EE, Emotional Exhaustion; Gyn/Obs, Gynecologic and Obstetrics; MBI-HSS, Maslach's burnout inventory human service survey; PA, Personal Accomplishment; TGSH, Tibebe-Ghion Specialized Hospital; UoGSRH, University of Gondar comprehensive Specialized referral Hospital.

2. Materials and methods

2.1. Type of study and its courses

A facility-based, cross-sectional, quantitative study was conducted at two public teaching hospitals located in the Amhara region of Ethiopia (Tibebe-Ghion and Gondar teaching hospitals).

2.2. Investigated institutions

Bahir Dar University College of Medicine and Health Sciences was established in 2007 and is one of the youngest medical training institutions in Ethiopia authorized to provide medical and health professionals training in the past 10 years. The hospital that provides both teaching and clinical services under the college of medicine and health science is known as Tibebe-Ghion Campus. The hospital provides both outpatient and inpatient care services, with over 452 beds. A total of 621 health professionals, 128 intern general practitioners, and 211 residents are currently working in the hospital. The surgical and gynecological care department of the hospital consists of 167 clinical staff, of which 25 nurses and 28 surgeons work in the surgical care department. The rest (69 midwifery nurses and 19 gynecologists and obstetricians) work in the gynecologic department. Additionally, 26 different-level anesthesia providers currently work in the two departments.

The second study institution is the UoGSRH which is a teaching hospital under the Gondar University College of Medicine and Health Sciences; established in 1954. UoGSRH is one of the largest specialized hospitals in Ethiopia, with over 540 beds. A total of 986 clinical staff, 141 intern general practitioners, and 243 residents currently work in the hospital. The surgical and gynecological care departments of the hospital consist of 245 health professionals of which 37 nurses and 41 surgeons work in the surgical care department. The rest (101 midwifery nurses and 28 gynecologists and obstetricians) work in the gynecologic department. Additionally, 38 different-level anesthesia providers currently work in the two departments.

2.3. Study population

The study population included all physicians and residents from the surgical, gynecologic, and obstetric (Gyn/Obs) departments. Midwifery, anesthetic, and all other nursing specialties who are working in the operative sites of the aforementioned hospitals.

Health professionals who are planning to leave their institution due to completion of their residency program, intend to attend a training program in other hospitals, or due to any other reasons within the upcoming 2 years, were excluded from the study. Based on these eligibility criteria, a total of 412 clinical personnel (167 from Tibebe-Gion and 245 from UoGSRH) were eligible for the survey.

2.4. Study variables

Levels of professional burnout (low, medium, high) and levels of resilience at work (low, medium, high) were defined as the dependent variables. The type of profession, work experience, and demographic characteristics were collected as independent variables. Family size, income per family size, and behavioral factors such as chat chewing and cigarette smoking were examined as confounder variables.,

2.5. Study tool and reliability

To assess the health professionals' burnout level, Maslach's burnout inventory human service survey (MBI-HSS), a tool consisting of 22 items was used. The tool comprises emotional exhaustion (9 items), personal accomplishment (8 items), and depersonalization (5 items) with a seven-point response scale (0 to 6), ranging from 0 = never to 6 = daily (28). The total scores of each dimension were summed and categorized as low, moderate, or high, and the average score was also calculated. The cut-off point score for health personnel's burnout was as follows: Emotional exhaustion: low (≤16), moderate (17–26), high (≥27); Personal accomplishment: low (≤33), moderate (29–34), high (>39); and Depersonalization: low (≤5), Moderate (6–9), High (≥10). Overall burnout (burnout syndrome) was considered when a health provider displayed high levels of emotional exhaustion and/or depersonalization and low levels of personal accomplishment (35, 36). In this study, the internal consistency of the MBI tool was checked. The overall internal consistency of the 22 items was high (Cronbach's $\alpha = 0.87$). Similarly, the domain-specific internal consistency was high for all three components, as follows: EE (Cronbach's $\alpha = 0.89$), Depersonalization (Cronbach's $\alpha = 0.85$), and PA domains (Cronbach's $\alpha = 0.81$).

Resilience at work was measured by using the Win wood 'resilience at work' measuring tool" (37). The tool consists of 20 items, classified into seven components with a seven-point response on a Likert scale (0 to 6), ranging from 0 = strongly disagree to 6 = strongly agree. The seven components are; Living authentically (three items), Finding one's calling (four items), Maintaining perspective (three items), Managing stress (four items), Interacting cooperatively (two items), Staying healthy (two items), and Building networks (two items) (37). The total score of the scale was calculated to obtain a composite resilience value. The levels of resilience at work were calculated using the mean scores. Mean was used to determine whether the current score is lower, consistent, or higher than Win wood's means core; participants who scored below 61, 61–81, and above 81 were considered as having a low, moderate, and high level of 'resilience at work' respectively (29, 38, 39). The internal consistency of the 'resilience at work' assessment tool was also assessed, which was high (Cronbach's $\alpha = 0.89$).

2.6. Study design

An English version of a self-administered structured questionnaire was used to collect the data on health professionals' burnout and 'resilience at work'. Before the actual data collection, the questionnaire was pre-tested among 20 health professionals (5% of the total sample). The pre-test study was conducted in other hospitals (not sampled in the study) that have similar characteristics to the main study participating hospitals.

Four data collectors and two supervisors participated in the data collection process. Intensive training was provided for the data collectors and supervisors before the data collection began. During the training, the trainers gave instructions concerning the questions to be asked, their meaning, ways to ask them, and how to record the answers. Both electronic and hard-copy survey tools were used to fill

in the data. The hard copy was used for those participants who lack electronic access or were not interested in using it. The electronically filled data was uploaded directly to excel and exported to the statistical package for social sciences (SPSS, version 23) software for analysis. The hard-copy filled data were entered directly into SPSS-23.

The data collectors approached the respondents by self-introduction, explaining the objectives of the study as well as their autonomic participation in the study. After informed consent was received from each respondent, the questionnaire was distributed by one of the two data collection means. Furthermore, the data collectors supported respondents who needed further assistance during detailing and checked for any missing or incomplete information. For data collected using a hard copy, any missing or incomplete data were corrected by re-collecting the correct information before leaving the respondent.

During the data collection process, the supervisors traveled with the data collection teams, to observe and ensure that their teams provide self-introduction, and explain the objectives of the study, stressing the confidentiality of the information, and the anonymity of participating in the study. Moreover, the supervisors followed the data collectors to take informed consent from each respondent. They also checked and assisted if any additional training or clarifications were needed. Furthermore, the principal investigator checked all the data that was submitted from the field every other day and communicated as needed with the supervisors.

2.7. Data analysis

The collected data were checked for completeness and consistency. Consequently, the data was compiled, cleaned, coded, and then exported/entered into SPSS version 23 for analysis. A descriptive analysis was conducted to summarize the findings. Descriptive statistics comparison was done using a t-test and one-way analysis of variance (one-way ANOVA). Simple linear regression analysis was applied to select the candidate variables for the multiple linear regression model. To control the confounding effect, a variable with a value of $p \leq 0.2$ on a simple linear regression was taken as a candidate variable for multiple linear regression. Multiple linear regression analysis was done *via* the enter method to identify the independent predictors for burnout for each dimension separately and for the RaW. value of $p < 0.05$ on multiple linear regression analysis was declared a statistically significant predictor for each burnout dimension and resilience and unstandardized-β was used for interpretation. Multiple linear regression assumptions (normality, linearity, and constant variance) were checked. Linear-correlation analysis was used to test the correlation between the three dimensions of burnout and 'resilience at work'. Additionally, t-test and one-way ANOVA were employed to test the differences in each burnout dimension and 'resilience at work 'according to the participants' demographic and work-related characteristics.

3. Results

3.1. Participants' socio-demographic characteristics

A total of 388 health professionals participated in the survey with a response rate of 94.2%. Around three-fourths of the respondents, 287 (74.0%) were male. The median age with Interquartile Range (±IQR) of the respondents was 29 (±5) years of age, which ranged from 20 to 49 years. Almost half of the participants, 197 (50.8%) were married. Three hundred thirty-eight (87.1%) respondents were Orthodox Christian followers. Professionally, more than one-third, 142 (36.6%) of the respondents were residents, and 264 (68.0%) respondents have 5 years or below of work experience. The average salary of the respondents in Ethiopian Birr (EBR) was 10,653.6 with a standard deviation (SD) of ±4532.7, while 194 (50.0%) respondents had a monthly salary of 10,075EBR or below (Table 1).

