frontiers | Research Topics

Transforming health and social education to include a greater focus on public health education in the curriculum

Edited by
Sharon Brownie, Constance Shumba, Louise Ackers and Georgina A. V. Murphy

Published in
Frontiers in Public Health
Frontiers in Medicine

ISSN 1664-8714
ISBN 978-2-8325-4084-8
DOI 10.3389/978-2-8325-4084-8

About Frontiers

Frontiers is more than just an open access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers journal series

The Frontiers journal series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the *Frontiers journal series* operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews. Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the *Frontiers journals series*: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area.

Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers editorial office: frontiersin.org/about/contact

Transforming health and social education to include a greater focus on public health education in the curriculum

Topic editors

Sharon Brownie – Swinburne University of Technology, Australia
Constance Shumba – Aga Khan University Hospital, Nairobi, Kenya
Louise Ackers – University of Salford, United Kingdom
Georgina A. V. Murphy – Bill and Melinda Gates Foundation, United States

Citation

Brownie, S., Shumba, C., Ackers, L., Murphy, G. A. V., eds. (2023). *Transforming health and social education to include a greater focus on public health education in the curriculum*. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-8325-4084-8

Table of contents

frontiers | Frontiers in Public Health

TYPE Editorial
PUBLISHED 24 November 2023
DOI 10.3389/fpubh.2023.1306124

OPEN ACCESS

EDITED AND REVIEWED BY
Christiane Stock,
Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Institute of Health and Nursing Science, Germany

*CORRESPONDENCE
Sharon Brownie
SBrownie@swin.edu.au;
s.brownie@griffith.edu.au;
sharon.brownie@wintec.ac.nz

RECEIVED 03 October 2023
ACCEPTED 08 November 2023
PUBLISHED 24 November 2023

CITATION
Brownie S, Ackers L, Murphy G and Shumba C (2023) Editorial: Transforming health and social education to include a greater focus on public health education in the curriculum. *Front. Public Health* 11:1306124. doi: 10.3389/fpubh.2023.1306124

Editorial: Transforming health and social education to include a greater focus on public health education in the curriculum

Sharon Brownie [1,2,3]*, Louise Ackers [4], Georgina Murphy [5] and Constance Shumba [6]

[1]School of Health Sciences, Swinburne University of Technology, Hawthorn, VIC, Australia, [2]School of Medicine and Dentistry, Griffith University, Gold Coast, QLD, Australia, [3]Centre for Health and Social Practice, Te Pukenga: Wintec, Hamilton, New Zealand, [4]Global Social Justice, University of Salford, Salford, United Kingdom, [5]Bill & Linda Gates Foundation, Seattle, WA, United States, [6]School of Nursing and Midwifery, Aga Khan University, Nairobi, Kenya

KEYWORDS

public health, curriculum, health and social education, diversity, health priorities

Editorial on the Research Topic
Transforming health and social education to include a greater focus on public health education in the curriculum

The Research Topic *"Transforming health and social education to include a greater focus on public health education in the curriculum"* has published 12 articles with 73 contributing authors from at least 11 countries demonstrating global interest in reshaping curricula across the future healthcare workforce. The articles depict diverse public health priorities for health and social education across a variety of contexts. The diversity of the Research Topic is indicative of the rapidly changing healthcare landscape in which we see new treatment discoveries; changing societal values and perspectives; technological innovation; increased expectations of personalized healthcare; and unresolved inequity despite the advances in healthcare discovery and innovation. The Research Topic adds to a growing body of literature calling for, update and change in public health education (1–4). Perspectives and interventions within the manuscripts provide examples of the direction that health and social education might take in the future in areas reinforcing the need for curricula change and preparation of new cadres of health professionals.

The changing public health priorities call for parallel changes in the **educational preparation** of the health workforce (5). Community Health Workers (CHWs) play a crucial role in public health by providing preventive and promotive health services, taking services closer to their communities, and increasing access to facility-based health services. Rogers et al. explored education, literacy, experience, training, and gender as potential predictors of Community Health Workers' (CHWs) performance in Migori County, Kenya. Results demonstrate that educational intervention has the capacity to contribute to increased knowledge among CHWs and a significant predictor of immunization rates and antenatal care completion rates among the clients reached by CHWs. The framework developed by Armstrong et al., provides a forward-thinking model for the development of population health competencies within the future medical workforce with the aim of ensuring greater understanding and commitment to population health priorities. Nursing curricula provide an important entry point to address community level MCH concerns and bolster MCH

outcomes. Isangula et al. co-designed an intervention package (prototype) to improve nurse–client relationships using a human-centered design approach with maternal and child health nurses and clients in rural Tanzania. One of the key interventions increased hours within the nursing education curriculum to focus on communication skills, customer care and patient-centered care, to improve nurse-client relationships—particularly important skills in primary care settings. Effective interprofessional strategies are needed to better address burgeoning public health issues such as T2DM, however, the acquisition of interprofessional competencies (IPC's) does not occur by chance. IPC's must be actively taught and assessed. Brownie et al. provide a collated guide of the IPE assessment tools available for teaching faculty wishing to support IP competency development for the future workforce. Aging of the population. Changes are needed across the full workforce with specific attention to all cadres of the health care team including allied health professionals (Dalton et al.) whose roles are increasing important.