3.2. Working environment-related characteristics

A majority ($N = 379$, 97.7%) of the respondents reported that they have a good or neutral relationship at work. Three-hundred thirty-one (85.3%) respondents perceived that there is a high workload, while 294 (75.8%) respondents had good or neutral perceptions of the existing management system in their hospitals. Regarding the perception of the working environment, 250 (64.4%) of the respondents have neutral or unsuitable perceptions. More than two-thirds, ($N = 257$, 66.2%) of the respondents reported that they fear contracting an illness during work (Table 2).

3.3. Magnitude of burnout

Burnout syndrome was shown among 101 (26.0%) study participants; which means they displayed high burnout in emotional exhaustion and/or depersonalization and low personal accomplishment, and 318 (82.0%) of them experienced burnout for at least one dimension. Furthermore, 205 (52.8%), 150 (38.7%), and 125 (32.2%) participants presented high emotional exhaustion, high depersonalization, and low personal accomplishment respectively, i.e., displayed a high level of burnout (Figure 1). The participants' mean score with standard-deviation (±SD) of emotional exhaustion, depersonalization, the personal accomplishment was 27.28 ± 12.67, 9.78 ± 7.93, and 36.19 ± 7.80, respectively.

3.4. Comparison of burnout sub-scales according to participants' demographic characteristics

Table 3 shows the comparison of the participants' burnout levels according to the demographic and work-related variables.

Using the independent *t*-test statistical analysis, a higher mean score of emotional exhaustion was found among participants who did not have children under 18 years compared to those who had such young children (28.48 ± 12.34 vs. 24.31 ± 13.08 respectively; $p < 0.01$). The analysis of variance (ANOVA) showed a significant difference in the mean score of EE by participants' monthly income; most especially, the difference was noted between respondents whose monthly income was above 11,306 EBR or between 7,072–10,075 EBR (24.19 ± 13.51 vs. 31.34 ± 10.51 respectively; $p < 0.01$). Participants who had a poor relationship at work had a higher mean score of EE compared to those who had a good relationship at work (35.89 ± 9.96 vs. 26.74 ± 12.84 respectively; $p = 0.024$). A high mean score of EE was also observed

TABLE 1 Socio-demographic characteristics of health personnel working at the surgical care department; tertiary hospitals, North-West Ethiopia, 2021 (n =388).

Variables	Category	Total N (%)	Tibebe Ghion n (%)	Gondar n (%)	Value of p
Sex	Male	287 (74.0)	128 (85.3)	159 (66.8)	0.000
	Female	101 (26.0)	22 (14.7)	79 (33.2)	
Age	20–25	41 (10.6)	13 (8.7)	28 (11.8)	0.732
	26–30	215 (55.4)	85 (56.6)	130 (54.6)	
	31–35	90 (23.2)	37 (24.7)	53 (22.3)	
	>35	42 (10.8)	15 (10.0)	27 (11.3)	
Marital status	Single	185 (47.7)	68 (45.3)	117 (49.2)	0.091
	Married	197 (50.8)	82 (54.7)	115 (48.3)	
	Others (divorced and widowed)	6 (1.5)	0	6 (2.5)	
Religion	Orthodox Christian	338 (87.1)	130 (86.7)	208 (87.4)	0.029
	Muslim	33 (8.5)	18 (12.0)	15 (6.3)	
	Protestant	13 (3.4)	2 (1.3)	11 (4.6)	
	Others	4 (1.0)	0	4 (1.7)	
Profession	Specialist	76 (19.6)	31 (20.7)	45 (18.9)	0.000
	Resident	142 (36.6)	56 (37.3)	86 (36.1)	
	Midwifery	37 (9.5)	0	37 (15.5)	
	Nurse	83 (21.4)	41 (27.3)	42 (17.6)	
	Anesthetist	50 (12.9)	22 (14.7)	27 (11.3)	
Work experience	≤2 years	96 (24.7)	43 (28.7)	53 (22.3)	0.360
	3–5 years	168 (43.3)	61 (40.7)	107 (44.9)	
	>5 years	124 (32.0)	46 (30.6)	78 (32.8)	
Have a managerial position	Yes	67 (17.3)	25 (16.7)	42 (17.6)	0.891
	No	321(82.7)	125 (83.3)	196 (82.4)	
Monthly salary	≤7,071	107 (27.6)	45 (30.0)	62 (26.1)	0.000
	7,072–10,075	87 (22.4)	12 (8.0)	75 (31.5)	
	10,076-11,305	101 (26.0)	57 (38.0)	44 (18.5)	
	≥11,306	93 (24.0)	36 (24.0)	57 (23.9)	
Have children under 18 years old	Yes	112 (28.9)	52 (34.7)	60 (25.2)	0.051
	No	276 (71.1)	98 (65.3)	178 (74.8)	
Number of children<18 years old (n = 112)	One	54 (48.2)	22 (43.1)	32 (52.5)	0.348
	Two and more	55 (51.8)	29 (56.9)	29 (47.5)	

among participants who had a high perceived workload compared to those who had a low perceived workload (28.39 ± 12.45 vs. 21.27 ± 16.07 respectively; $p < 0.01$). Moreover, participants who had poor hope of promotion had a high EE mean score compared to those who had good hope of promotion (32.30 ± 11.81 vs. 25.64 ± 12.68 respectively; $p < 0.01$). Relatively, a higher EE mean score was found among males compared to females (28.00 ± 12.29 vs. 25.23 ± 15.86 respectively) but this difference was not found to be significant ($p > 0.05$). The mean score of EE did not show a significant difference by the type of hospital in which the clinicians were employed (27.33 ± 12.11 for Tibebe-Ghion vs. 27.25 ± 13.05 for Gondar; $p > 0.05$).

Burnout levels in the dimension of depersonalization were higher among females compared to males (11.25 ± 7.83 vs. 9.26 ± 7.91 respectively; $p = 0.030$). The mean score of depersonalizations was also higher among Christians compared to Muslims (10.07 ± 8.01 vs. 6.64 ± 6.25 respectively; $p = 0.017$). There was a significant difference in the mean score of depersonalizations by profession; most especially the difference was observed between midwifery and residents (15.14 ± 9.36 vs. 7.76 ± 6.48 respectively; $p < 0.01$). A significant difference in the mean score of depersonalizations was also noted concerning the participants' monthly income; particularly, these differences were noted between participants who received a monthly income below 7,071 EBR compared to those who earn 10,076–11305EBR (12.01 ± 8.16 vs. 7.76 ± 6.73 respectively; $p < 0.01$). However, the difference in the mean score of depersonalizations was not observed by the

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TABLE 2 Working environment-related characteristics of health personnel working at the surgical care department; tertiary hospitals, North-West Ethiopia, 2021 (*n* =388).