As much as 50% of health professional **education** occurs **in clinical settings**. In order to effect real change, enhancements within written curricula must flow from class-based settings class to clinical education context where students are able to see and reflect upon grass-roots public health challenges including both chronic and emergency settings (Jie et al.) The scoping review by Sampath et al. investigated the prospect for curriculum enhancement through the role of Student run free clinics (SRFCs) and their effectiveness in the prevention and management of type 2 diabetes mellitus (T2DM) among indigenous older adults. The review found that SRFCs are particularly beneficial in providing high quality and effective T2DM management for underserved populations with no health insurance and of lower socio-economic status. Female cervical cancer deaths in sub-Saharan Africa, continue to be a major public health issue despite being both preventable and curable if detected and treated early. The Community Case Study by Auma et al. presents a multi-pronged, technology informed, point-of-care screening intervention using a series of action-research cycles to scale-up screening and treatment of cervical cancer through a community-based model in Uganda. The cycles included device procurement, capability-enhancement, the use of Geographic Information Systems to guide awareness-raising and service integration with HIV care. In accordance with the Ministry of Health guidelines in Uganda, low-cost screening is done using Visual Inspection with Acetic Acid and treatment of early dysplasia (cervical intraepithelial neoplasia) using cryotherapy. The action-research cycles were progressively integrated into a comprehensive, task-shifted, point-of-care, prevention program in a community-based public health facility. The authors found that task-shifting responsibility to Community Health Workers and the application of Geographic Information Systems to strategically guide health awareness-raising and the deployment of medical devices was effective in supporting respectful and sustainable point-of-care screen-and-treat services. Further, integration with HIV services increases reach among those at the highest risk of cervical cancer. The integration of this with public HIV services demonstrates the ability to engage hard-to-reach "key populations" at greatest risk of cervical cancer. The model presents opportunities for policy transfer to other areas of health promotion and prevention with important lessons for international health partnership engagement. Findings also demonstrate the impact of external influences and the Results Based Financing approach, adopted by many foreign NGOs. The works of Auma et al., Case et al. and Sun et al. demonstrate the rapid expansion of technological innovation with which curricula transformation must keep pace.

Societal values, beliefs and mores are continuously changing with increased commitment to more inclusive and culturally attuned care provision with significant opportunity for curriculum transformation in these areas Promoting inclusiveness and the provision of culturally competent healthcare among Lesbian, Gay, Bi-sexual, Transgender, Questioning, Intersex, and Asexual (LGBTQIA+) patients is an area of growing public health importance to counter persistent discrimination in the provider-client encounters. Prasad et al. assessed the educational impact of an active learning session that was specifically designed to enhance LGBTQIA+ cultural competency awareness using an interprofessional setting. Students in the study identified self-reflection processes as being crucial in addressing implicit biases regarding LGBTQIA+ individuals. The authors pointed to how useful expanded culturally competent interprofessional collaboration through education and awareness could be in improving healthcare for LGBTQIA+ patients. Health delivery transcends national boundaries with practitioners working across a variety of settings. Fostering cross-cultural communication skills by leveraging platforms and tools that enhance social connections and communication. Ahmad et al. and Case et al. both implemented virtual programs aimed at developing students' intercultural competency by engaging students from Australia and India and the US and Egypt respectively. Both used a peer-to-peer approach with the Australia- India interactions being synchronous while the US-Egypt study used both text and synchronous Zoom medium. Both studies provide important insights on the role that virtual platforms can be utilized in public health to support intercultural learning among students as peers.

The Research Topic provides useful examples in class and clinical education settings illustrative of the breadth of the health workforce—HCW's doctors, nurses, and allied health personnel. The diversity of the Research Topic is indicative of the rapidly changing healthcare landscape in which we see new treatment discoveries; changing societal values and perspectives; technological innovation; expectations of personalized healthcare; and embedded inequity despite the advances in healthcare discovery and innovation. In short, nothing stands still, and each decade heralds a very different practice landscape into which graduate health professionals emerge. The diversity of studies points to the need to continuously examine and renew the public health curriculum.

Author contributions

SB: Conceptualization, Methodology, Project administration, Supervision, Writing—original draft. LA: Conceptualization, Writing—review & editing. GM: Conceptualization,

Writing—original draft. CS: Conceptualization, Methodology, Writing—original draft.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Acknowledgments

We gratefully acknowledge the contributing authors and reviewers of this Research Topic.

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

References

1. Bürkin BM, Venticich PM, Adongo PB, De Almeida-Filho N, Magaña L, Middleton J, et al. Revolutionizing the Public Health Workforce—A Policy Brief in Retrospect of the World Congress on Public Health Rome 2020. *Public Health Rev.* (2023) 44:1604807. doi: 10.3389/phrs.2023.1604807

2. Conn C, Nayar S, Williams MH, Cammock R. Re-thinking public health education in Aotearoa New Zealand: factory model to personalized learning. *Front Educ.* (2021) 6:636311. doi: 10.3389/feduc.2021.636311

3. Ghaffar A, Rashid SF, Wanyenze RK, Hyder AA. Public health education post-COVID-19: a proposal for critical revisions. *BMJ Glob Health.* (2021) 6:e005669. doi: 10.1136/bmjgh-2021-005669