Variables	Category	Total *N* (%)	Tibebe Ghion *n* (%)	Gondar *n* (%)	*p*-value
Relationship at workplace	Good	350 (90.2)	132 (88.0)	218 (91.6)	0.499
	Neutral	29 (7.5)	14 (9.3)	15 (6.3)	
	Low	9 (2.3)	4 (2.7)	5 (2.1)	
Perception of the management system	Good	207 (53.4)	49 (32.7)	158 (66.4)	0.000
	Neutral	87 (22.4)	38 (25.3)	49 (20.6)	
	Low	94 (24.2)	63 (42.0)	31 (13.0)	
Prospect of promotion	Good	258 (66.5)	73 (48.7)	185 (77.7)	0.000
	Neutral	87 (22.4)	48 (32.0)	39 (16.4)	
	Low	43 (11.1)	29 (19.3)	14 (5.9)	
Perception of workload	High	331 (85.3%)	127 (84.7)	204 (85.7)	0.047
	Balanced	46 (11.9)	15 (10.0)	31 (13.0)	
	Low	11 (2.8)	8 (5.3)	3 (1.3)	
Perception of the working environment	Suitable	138 (35.6)	23 (15.3)	115 (48.3)	0.000
	Neutral	90 (23.2)	30 (20.0)	60 (25.2)	
	Unsuitable	160 (41.2)	97 (64.7)	63 (26.5)	
Perception of professional recognition	Good	236 (60.8)	73 (48.7)	163 (68.5)	0.000
	Neutral	68 (17.5)	27 (18.0)	41 (17.2)	
	Low	84 (21.7)	50 (33.3)	34 (14.3)	
Resource availability	Sufficient	80 (20.6)	12 (8.0)	68 (28.6)	0.000
	Neutral	41 (10.6)	14 (9.3)	27 (11.3)	
	Insufficient	267 (68.8)	124 (82.7)	143 (60.1)	
Is there any fear of contracting an illness during work	Yes	257 (66.2)	127 (84.7)	130 (54.6)	0.000
	No	131 (33.8)	23 (15.3)	108 (45.4)	

participants' work experience, having children under 18 years old, relationships at work, and hope of promotion ($p > 0.05$).

Concerning burnout levels in the dimension of personal accomplishment, a higher mean score was reported among males compared to females (36.74 ± 7.39 vs. 34.62 ± 8.71 respectively; $p = 0.019$), and among Muslim religion, followers compared to Christians (39.48 ± 4.68 vs. 35.88 ± 7.96 respectively; $p = 0.011$). Significant differences in the mean score of PA were found according to the profession of the respondents; most especially the difference was noted between residents and midwifery as well as between specialists and midwifery (38.03 ± 6.54 for residents, 36.25 ± 7.51 for specialists' vs. 32.54 ± 8.55 for midwifery; $p < 0.01$). The mean score of PA was lower among respondents who hold a managerial position compared to those who do not hold such positions (33.16 ± 8.60 vs. 36.82 ± 7.48 respectively; $p < 0.01$). Significant differences in PA mean score were also observed in participants 'monthly income; most notably, it was lower among respondents whose monthly income was below 7,071 EBR compared to those whose monthly income was between 10,076–11,305 EBR (32.28 ± 8.74 vs. 38.21 ± 7.09 respectively; $p < 0.01$). From the work-related variables, there was a significant difference in the mean score of PA according to participants' perceived hopes of promotion and professional recognition. Particularly, participants who have poor hope of promotion have lower levels compared to those who have good and neutral levels of hope (33.09 ± 7.93 vs. 36.49 ± 7.98 and 36.84 ± 6.86 respectively; $p = 0.020$). The same trend was identified among those who have a poor perception of professional recognition compared to those with a good perception (34.11 ± 7.47 vs. 36.77 ± 7.91 respectively; $p = 0.021$).

The three burnout domains were not found to be significantly different according to the participant's age, work experience, or the hospital in which they are employed ($p > 0.05$; Table 3).

3.5. The magnitude of 'resilience at work' (RaW)

The participants' mean resilience at work score with standard deviation (±SD) was 78.36 ± 17.78. In this study, 53 (13.7%), 141 (36.3%), and 194 (50.0%) respondents have low, moderate, and high levels of resilience at work, respectively.

The mean resilience score has a significant difference across the participants' marital status, profession, and monthly income. Married women have a high resilience mean score compared to those who are not married (either divorced or widowed together) (79.18 ± 18.20 vs. 60.50 ± 26.58 respectively; $p = 0.038$). Professionally, specialists have the highest (82.59 ± 14.17) resilience mean scores compared to other professionals, and the lowest level of resilience at work was found among Midwives (70.62 ± 21.04; $p < 0.001$). Similarly, the mean score

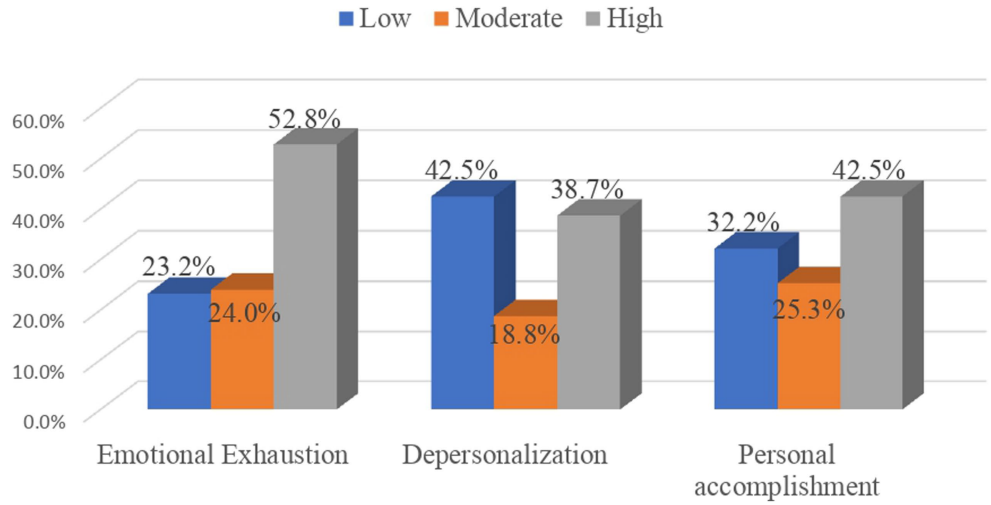

FIGURE 1
Maslach burnout subscale levels among health personnel working at the surgical care department; tertiary hospitals, north-west Ethiopia, 2021 (n=388).

of resilience was found to be higher according to the income level of the respondents. The mean score for income <7,071, 7,072–10,075, 10,076–11,305, and >11,305 was 74.04 ± 21.45, 76.94 ± 16.17, 80.66 ± 16.21, and 82.17 ± 15.03 respectively; $p < 0.01$.

Resilience at work had no significant difference according to the hospital in which the clinicians are employed (77.64 ± 16.00 for Tibebe-Ghion vs. 78.82 ± 18.84 for Gondar hospital; $p > 0.05$). Relatively, the mean score of resilience at work was higher among participants in the age group between 31 and 35 years compared to those whose age was below 26 years (82.59 ± 15.22 vs. 76.05 ± 18.18 respectively; $p > 0.05$). Resilience at work had no significant difference by the sex of the respondents (77.34 ± 20.57 for females vs. 78.82 ± 16.72 for males; $p > 0.05$). Moreover, the score of resilience at work had no significant difference according to the respondents' work experience, managerial position, workload, working environment's suitability for work, and resource availability ($p > 0.05$; Table 4).

3.6. Correlation between burnout sub-scales and resilience at work

Resilience at work was found to be associated with all three burnout dimensions (Pearson correlation between −0.139 to 0.479; $p < 0.05$). The Pearson correlation analysis showed that resilience at work has a negative association with emotional exhaustion and depersonalization, and in contrast, a positive association with the personal accomplishment burnout sub-scale.

3.7. Factors associated with burnout and 'resilience at work'

3.7.1. Factors associated with emotional exhaustion

Multiple linear regression results revealed that midwifery professionals [β: 5.503, 95%CI: 0.125, 10.882], anesthetic professionals [β: 5.029, 95%CI: 0.260, 9.798], the hope of promotion [β: 1.688, 95%CI: 0.039, 3.336], perception of professional recognition [β: 1.568, 95%CI: 0.120, 3.105] and fear of contracting illness during work [β: 4.426, 95%CI: 1.662, 7.190] were positively associated with the emotional exhaustion score. In contrast, the perception of workload [β: -3.367, 95%CI: −4.997, −1.736] was negatively associated with the emotional exhaustion score (Table 5). The R-square of this regression model was 0.159; which means that 15.9% of the dependent variable (emotional exhaustion) mean variation is explained by these independent variables collectively (Figure 2).

3.7.2. Factors associated with depersonalization

The multiple linear regression results revealed that depersonalization was positively affected by the participants' age [β: 0.235, 95% CI:0.016, 0.455] and professional type; midwifery [β:7.032, 95% CI: 3.627, 10.437], and nursing profession [β:4.754, 95% CI: 2.075,7.433]. Conversely, it was negatively affected by the participants' perception of workload [β: -1.184, 95% CI: −2.207, −0.161] (Table 6). The R-square of this regression model was 0.138; these independent variables collectively explained 13.8% of the dependent variable (depersonalization) mean variation (Figure 3).

3.7.3. Factors associated with personal accomplishment

The results of the multiple linear regression indicated that midwifery professionals [: -4.103, 95%CI: −7.105, −1.100], have managerial positions [: -3.806, 95%CI: −5.783, −1.819], relationship at workplace (very good, very bad) [β: -1.431, 95%CI: −2.447, −0.414], and perception of professional recognition (very good, very bad) [β: -1.038, 95%CI: −1.856, −0.221] were negatively associated with the personal accomplishment score (Table 7). The R-square of this regression model was 0.134; these independent variables collectively explained 13.4% of the mean variation of personal accomplishment (Figure 4).

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TABLE 3 The mean score of the three burnout dimensions based on the participants demographic and work-related variables of health personnel working at the surgical care department; tertiary hospitals, North-West Ethiopia; 2021 (*n*=388).

Variable	Burnout dimensions					
	Emotional exhaustion		Depersonalization		Personal accomplishment	
	Mean (±SD)	*P*-value	Mean (±SD)	*P*-value	Mean (±SD)	*P*-value
Gender						
Male	28.00 (12.29)	0.059	9.26 (7.91)	**0.030**	36.74 (7.39)	**0.019**
Female	25.23 (15.86)		11.25 (7.83)		34.62 (8.71)	
Age						
≤ 25	27.95 (14.22)	0.353	10.24 (8.52)	0.122	35.71 (7.45)	0.704
25–30	28.14 (12.08)		9.17 (7.50)		35.96 (8.05)	
31–35	25.80 (12.46)		9.82 (7.44)		37.03 (7.18)	
> 35	25.38 (14.42)		12.33 (10.01)		36.02 (8.22)	
Religion						
Christian	27.46 (12.50)	0.350	10.07 (8.01)	**0.017**	35.88 (7.96)	**0.011**
Muslim	25.30 (14.49)		6.64 (6.25)		39.48 (4.67)	
Marital status						
Single	28.54 (12.47)	0.120	8.88 (7.50)	**0.024**	36.38 (7.88)	0.598
Married	25.99 (12.62)		10.41 (8.09)		36.11 (7.70)	
Others	30.50 (18.58)		16.17 (11.50)		33.17 (9.43)	
Profession						
Specialist	24.33 (13.65)	0.133	8.63 (7.58)	< **0.001**	36.25 (7.51)	<**0.001**
Residents	28.42 (11.77)		7.76 (6.48)		38.03 (6.54)	
Midwifery	26.73 (14.22)		15.14 (9.36)		32.54 (8.55)	
Nurse	29.58 (13.05)		8.88 (8.17)		36.76 (7.01)	
Anesthetist	26.89 (12.08)		12.42 (8.06)		34.28 (9.20)	
Hospital in which they are employed						
Bebhionn	27.33 (12.11)	0.953	8.49 (6.95)	0.067	36.26 (7.33)	0.890
Gondar	27.25 (13.05)		10.58 (8.40)		36.15 (8.10)	
Work experience						
≤2 years	28.93 (11.01)	0.216	8.86 (7.24)	0.220	36.3 (7.65)	0.983
3–5 years	27.35 (13.13)		9.61 (7.81)		36.19 (7.64)	
≥ 6 years	25.91 (13.20)		10.70 (8.55)		36.10 (8.18)	
Have managerial position						
Yes	26.00 (12.39)	0.365	10.51 (7.99)	0.407	33.16 (8.60)	<**0.001**
No	27.55 (12.74)		9.62 (7.92)		36.82 (7.48)	
Have <18 years of children						
Yes	24.31 (13.08)	**0.003**	9.31 (7.33)	0.464	36.04 (7.89)	0.815
No	28.48 (12.34)		9.96 (8.17)		36.25 (7.78)	
Monthly income in EBR						
≤ 7,071	25.87 (12.71)	**0.001**	12.01 (8.18)	< **0.001**	32.28 (8.74)	<**0.001**
7,072–10,075	31.34 (10.51)		10.72 (8.43)		37.11 (6.88)	
10,076–11,305	28.11 (12.73)		7.76 (6.73)		38.21 (7.09)	
≥ 11,306	24.19 (13.51)		8.51 (7.68)		36.48 (7.33)	

(Continued)

TABLE 3 (Continued)

Variable	Burnout dimensions					
	Emotional exhaustion		Depersonalization		Personal accomplishment	
	Mean (±SD)	*P*-value	Mean (±SD)	*P*-value	Mean (±SD)	*P*-value
Relationship at work						
Good	26.74 (12.84)	**0.024**	9.95 (8.01)	0.383	36.32 (7.90)	0.240
Neutral	31.10 (9.87)		7.83 (6.93)		35.97 (6.91)	
Poor	35.89 (9.96)		9.44 (7.92)		31.89 (5.53)	
Management system						
Good	26.01 (12.95)	**0.033**	10.93 (8.16)	**0.004**	36.12 (8.25)	0.698
Neutral	27.22 (12.68)		7.74 (7.00)		36.77 (7.10)	
Poor	30.13 (11.71)		9.12 (7.85)		35.81 (7.43)	
Hope of promotion						
Good	25.64 (12.68)	**0.001**	10.26 (8.10)	0.237	36.49 (7.98)	**0.020**
Neutral	29.66 (12.17)		8.75 (7.72)		36.84 (6.86)	
Poor	32.30 (11.81)		8.95 (7.20)		33.09 (7.93)	
Perception of workload						
High	28.39 (12.45)	**<0.001**	9.82 (8.00)	0.375	36.40 (7.61)	0.424
Balanced	20.70 (11.21)		10.20 (7.87)		35.15 (8.72)	
Low	21.27 (16.07)		6.55 (5.52)		34.27 (9.35)	
Perception of the working environment						
Suitable	24.63 (13.10)	**0.008**	11.07 (8.04)	0.055	35.44 (8.54)	0.151
Neutral	28.12 (10.62)		8.83 (7.62)		37.49 (7.03)	
Not suitable	29.09 (13.05)		9.19 (7.91)		36.11 (7.80)	
Professional recognition						
Good	25.61 (12.56)	**0.004**	10.75 (8.12)	**0.007**	36.77 (7.91)	**0.021**
Neutral	29.32 (12.90)		8.96 (8.45)		36.75 (7.46)	
Poor	30.32 (12.16)		7.71 (6.47)		34.11 (7.47)	
Resource availability						
Sufficient	23.63 (13.42)	**0.009**	12.08 (8.63)	**0.014**	35.79 (8.84)	0.274
Neutral	30.12 (11.71)		8.98 (8.15)		38.02 (6.35)	
Insufficient	27.94 (12.41)		9.21 (7.57)		36.03 (7.66)	
Have a fear of contracting an illness during work						
Yes	29.33 (12.22)	**<0.001**	9.11 (7.49)	**0.021**	36.26 (7.54)	0.815
No	23.24 (12.65)		11.08 (8.61)		36.06 (8.31)	

The dependent variable has a difference according to the independent variable that has such a bold *p*-value.

3.7.4. Factors associated with 'resilience at work'

The multiple linear regression results indicated that the level of 'resilience at work' was affected by the participants' profession and marital status. Participants with midwifery [: -12.258, 95%CI: −19.888, −4.627], BSc nurse [*β*: -6.657, 95%CI: −12.616, −0.699], and others (divorced and widowed) marital status category [*β*: -16.410, 95%CI: −30.578, −2.243] were negatively associated with the participants 'resilience at work' score (Table 8). The R-square of this regression model was 0.089; these independent variables explained 8.9% of resilience at work mean variation score (Figure 5).