4. Neubauer LC, Merzel C, Weist EM, Corvin JA, Forsman A, Fraser J, et al. Realizing promising educational practices in academic public health: a model for the scholarship of teaching and learning. *Front Public Health.* (2022) 9:750682. doi: 10.3389/fpubh.2021.750682

5. The Lancet Global H. Health-care workers must be trained and retained. *Lancet Global Health.* (2023) 11:e629. doi: 10.1016/S2214-109X(23)00172-9

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 31 October 2022
DOI 10.3389/fpubh.2022.1030887

OPEN ACCESS

EDITED BY
Georgina Murphy,
Bill and Melinda Gates Foundation,
United States

REVIEWED BY
Dirk Bruland,
Bielefeld University of Applied Sciences, Germany
Jatinderkumar R. Saini,
Symbiosis Institute of Computer Studies and Research (SICSR), India

*CORRESPONDENCE
Yongbing Liu
bingbing19950806@163.com

†These authors have contributed equally to this work

SPECIALTY SECTION
This article was submitted to Public Health Education and Promotion,
a section of the journal Frontiers in Public Health

RECEIVED 29 August 2022
ACCEPTED 13 October 2022
PUBLISHED 31 October 2022

CITATION
Sun H, Qian L, Xue M, Zhou T, Qu J, Zhou J, Qu J, Ji S, Bu Y, Hu Y, Wu S, Chen Y, You J and Liu Y (2022) The relationship between eHealth literacy, social media self-efficacy and health communication intention among Chinese nursing undergraduates: A cross-sectional study.
Front. Public Health 10:1030887.
doi: 10.3389/fpubh.2022.1030887

The relationship between eHealth literacy, social media self-efficacy and health communication intention among Chinese nursing undergraduates: A cross-sectional study

Huiping Sun†, Lin Qian†, Mengxin Xue, Ting Zhou, Jiling Qu, Jingxin Zhou, Junchao Qu, Siqi Ji, Yuan Bu, Yicheng Hu, Shaung Wu, Yuhui Chen, Jiachun You and Yongbing Liu*

School of Nursing, School of Public Health, Yangzhou University, Yangzhou, China

Background: With the popularization of the Internet, it has become possible to widely disseminate health information *via* social media. Medical staff's health communication through social media can improve the public's health literacy, and improving the intention of health communication among nursing undergraduates is of great significance for them to actively carry out health communication after entering clinical practice.

Objective: To explore the relationship among eHealth literacy, social media self-efficacy, and health communication intention and to determine the mediating role of social media self-efficacy in the relationship between eHealth literacy and health communication intention.

Design: A cross-sectional descriptive correlation design was used in this study.

Participants: Stratified cluster sampling was used to select 958 nursing students from four nursing colleges in Jiangsu Province, China, from June to July 2021.

Methods: Data were collected using the eHealth Literacy Scale, the Social Media Self-efficacy Scale, and the Health Communication Intention Questionnaire. Sociodemographic data were also collected. Correlation analysis and regression analysis were used to determine the relationship between eHealth literacy, social media self-efficacy, and health communication intention.

Results: Health communication intention is positively correlated with eHealth literacy and social media self-efficacy. There is a significant positive correlation between eHealth literacy and health communication intention ($\beta = 0.57$, $p < 0.001$), and social media self-efficacy played a mediating role in the influence of eHealth literacy on health communication intention (the mediating effect accounted for 37.2% of the total effect).

Conclusion: The study found that eHealth literacy and social media self-efficacy had an impact on health communication intention. Because there is a correlation between eHealth literacy and social media self-efficacy and health communication intention, in order to promote health communication intention of nursing students, it is also important to cultivate eHealth literacy and social media self-efficacy of nursing students. In view of these results, targeted educational programs must be developed to improve eHealth literacy and social media self-efficacy among nursing undergraduates, thereby promoting their health information transmission.

KEYWORDS

nursing undergraduates, eHealth literacy, social media self-efficacy, health communication, health communication intention

Introduction

Health communication is a kind of behavior that transforms the results of medical research into public health knowledge and aims to reduce the morbidity and mortality due to diseases and effectively improve the quality of life and health of a community or country through attitude and behavior change (1). With the improvement of public health awareness and the advent of the Internet era, the Internet has become the main source of public health information (2). As of June 2019, China had 854 million Internet users and an Internet penetration rate of 61.2% (3). With the rapid development of new media, health information can be transmitted through different media (4). Social media enables people to spread health information by creating and sharing content *via* a wide variety of applications (such as WeChat, Weibo, and blogs) (5). Studies have found that doctor-patient interactions on social media can have a significant impact on patients' health behaviors through knowledge, self-efficacy, and outcome expectations (6, 7). Among the active users of new media who pay attention to health information, 92% will change their health behavior after reading health information, wherein 71% of users act immediately, and 45% are influenced by the message (8).