4. Discussion

In this study, 23.2, 24.0, and 52.8% of study participants have a low, moderate, and high level of burnout in Emotional exhaustion, respectively. Regarding burnout in depersonalization, 42.5, 18.8, and 38.7% of participants have low, moderate, and high levels of burnout, respectively. Similarly, 32.2, 23.5%, and 42. % of participants have low, moderate, and high levels of burnout in personal accomplishment. Regarding resilience at work, 13.7, 36.3, and 50.0% of respondents have low, moderate, and high levels of resilience at work, respectively. Resilience at work has a positive

TABLE 4 Mean scores of RaW according to the participants' demographic and working environmental-related variables of health personnel working at the surgical care department; tertiary hospitals, North-West Ethiopia; 2021 (n=388).

Variables	Category	Mean (±SD)	p-value
Age	≤ 25 years	76.05 (18.18)	0.072
	26–30	77.04 (18.46)	
	31–35	82.59 (15.22)	
	≥ 36	78.33 (18.07)	
Gender	Female	77.34 (20.57)	0.501
	Male	78.72 (16.72)	
Hospital they are serving	Tibebe-Ghion	77.64 (16.00)	0.525
	Gondar	78.82 (18.84)	
Have a managerial position	No	78.74 (17.45)	0.360
	Yes	76.55 (19.35)	
Marital status	Single	78.07 (16.87)	**0.038**
	Married	79.18 (18.20)	
	Others (divorced and widowed)	60.50 (26.58)	
Religion	Christian	78.03 (18.01)	0.232
	Muslim	81.91 (14.93)	
Profession	Specialist	82.59 (14.17)	**0.007**
	Resident	79.77 (15.62)	
	Midwifery	70.62 (21.04)	
	Anesthetist	78.06 (15.71)	
	Nurse	75.71 (22.21)	
Monthly income in Ethiopian Birr	≤ 7,071	74.04 (21.45)	**0.005**
	7,072–10,075	76.94 (16.17)	
	10,076–11,305	80.66 (16.21)	
	≥ 11,306	82.17 (15.03)	
Work experience	≤ 2 years	77.26 (18.16)	0.660
	3–5 years	78.20 (17.40)	
	≥ 6 years	79.44 (18.08)	
Have <18 years of children	No	77.68 (17.65)	0.236
	Yes	80.04 (18.07)	
Perceived relationship at work	Good	78.68 (17.89)	0.541
	Neutral	76.03 (15.96)	
	Poor	73.67 (19.63)	
Perception of the management system	Good	78.86 (19.24)	0.450
	Neutral	79.34(16.89)	
	Poor	76.37 (15.05)	
Hope of promotion	Good	79.40 (18.64)	0.078
	Neutral	78.05 (14.59)	
	Poor	72.81 (17.68)	
Perception of workload	High	77.90 (17.67)	0.202
	Balanced	82.54 (18.78)	
	Low	74.82 (15.53)	
Perception of the working environment	Suitable	78.68 (20.77)	0.176
	Neutral	80.96 (14.22)	
	Not suitable	76.63 (16.67)	
Perception of professional recognition	Good	80.22 (18.50)	**0.036**
	Neutral	75.12 (16.38)	
	Poor	75.76 (16.22)	
Perception of resource availability	Sufficient	77.60 (21.97)	0.627
	Neutral	80.80 (18.60)	
	Insufficient	78.22 (16.24)	
Have a fear of contracting an illness during work	No	80.47 (18.28)	0.096
	Yes	77.29 (17.46)	

(Continued)

TABLE 4 (Continued)

The dependent variable has a difference according to the independent variable that has such a bold p-value.

association with PA and an inverse association with EE and depersonalization burnout sub-domains.

4.1. Level of burnout

The study revealed that more than half of health professionals have high levels of burnout concerning the emotional exhaustion subscale. This is consistent with studies conducted in other African and/or Asian nations, such as in Mekelle Ethiopia (55.9%) (30), Iran (55.3%) (31), and Saudi Arabia (54%) (32). However, this level of emotional exhaustion is lower than the findings from the Southern part of Ethiopia (65.2%) (33), Brazil (70.6%) (34), and a pooled prevalence systemic review findings from 45 countries (68.1%) (40). The possible reason for the lower prevalence of burnout in high emotional exhaustion in the current study might be the difference in the cutoff point in high emotional exhaustion (≥ 24 for southern Ethiopia, >14 for Brazil vs. ≥27 in the current study) (33, 34). In contrast, it was higher compared to findings from Addis Ababa (42.0%) (41) and South France (15.8%) (42). The difference in perception of workload might be the plausible reason for the high prevalence of burnout in high EE in the current study as compared to Addis Ababa (high workload; 85.7% in the current study vs. 38.9% in Addis Ababa) (41). Contrarily, the distinction in EE from a study done in France may result from variations in the work environment set-up, patient volume, and working culture. In Ethiopia (43) one medical doctor and nurse are expected to serve populations of 28,847 and 2,299 respectively, whereas the equivalent figure in France is below 325 and 110 (44). Evidence showed that clinicians with high patient volume have a high rate of burnout (33, 45, 46).

In the current study, the magnitude of burnout among health professionals concerning high levels of depersonalization was 38.7%. This scope is comparable with the findings of previous studies done in Addis Ababa, Ethiopia (43.0%) (41), and Saudi Arabia (35%) (32). However, it is lower than the findings from Derdeba, Ethiopia (70.6%) (47) and South Africa (50.0%) (48). The possible reason for the lower prevalence of burnout concerning depersonalization may be derived from the relatively smaller proportion of females (26.0%) that participated in the current study compared to 44.5–55.6% of female participants that were

TABLE 5 Factors associated with emotional exhaustion among health personnel working at the surgical care department; tertiary hospitals, North-West Ethiopia; 2021 (n=388).

Variables	Unstandardized β-coefficient	95% CI		p-value
		Lower	Upper	
Age (20–49 years)	0.362	−0.133	0.857	0.151
Work experience (< 1 to 31 years)	−0.449	−0.976	0.079	0.095
Gender (male)	0.284	−2.928	3.496	0.862
Marital status				
Married	1	1	11	
Single	1.351	−1.412	4.114	0.337
Others (divorced and widowed)	4.490	−5.318	14.299	0.369
Profession				
Specialist	1	1	1	1
Resident	2.642	−1.298	6.581	0.188
Midwifery	5.503	0.125	10.882	**0.045**
Anesthetist	5.029	0.269	9.798	**0.039**
Nurse	3.145	−1.223	7.513	0.158
Relationship at the workplace [a] (1-5)	1.062	−0.651	2.775	0.224
Perception of management system [a] (1-5)	−0.578	−1.957	0.802	0.411
The hope of promotion [a] (1-5)	1.688	0.039	3.336	**0.045**
Perception of workload [b] (1-5)	−3.367	−4.997	−1.736	**< 0.001**
Perception of working Environment [c] (1-5)	−0.295	−1.816	1.225	0.703
Perception of professional recognition [a] (1-5)	1.568	0.120	3.015	**0.034**
Resource availability [d] (1-5)	0.597	−0.784	1.979	0.396
Fear of contracting an illness during work (yes)	4.426	1.662	7.190	**0.002**

[a]Very good, good, neutral, bad and very bad.
[b]Very high, high, balanced, low and very low.
[c]Very suitable, suitable, neutral, unsuitable and very unsuitable.
[d]highly sufficient, sufficient, neutral, insufficient, highly insufficient.
$R = 0.394$, $R^2 = 0.159$, $p < 0.001$.
The dependent variable has a difference according to the independent variable that has such a bold p-value.

reported in the aforementioned studies. Some evidence showed that depersonalization is more prevalent among females compared to men (49, 50). Another reason for the lower prevalence of depersonalization in the current study may be the presence of a higher number of specialists compared to the above previous studies (47). Conversely, burnout concerning depersonalization was found to be higher compared to previous studies done in Nigeria (15.8%) (51), China (7.5%) (52), and South Khorasan (16.8%) (53). Differences in a study setting might contribute to the differences; the aforementioned studies were conducted among primary healthcare professionals while the current study focused on healthcare workers employed in hospitals, characterized by relatively high workloads (54, 55).

The other dimension of burnout that was assessed in this study is personal accomplishment. According to the findings, 32.2% of the participants have high burnout levels, as displayed by low levels of personal accomplishment. This is consistent with other studies done in Romania (38%) (56), Palestine (34.6%) (57), and a systematic review of findings from low and middle-income countries (31.9%) (58). However, the percentage of high burnout in low personal accomplishment was lower than the findings from Debrebirhan (59.7%) (59), Addis Ababa (45%) (41), and among interns at other Ethiopian teaching hospitals (44.4%) (60). A possible reason for the lower prevalence reported in the current study as compared to the aforementioned studies may be the higher number of physicians who participated in the current study. Research on healthcare professionals showed that undergraduate professionals are more prone to burnout compared to post-graduate health professionals including specialists (41).

In contrast, the prevalence of low levels of personal accomplishment is higher compared to studies done in Mekelle Ethiopia (21.8%) (30), Uganda (18.33%) (61), Belgium (10.4%) (62), Germany (21.5%) (63), and Ecuador (18.2%) (64). The reason may be that compared to other studies, the current sample included a relatively higher prevalence of healthcare personnel that also hold managerial positions in addition to their professional duty (17%) compared to a much lower level in the aforementioned studies (62, 64). Literature findings present that managerial strain is positively associated with low personal performance (i.e., a high level of burnout) (65, 66). Another reason might be that the current study was conducted in high patient-load referral hospitals, which is characterized by the increased workload. A high workload was found to have a positive association with low levels of personal accomplishment (46, 67).

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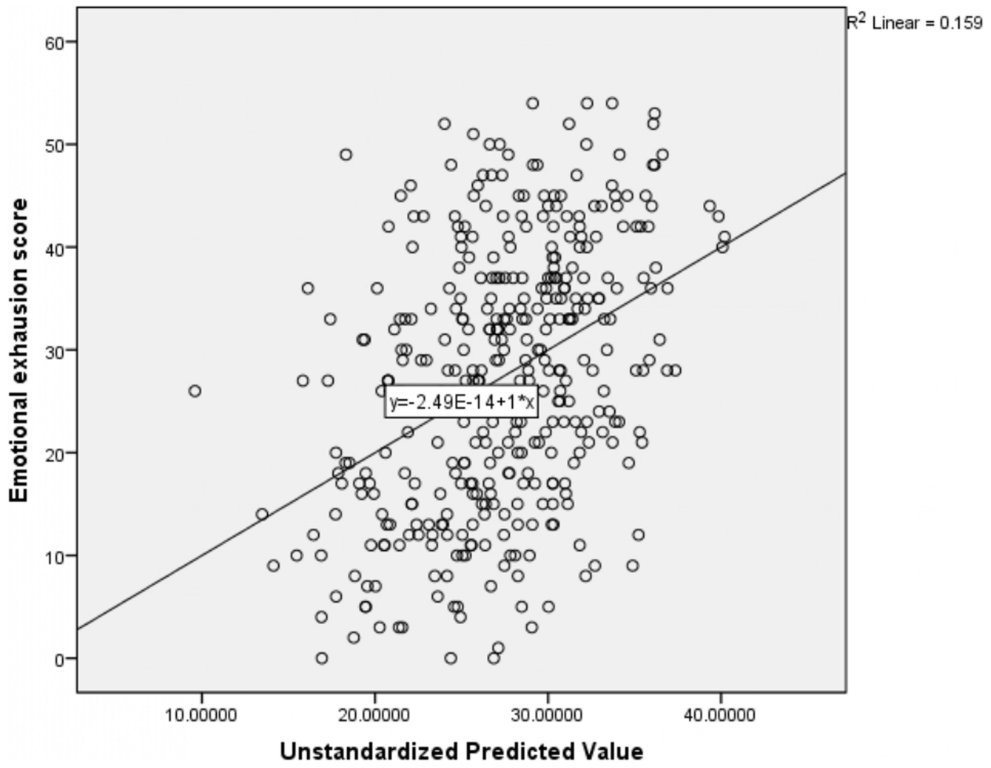

FIGURE 2
Scatter plot showing the amount of mean variation of emotional exhaustion score explained by the independent variables together.

TABLE 6 Factors associated with depersonalization among health personnel working at the surgical care department; tertiary hospitals, North-West Ethiopia; 2021 (n=388).

Variables	Unstandardized β-coefficient	95% CI		p-value
		Lower	Upper	
Age	0.235	0.016	0.455	**0.036**
Gender (male)	0.424	−1.591	2.438	0.679
Profession				
Specialist	1	1	1	
Resident	−0.175	−2.566	2.215	0.886
Midwifery	7.032	3.627	10.437	< **0.001**
Anesthetist	1.281	−1.587	4.150	0.380
Nurse	4.754	2.075	7.433	**0.001**
The hope of promotion[a] (1-5)	−0.139	−0.999	0.772	0.752
Perception of workload[b] (1-5)	−1.184	−2.207	−0.161	**0.023**
Resource availability[d] (1-5)	−0.317	−1.131	0.497	0.445
Have fear of contracting an illness during work (yes)	−0.709	−2.456	1.038	0.425
The hospital they are serving				
Gondar	0.982	−0.783	2.746	0.275
Tibebe Ghion	1	1	1	

$R = 0.371$, $R^2 = 0.138$, $p < 0.001$.
[a]Very good, good, neutral, bad and very bad.
[b]Very high, high, balanced, low and very low.
[d]highly sufficient, sufficient, neutral, insufficient, highly insufficient.
The dependent variable has a difference according to the independent variable that has such a bold p-value.

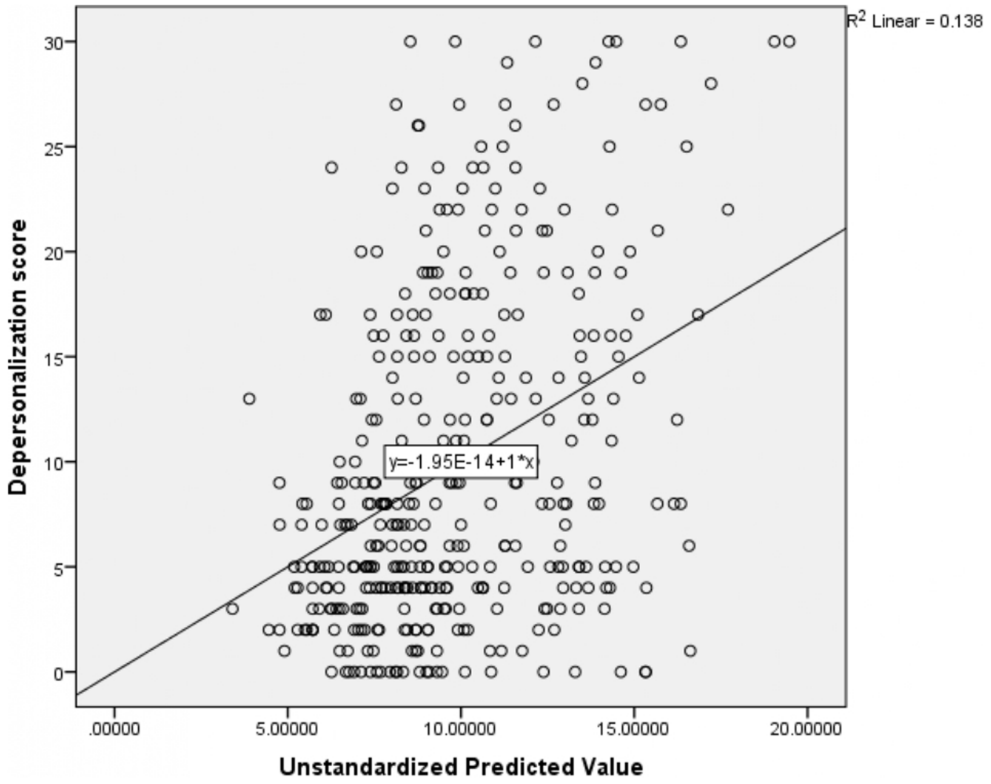

FIGURE 3
Scatter plot showing the amount of mean variation of Depersonalization score explained by the independent variables together.

TABLE 7 Factors associated with personal accomplishment among health personnel working at the surgical care department; tertiary hospitals, North-West Ethiopia; 2021 (*n*=388).