However, the quality of health information obtained through social media varies greatly, and health professionals need to engage in health communication *via* relevant media to improve the reliability of health information (9, 10). Studies have shown that people are more likely to trust health information transmitted by professionals, such as medical staff (11). At present, it is widely believed that effective communication plays an important role in health care in medical and academic circles. Health communication is not an insignificant addition to the medical process but rather lies at the core of the medical process (12). By disseminating health knowledge through social media, medical staff can improve people's health literacy and, thus, improve their work efficiency (13). Nurses play an important role in the dissemination of health information (14). In order to promote the use of social media by nurses to share expertise and acquire knowledge in their field of work in their free time, the Finnish Nurses Association has developed guidelines for social media use (15). Therefore, the intention of health communication in this study is the intention of using social media to spread health knowledge. However, the study found that nurses are mostly invisible in the media due to a lack of media literacy and communication intention (16, 17). Therefore, there is an urgent need to improve nurses' intention to communicate about health on social media to change this situation. Some studies have pointed out that age will affect the willingness to learn to use social media, the older the age (18), the lower the willingness to learn to use social media, and the greater the work pressure of nurses, it is relatively difficult to find free time to learn how to use social media to spread health knowledge (19). Nursing students are the main force of the nursing industry in the future. They have a good medical knowledge base and also need to assume the responsibility of spreading health information (20). At the same time, cultivating the ability of using social media to spread health information is conducive to better spreading health knowledge after entering clinical practice.

The purpose of health communication activities is to improve people's health levels. To ensure the scientific nature of the health information, disseminators need to have good health literacy. In the information age, eHealth literacy is an important part of health literacy. Some studies have pointed out that the level of eHealth literacy will affect the intention of users to spread health information (21). eHealth literacy is the ability to seek, discover, understand, and evaluate health information in electronic media and to share access to this information to solve health problems (22). There are six core types of literacy: traditional literacy (basic reading and writing skills are essential to derive meaning from text-filled resources), health literacy (patients with sufficient health literacy

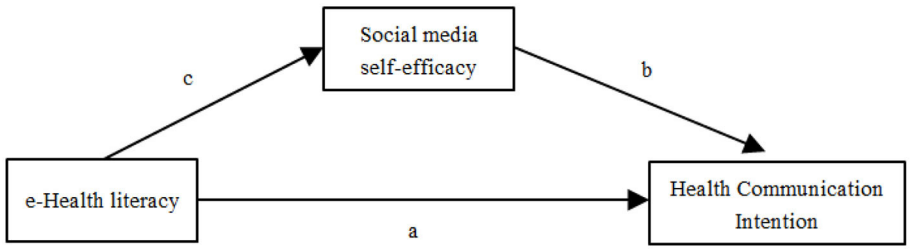


FIGURE 1
Hypothesized model. a: There is a positive relationship between eHealth literacy and the intention of nursing undergraduates to participate in health communication (hypothesis 1); b: The higher the level of social media self-efficacy of nursing undergraduates, the stronger their intention to communicate about health (hypothesis 2); c: Social media self-efficacy mediates the impact of eHealth literacy on health communication intention (hypothesis 3).

can read, understand, and act on healthcare information), information literacy (an information literate person knows which potential resources to consult for information on a particular topic, can develop an appropriate search strategy, and can filter the results to extract relevant knowledge), scientific literacy (Does scientific literacy place health research findings in proper context, informing consumers about how science is done and the largely incremental process of discovery, as well as the limitations and opportunities that research may present), media literacy (enabling people to place messages in a social and political context and to consider issues such as how markets, audience relations, and the media form itself shape the message conveyed), and computer literacy (including the ability to adapt to new technologies and software, including absolute and relative access to e-health resources). Making the most of eHealth resources requires both analytical (traditional literacy, media literacy, and information) and context-specific skills (computer literacy, scientific literacy, and health literacy) (23). Previous literature suggests that users' intentions to share health information on social media may be related to their level of eHealth literacy (21, 24, 25). The Integrative Model of E-Health Use (ImeHU) (26) also indicates that eHealth literacy contributes to health information effectiveness and eHealth practices (i.e., eHealth use behaviors, such as searching for health knowledge on the Internet and using social networks to communicate health knowledge with others). Health communication *via* social media is a key step in promoting healthy behavior change. However, empirical studies on eHealth literacy and its impact on health communication intentions are still lacking, so we propose the following hypotheses:

Hypothesis 1: There is a positive relationship between eHealth literacy and the intention of nursing undergraduates to participate in health communication.

The social cognitive model proposed by Bandura (27) points out that self-efficacy can significantly affect the effort level of individuals to take risks. Self-efficacy is a key structure in social cognitive theory, describing a person's confidence in their ability to complete an action or a behavior that will lead to the desired outcome. Technology-related self-efficacy can affect job performance. Social media self-efficacy is a person's perceived ability to achieve their desired results in a social media environment (18). A number of studies have shown that self-efficacy can positively influence health transmission behavior (28–30). However, there are few studies on social media self-efficacy and eHealth literacy. This study aims to explore whether eHealth literacy can influence the intention of health communication among nursing undergraduates through social media self-efficacy. Therefore, we propose the following hypothesis:

Hypothesis 2: The higher the level of social media self-efficacy of nursing undergraduates, the stronger their intention to communicate about health.

Hypothesis 3: Social media self-efficacy mediates the impact of eHealth literacy on health communication intention. The hypothesized model of this study is shown in Figure 1.

Methods

Study design

This is a cross-sectional descriptive study examining the effects of eHealth literacy and social media self-efficacy on health communication intentions among nursing undergraduates.