Variables	Unstandardized β-coefficient	95% CI		*p*-value
		Lower	Upper	
Gender (male)	1.282	−0.604	3.169	0.182
Profession				
Specialist	1	1	1	
Resident	0.626	−1.487	2.739	0.560
Midwifery	−4.103	−7.105	−1.100	**0.008**
Anesthetist	0.216	−2.446	2.879	0.873
Nurse	−2.280	−4.695	0.135	0.064
Have a managerial position (yes)	−3.806	−5.783	−1.819	**< 0.001**
Relationship at the workplace[a] (1-5)	−1.431	−2.447	−0.414	**0.006**
The hope of promotion[a] (1-5)	−0.248	−1.141	0.645	0.586
Perception of professional recognition[a] (1-5)	−1.038	−1.856	−0.221	**0.013**

$R = 0.342$, $R^2 = 0.134$, $p < 0.001$.
[a]Very good, good, neutral, bad, and very bad.
The dependent variable has a difference according to the independent variable that has such a bold *p*-value.

4.2. The factors that impact health professionals' burnout

In this study, midwifery health professionals were found to have a higher level of emotional exhaustion and depersonalization, and a lower level of personal accomplishment (burnout sub-scales) as compared to specialists. Moreover, anesthetic and nursing health professionals have a higher level of emotional exhaustion and depersonalization burnout, respectively, as compared to specialists. A systematic review report from Sub-Saharan Africa and Ghana is in line with the current findings (55,

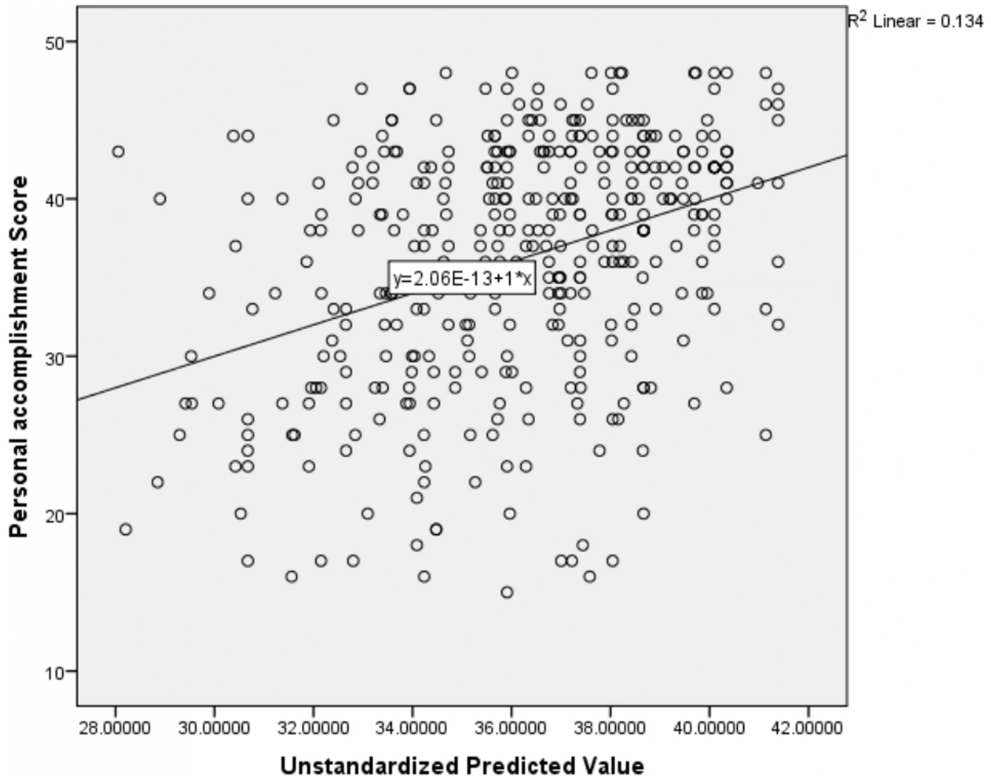

FIGURE 4
Scatter plot showing the amount of mean variation of personal accomplishment score explained by the independent variables together.

68). In contrast, a study from Addis Ababa Ethiopia, which concentrated on varied types of professions, did not identify an association with any of the burnout dimensions (41).

The other demographic variable that predicted the level of burnout in the current study is the age of the participants. However, the association was found only concerning the depersonalization burnout sub-scale. According to this study, the level of depersonalization increases by 0.235 every one-year increment in participants' age. This is in line with other studies (31, 41). Similarly, in a study done in Iran age groups of 30–39, 40–49, and ≥50 years had a significant correlation with the increased likelihood of burnout compared to those below 30 years of age groups (69). In contrast, a study conducted among physicians in southern Ethiopia presented that the age of the participants had an inverse relationship with both emotional exhaustion and depersonalization burnout sub-scale scores (33). However, in several other studies, the age of participants was not found to have any statistical association with the three burnout sub-scales (59, 70, 71).

Lower levels of participants' perceptions of professional recognition were found to be positively associated with emotional exhaustion and low levels of personal accomplishment. In contrast, reducing the perception of high workloads was negatively associated with emotional exhaustion and depersonalization. Similar previous studies support these findings; studies done in Ethiopia and Malawi showed that participants who got recognition/support from hospital managers had a lower level of emotional exhaustion compared to their counterparts (33, 72, 73). The previous findings in Ethiopia in the context of workload showed that an increased workload increases the health personnel's stress at work (74). Similarly, a study in the United Kingdom (UK) reported a high prevalence of burnout among participants with high work overload (10).

In line with a previous study conducted in Ethiopia (75), the current study revealed that reducing participants' hope of promotion was positively associated with emotional exhaustion. In contrast to the current study, a study in Malawi presented that participants' hope of future promotion was not significantly associated with emotional exhaustion (73).

Relationship at the workplace is another work-related variable that determines personal accomplishment. The participants' level of burnout concerning a low personal accomplishment was increased when the participant's perception of a relationship at the workplace decreased from very good to very bad relations. This is in line with findings from previous studies (75–77). As was found in the current study, previous findings also revealed that participants who have a fear of contracting an illness during their work have higher emotional exhaustion compared to their counterparts (75).

Among this study's participants, seniority in work (work experience) had no statistical association with all dimensions of burnout. This was also found in previous studies (78). In contrast, a study done in Malaysia found that health professionals working under 10 years have higher levels of burnout compared to those working above 10 years (79). In divergence, other studies showed a higher prevalence of emotional exhaustion among participants who work above 10 years as compared to health professionals that work less than that (31, 53). Similarly, in a study done in Greek (80) a positive association was found between professional work experience and depersonalization and an inverse relationship with personal accomplishment.

TABLE 8 Factors associated with 'resilience at work' among health personnel working at the surgical care department; tertiary hospitals, north-west Ethiopia; 2021 (n=388).

Variables	Unstandardized β-coefficient	95% CI		p-value
		Lower	Upper	
Age	0.140	−0.361	0.641	0.583
Profession				
Specialist	1	1	1	
Resident	−2.816	−8.368	2.735	0.319
Midwifery	−12.258	−19.888	−4.627	**0.002**
Anesthetist	−3.065	−9.759	3.629	0.369
Nurse	−6.657	−12.616	−0.699	**0.029**
Marital status				
Married	1	1	1	
Single	−0.797	−4.755	3.161	0.692
Others (divorced and widowed)	−16.410	−30.578	−2.243	**0.023**
Relationship at the workplace[a] (1-5)	−1.317	−3.771	1.138	0.292
The hope of promotion[a] (1-5)	−1.173	−3.304	0.959	0.280
Perception of working Environment[c] (1-5)	0.022	−1.958	2.001	0.983
Perception of professional recognition[a] (1-5)	−1.753	−3.819	0.314	0.096
Have fear of contracting an illness during work (yes)	−2.594	−6.505	1.317	0.193

$R = 0.299$, $R^2 = 0.089$, $p < 0.001$.
[a]Very good, good, neutral, bad, and very bad.
[c]Very suitable, suitable, neutral, unsuitable and very unsuitable.
The dependent variable has a difference according to the independent variable that has such a bold p-value.

4.3. Levels of resilience at work

The mean comparison analysis of this study affirms that the level of mean resilience at work score was higher among medical specialists as compared to nurse professionals. The multiple linear regression findings of this study also revealed that midwifery and nurse professionals have 12.26 and 6.66% lower scores of resilience at work respectively, as compared to specialists. This is in line with previous studies that also found that nurses and midwives present lower levels of resilience at work as compared to medical professionals (81, 82). This difference might be derived from the medical specialists' having more years of education compared to nurses; an increase in education was found to improve the level of resilience at work (83).

Similar to other studies (82), being divorced and widowed is associated with a lower level of resilience at work, as compared to married health professionals. The multiple linear regression analysis also revealed that participants that are divorced or widowed have a lower mean of resilience at work as compared to their married counterparts.

In addition to the demographic variables, the working environment-related variable (perceived professional recognition) is associated with the resilience mean score. Participants in the current study who have a good perception of professional recognition were found to have a higher level of mean resilience score as compared to those who have a neutral or poor perception of professional recognition. Previous evidence showed that professional recognition and support can increase professionals' resilience levels in their work (33, 84).

In line with findings from previous studies, resilience at work was found in the current study to have a negative association with emotional exhaustion and depersonalization, and a positive association with personal accomplishment (39, 85–88). Increased professional resilience has an impact on reducing emotional exhaustion, and increasing clinicians' work engagement, as well as enhancing function when facing challenges at the workplace (89). Health personnel with a high level of 'resilience at work' have a negative association with psychological distress and burnout (90). In contrast, experiencing a high level of job-related stress and burnout is positively associated with a high-level health professional turnover and dissatisfaction (91).

4.4. The variance explained by the model

The adjusted R-square of the four models ranged from 8.9 to 15.9% (Figures 2-5). This reflects a very small amount of the mean variation of the four outcome variables (emotional exhaustion, depersonalization, personal accomplishment, and Resilience at work)

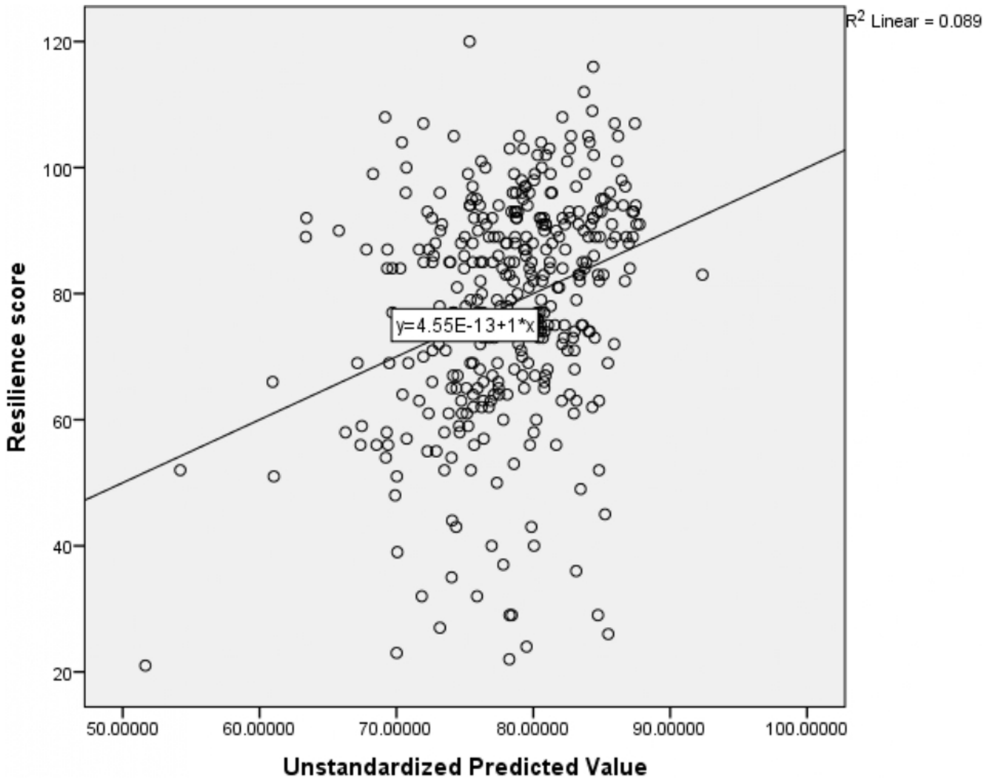

FIGURE 5
Scatter plot showing the amount of mean variation of resilience at work score explained by the independent variables together.

explained by the predictor variables collectively in the model. This small R-square value might be due to different reasons; The first reason might be important predictor variables like; substance use, family size, role in the family, and house ownership not included in the model that might have a higher capacity to explain the mean variation of those outcome variables. The second reason for the low R-square might also be secondary to the difficulty in explaining human behavior. In most cases, a mall R-square value is considered a sign of a bad model, but it is not always true. It depends on the type of the problem being solved; to explain materials high R-square value is recommended, but in some problems such as human behavior, the model with a small R-square value can be considered a good model (92). As a result, the current model could be a good model to predict the outcome variables with the existing low R-square.

4.5. Limitations of the study

This study has some limitations; due to the cross-sectional nature; the study does not show the cause-effect relationships between the predictor and the outcome variables. Moreover, due to the small sample size, there is limited generalizability of the current study findings. Since the study targeted specific specialties, the selection bias cannot be excluded. More exploration of working environment-related predictor variables by using a qualitative study design might be useful to identify additional relevant factors.

5. Conclusion

This study revealed that most of the health professionals who are working in Ethiopian hospitals experience one or more forms of burnout. Around one-fourth of health professionals, face an overall burnout syndrome. In the current study, a low mean score of 'resilience at work' was reported. This may have a negative influence on organizational performance. This study also revealed that professional burnout and resilience at work are inversely correlated. Therefore, efforts should be invested to increase the level of resilience at work and promote professional recognition, as well as reduce high workloads in the strive of reducing burnout. Moreover, all Ethiopian hospitals should learn from this finding, and invest efforts to reduce burnout and enhance resilience at work by strengthening professional recognition, the hope of promotion, relationships at work, and reducing high workload. Further research concerning burnout and resilience at work is recommended by incorporating additional variables such as the presence of comorbidities, family-related challenges, and behavioral variables like substance use. Moreover, intervention-based studies are recommended for assessing the effect of training on the area of resilience and burnout.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethical Review Board of the Rabin Medical Center and Tel-Aviv University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

YG and BA were conceived and designed for the study to conduct the analysis. YG, BA, and KH were equally involved in the interpretation and writing of the results. All authors read and approve the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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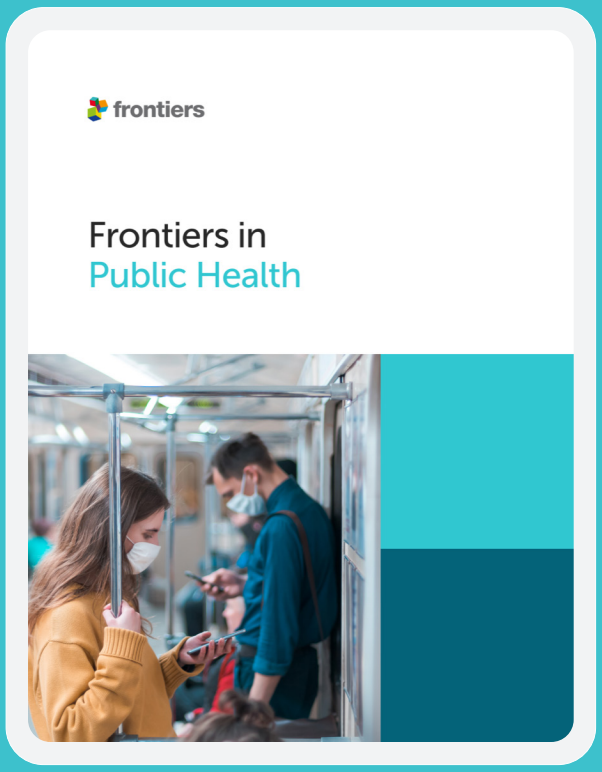

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