Participants

Participants were recruited through stratifiedcluster sampling from students at four nursing schools in a province in China, and data were collected between June 2021 and July 2021. The inclusion criteria included: (1) voluntary participation in the study; (2) being a full-time undergraduate student majoring

TABLE 1 Differences in general characteristics of participants' intention to transmit health information ($N = 958$).

Characteristic	Category	*N* (%)	Mean ± SD	*t*/*F*	*P*
Gender	Male	235 (24.5)	11.01 ± 0.15	−1.04	0.301
	Female	723 (75.5)	11.18 ± 0.07		
Academic year	First	292 (30.5)	10.90 ± 0.12	3.23	0.022
	Second	295 (30.8)	11.20 ± 0.11		
	Third	238 (24.8)	11.14 ± 0.11		
	Fourth	133 (13.9)	11.50 ± 0.15		
Monthly household income	≤5,000	332 (24.7)	10.95 ± 0.10	−2.23	0.026
	>5,000	626 (65.3)	11.23 ± 0.08		
Knowledge of health communication	Completely unknown	32 (3.3)	10.59 ± 0.59	19.91	<0.001
	Not very familiar	129 (13.5)	10.71 ± 0.16		
	Average	400 (41.8)	10.78 ± 0.09		
	Known	323 (33.7)	11.47 ± 0.10		
	Very well-known	74 (7.7)	12.58 ± 0.24		
Media related training	Yes	81 (8.5)	11.96 ± 0.21	4.07	<0.001
	No	877 (91.5)	11.06 ± 0.06		
Nursing experience	Yes	305 (31.8)	11.48 ± 0.10	3.93	<0.001
	No	653 (68.2)	10.97 ± 0.08		
Intention to change major	Yes	538 (56.2)	11.08 ± 0.08	−1.05	0.296
	No	420 (43.8)	11.20 ± 0.09		

SD, standard deviation.

in nursing. Through the power analysis performed to determine the sample size, the sample size was calculated as $n = 188$, with a 0.30 effect size, 99% power, and 0.05 margin of error. The sample size of this study was 958.

Data collection and ethical considerations

This study was approved by the Ethics Committee of the School of Nursing at Yangzhou University (No: YZUHL2021026). We sent questionnaires to teachers at four schools and commissioned them to distribute the questionnaires to nursing undergraduates. Participants completed a survey *via* the online survey platform Wenjuangxing (www.wjx.cn), a website that allows you to create electronic questionnaires for free. Online surveys help ensure that the responses submitted do not contain missing data. One device, one account, and one IP address can complete only one questionnaire. Completing the online questionnaire was considered a voluntary agreement to participate in the study.

Instruments

The questionnaire collected the demographic information of nursing students (gender, year in nursing school, monthly household income, understanding of health communication, media-related training, nursing experience, and intention to change major), as well as their eHealth literacy, social media self-efficacy, and health communication intention.

TABLE 2 Participants' scores for the eHEALS, social media self-efficacy, and health communication intention ($N = 958$).

Measure	Mean	SD	Minimum	Maximum
eHEALS	74.01	13.36	20.00	100.00
Social media Self-efficacy	92.74	20.82	24.00	144.00
Health Communication Intention	11.14	1.93	3.00	15.00

eHEALS, the eHealth Literacy Scale; SD, standard deviation.

The eHealth Literacy Scale was used to evaluate the eHealth literacy of nursing students. The scale was originally developed by Norman (31) and adapted by Tang et al. (32) due to cultural differences and the development of Web 2.0 technology. The revised scale consists of 20 questions, including three dimensions: health information acquisition ability (items 1–7), health information evaluation ability (items 8–15), and health information practice ability (items 16–20). The Cronbach's α in this study was 0.96, showing good homogeneity and internal consistency. A 5-point Likert scale was used for each project

TABLE 3 Bivariate correlations among measures ($N = 958$).

Measure	eHEALS	Social media self-efficacy	Health communication intention
eHEALS	1		
Social Media Self-efficacy	0.68**	1	
Health Communication Intention	0.59**	0.56**	1

eHEALS, the eHealth Literacy Scale.
**p ≤ 0.001.

(from 1 = strongly disagree to 5 = strongly agree), and the total score was between 20 and 100. The higher the score, the higher the students' eHealth literacy level.

The Social Media Self-efficacy Scale was adapted by Qiaodan et al. (33), based on the Social Media Self-efficacy Scale developed by Alber et al. (34), with a total of 24 questions aimed at evaluating nursing undergraduates' confidence in their social media ability. The Cronbach's α in this study was 0.98. A 6-point Likert scale (from 1 = very low confidence to 6 = very high confidence) was used, and the total score ranged from 24 to 144. The higher the score was, the better the nursing undergraduates' social media self-efficacy was.

According to the purpose of this study, the Science Communication Intention Questionnaire (35), compiled by Wu et al., was adapted into the Health Communication Intention Questionnaire, consisting of three items. A 5-point Likert scoring item was used to evaluate the degree to which nursing undergraduates were willing to engage in health communication. The Cronbach's α in this study was 0.89.

Statistical analysis

Descriptive statistics were used to analyze general information about participants, such as means, ranges, standard deviations, and percentages. A t-test and an ANOVA were used to analyze differences in the health communication intentions of participants, and a Pearson correlation was used to analyze the correlation among eHealth literacy, health communication self-efficacy, and health communication intention. The Process V3 plug-in, developed by Andrew F. Hayes, was used to analyze the mediating effect, and $P < 0.05$ was considered statistically significant. The bias-corrected Bootstrap method was used to test the mediation effect, and the 95% confidence interval (CI) of the mediation effect was estimated. If the 95% CI does not contain 0, it indicates that the mediation effect is significant. SPSS 26.0 software was used to sort and analyze the data.

Results

Participants' characteristics

Among the participants, 235 (24.5%) were male; 292 students (30.5%) were in their 1st year, 295 students (30.8%) were in their 2nd year, 238 students (24.8%) were in their 3rd year, 133 students (13.9%) were in their 4th year; 626 people (65.3%) had a monthly household income of more than 5,000 yuan (783 dollars); only 81 students (8.5%) had received media-related training; 305 (31.8%) had nursing experience (Table 1). As shown in Table 2, the average scores of eHealth literacy, social media self-efficacy, and health communication intention of nursing undergraduates were 74.01 ± 13.36, 92.74 ± 20.82, and 11.14 ± 1.93, respectively.

Differences in each participant's health communication intention

Health communication intention scores by nursing school year ($F = 3.23$, $P = 0.022$), monthly family income ($t = -2.23$, $P = 0.026$), knowledge of health communication ($F = 19.91$, $p < 0.001$), media-related training ($t = 4.07$, $p < 0.001$), whether the student had any internship experience ($t = 3.93$, $p < 0.001$), and the results are shown in Table 1. Among them, the intention of engaging in health communication among year 1 students was higher than that of students in other years. Students with a high monthly household income have strong intentions to engage in health communication. The higher their understanding of health communication, the stronger their intention to engage in health communication. The students with media-related training had higher intentions of engaging in health communication than those without. In addition, students with internship experience were more willing to spread health information than those without internship experience.

Correlations among variables

Table 3 shows the binary correlations between eHealth literacy, social media self-efficacy, and health communication intention. Health communication intention was positively correlated with both eHealth literacy ($r = 0.59$, $p < 0.001$) and social media self-efficacy ($r = 0.56$, $p < 0.001$); eHealth literacy was also positively correlated with social media self-efficacy ($r = 0.68$, $p < 0.001$).

Mediating role of social media self-efficacy in the relationship between eHealth literacy and health communication intention

In the first step, there was a significant positive correlation between eHealth literacy and social media self-efficacy ($\beta = 0.68$, $p < 0.001$; Table 4), and the explanatory power was 48.2%. In the second step, there is a significant positive correlation between eHealth literacy and health communication intention ($\beta = 0.57$, $p < 0.001$), and the explanatory power was 35.1%. In the third step, social media self-efficacy has a significant positive correlation with health communication intention ($\beta = 0.31$, $p < 0.001$), while eHealth literacy has a significant positive correlation with social media self-efficacy ($\beta = 0.36$, $p < 0.001$), and the explanatory power was 40.1% (Table 4 and Figure 2). The Bootstrap method was used to further verify the mediating effect of social media self-efficacy. The 95% CI of the direct effect and indirect effect of eHealth literacy on health communication intention did not contain zero. In general, the mediating effect model of social media self-efficacy was established, and the mediating effect value was 0.21, accounting for 37.2% of the total variation. The results are shown in Table 5.

Discussion

This study investigated the present situation of nursing undergraduates' eHealth literacy, social media self-efficacy, and their intention to engage in health communication, and probed into the relationship among the eHealth literacy, social media self-efficacy, and health communication intention, investigating the mediating effect of social media self-efficacy on eHealth literacy and health communication intention. Research results show that nursing students' willingness to communicate health is at a medium level, which may be related to the majority of nursing students in China who want to leave the nursing profession (36–38), although our research results show no significant impact on health communication willingness. In this study, nursing undergraduates were more willing to participate in health communication than the scientists investigated by Wen-xi and Ting (35). The reason for this phenomenon may be determined by the characteristics of the profession. Nurses often have two-way communication with patients in their daily work to cultivate patients' behavior of sharing health knowledge.

Our results show that eHealth literacy has a significant positive correlation with the intention to engage in health communication, indicating that nursing undergraduates with higher eHealth literacy have a stronger intention to engage in health communication. Hypothesis 1 is, therefore, verified. Zhao et al. (39) found that users with high levels of eHealth literacy were more willing to share health articles on social media, which is consistent with our findings. As pointed out

TABLE 4 Mediating role of social media self-efficacy in the relationship between eHealth literacy and health communication intention ($N = 958$).

Variable	Step 1. Social media self-efficacy				Step 2. Health communication intention				Step 3. Health communication intention			
	B	*β*	*t*	*p*	*B*	*β*	*t*	*P*	*B*	*β*	*t*	*p*
Academic year	−0.54	−0.03	−0.94	0.348	0.06	0.03	1.09	0.276	0.08	0.04	1.40	0.161
Monthly household income	3.84	0.18	3.74	0.000	0.10	0.05	0.95	0.341	−0.01	0.00	−0.09	0.930
Knowledge of health communication	−0.21	−0.01	−0.36	0.719	0.02	0.01	0.28	0.780	0.02	0.01	0.39	0.694
Media related training	−4.29	−0.21	−2.42	0.016	−0.39	−0.20	−2.10	0.036	−0.26	−0.14	−1.48	0.140
Nursing experience	2.92	0.14	2.30	0.022	−0.05	−0.03	−0.40	0.691	−0.14	−0.07	−1.08	0.283
eHealth literacy	1.07	0.68	26.55	< 0.001	0.08	0.57	19.80	< 0.001	0.05	0.36	9.80	< 0.001
Social media self-efficacy									0.03	0.31	8.89	< 0.001
R^2	0.48				0.35				0.40			
F	147.82				85.76				90.84			
P	<0.001				<0.001				<0.001			

B, The standardized regression coefficient; β, The unstandardized regression coefficient.

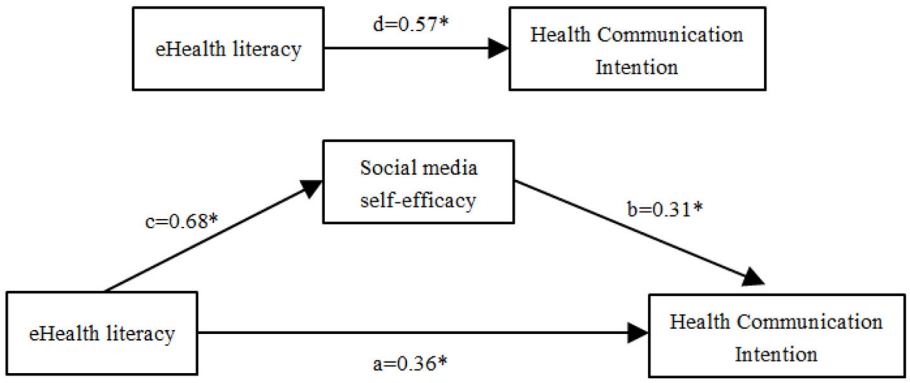


FIGURE 2
Mediation model shows the direct effect and path coefficients that link eHealth literacy and health communication intention *via* social media self-efficacy ($n = 958$). a: the unstandardized regression coefficient between eHealth literacy on health communication intention. b: the unstandardized regression coefficient between social media self-efficacy and health communication intention; c: the unstandardized regression coefficient of eHealth literacy on social media self-efficacy; d: the total effect between eHealth literacy and health communication intention. *: $p \leq 0.001$.

in the previous article, eHealth literacy consists of multiple dimensions, such as the basic knowledge and information search ability of nursing students from health literacy and information search ability. Some studies have pointed out that people with high health literacy are more likely to share health information (40), and 40% of people who have searched for health information will share health information (41). Nursing undergraduates with high e-health literacy may have good health literacy to understand the health information needs of patients, and may also have good information literacy to effectively use information technology for information retrieval. All of these factors enhance students' perceptual behavior control and further promote their communication intentions. In our study, the eHealth literacy score of nursing undergraduates was higher than that of nursing undergraduates in Shandong Province, China, surveyed by Guo and Xin (42) and the students' scores in Tang's adapted tool (32). One possible reason is that through the study of disease prevention, health care, and other theories, the professional knowledge reserve of undergraduate nursing students can help them identify and evaluate eHealth resources (43). However, considering that medical students may have inflated self-efficacy and systematic evaluation, they may lack the actual ability to locate and evaluate high-quality health information on the Internet (44). Therefore, medical education needs to set up corresponding courses to cultivate students' ability to search evidence-based health information on the Internet, enabling them to embed eHealth information into their behavior and lifestyle.

The study found that social media self-efficacy also has a significant positive correlation with health communication intention, which verifies Hypothesis 2 and is consistent with previous research results on self-efficacy and behavioral intention (41). Ajjan found in his research on entrepreneurial

TABLE 5 Mediation effect Bootstrap results.

Effect of type	Effect	SE	LLCI	ULCI	Relative effect value
Total effect	0.57	0.04	0.49	0.65	
Direct effect	0.36	0.05	0.26	0.46	62.80%
Indirect effect	0.21	0.03	0.16	0.26	37.20%

SE, Standard Error; CI, Confidence Interval; LLCI, Lower Limit Confidence Interval; ULCL, Upper Limit Confidence Limit Interval.

intentions that social media self-efficacy could positively predict perceived behavioral control, thus promoting entrepreneurial intentions (45). This also confirms the important role of social media self-efficacy in promoting health communication intentions. The low social media self-efficacy scores of nursing undergraduates in this study indicate that they lack sufficient skills to search for reliable information on the Internet or social media, which may be related to the fact that nursing colleges in China offer relevant information skills courses but do not pay enough attention to them. The low self-efficacy regarding social media use among nursing undergraduates may be due to the lack of adequate social media channels and limited opportunities to use social media to communicate health knowledge (18). Some studies have also found that experience in producing social media content contributes to social media self-efficacy, helps individuals build confidence in their ability to successfully find the specific information they need online, and enables them to perceive their social media skills accurately (9, 18). Such experience can be obtained through practice, training, and guidance. It is suggested that nursing colleges should pay attention to the training of students' information skills, carry out

corresponding health communication activities, and provide a platform for students to spread health knowledge effectively.

Another important finding of this study is that social media self-efficacy plays a mediating role between eHealth literacy and health communication intention, accounting for 37.2% of the total effect. Hypothesis 3 is also verified. The results suggest that institutions can prioritize the social media self-efficacy of nursing students to ultimately improve their willingness to communicate health. A high eHealth literacy among nursing undergraduate students in the process of retrieving health information is a good way to observe others' successful health communication on social media. On the one hand, this is due to the effect of alternative experiences and varying media self-efficacy levels; on the other hand, it can also stimulate positive emotions among nursing undergraduates so as to enhance their self-efficacy level, eventually promoting health communication (30). This suggests that nursing colleges can show students positive cases of health communication from classmates or teachers and set up corresponding skill training courses to enhance their confidence in health communication and encourage them to actively engage in it, which is of great significance to improving the intention to engage in health communication among nursing undergraduates.

There are some limitations to this study. This study is only a cross-sectional study, so causal relationships cannot be inferred from the correlations between variables. Therefore, a longitudinal design should be considered in future studies. Only investigated nursing undergraduates from four universities in Jiangsu Province, China, and its results may not be applicable to nursing undergraduates from other regions, so its stability among intercultural nursing undergraduates needs to be explored in the future. All the participants participated voluntarily, and those nursing students with higher awareness of eHealth literacy may be more willing to participate in our study, and students' intentions to engage in health communication were self-reported, which may have been affected by social expectations, which may cause selection bias. In the future, actual health communication behaviors should be considered for research. Finally most of the participants are female students, and nearly half of them have the idea of switching majors. However, this reflects the gender ratio and brain drain of nursing students in our country.

Conclusions

In China, health communication plays a vital role in improving public health literacy. This study supports the mediating role of social media self-efficacy between eHealth literacy and health communication intention. The study found that eHealth literacy and social media self-efficacy had an impact on health communication intention. Because there is a correlation between eHealth literacy and social media self-efficacy and health communication intention, in order to promote health communication intention of nursing students, it is also important to cultivate eHealth literacy and social media self-efficacy of nursing students. In view of these results, targeted educational programs must be developed to improve eHealth literacy and social media self-efficacy among nursing undergraduates, thereby promoting their health information transmission.

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 School of Nursing at Yangzhou University (No: YZUHL2021026). The patients/participants provided their written informed consent to participate in this study.

Author contributions

HS and LQ: writing and preliminary manuscript draft preparation and research. MX: software and data management. JiQ and TZ: investigation and verification. JZ and JuQ: supervision and verification. SJ, YB, YH, SW, YC, and JY: investigation. YL: conceptualization, methodology, proofreading, and editing. All authors contributed to the article and approved the submitted version.

Funding

This study was supported by Innovation and Entrepreneurship Training Program for College Students of Jiangsu Province (Nos. 202111117020Z and 202211117010Z) and the 2019 Jiangsu Province Geriatric Teaching and Learning Resource Library Sub-Library Project.

Acknowledgments

The authors would like to thanks the Research Deputy of Yangzhou University and nursing students who participated in the study.

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

References

1. Rogers EM. The field of health communication today: an up-to-date report. *J Health Commun.* (1996) 1:15–23. doi: 10.1080/108107396128202

2. Tariq A, Khan SR, Basharat A. Internet use, eHealth literacy, and dietary supplement use among young adults in Pakistan: cross-sectional study. *J Med Internet Res.* (2020) 22:e17014. doi: 10.2196/17014

3. Yu Z. CNNIC releases the 44th statistical report on internet development in China. *Civil-Military Integr Cyberspace.* (2019) 2019:30–1.

4. Zhang D, Shi Z, Hu H, Han GK. Classification of the use of online health information channels and variation in motivations for channel selection: cross-sectional survey. *J Med Internet Res.* (2021) 23:e24945. doi: 10.2196/24945

5. Chen J, Wang Y. Social media use for health purposes: systematic review. *J Med Internet Res.* (2021) 23:e17917. doi: 10.2196/17917

6. Wu T, Deng Z, Feng Z, Gaskin DJ, Zhang D, Wang R, et al. The effect of doctor-consumer interaction on social media on consumers' health behaviors: cross-sectional study. *J Med Internet Res.* (2018) 20:e73. doi: 10.2196/jmir.9003

7. Chen Z, Hunag H, Chen J. An empirical study on the influence of health communication information on audience's health behavior: an experiment based on dietary behavior tendency. *Modern Commun.* (2016) 38:52–7. doi: 10.3969/j.issn.1007-8770.2016.07.010

8. Jin X, Zhang D, Fen H. An empirical study on health information dissemination effect in mobile social media. *Informat Sci.* (2018) 36:129–35. doi: 10.13833/j.issn.1007-7634.2018.09.023

9. Hocevar KP, Flanagin AJ, Metzger MJ. Social media self-efficacy and information evaluation online. *Comput Human Behav.* (2014) 39:254–62. doi: 10.1016/j.chb.2014.07.020

10. Hopf H, Krief A, Mehta G, Matlin SA. Fake science and the knowledge crisis: ignorance can be fatal. *R Soc Open Sci.* (2019) 6:190161. doi: 10.1098/rsos.190161

11. Eysenbach G, Credibility of health information and digital media: New perspectives and implications for youth. MacArthur Foundation Digital Media and Learning Initiative (2008).

12. Liu H. On the positive communication potential of we media and doctor-patient relationship. *Modern Commun.* (2018) 40:44–8.

13. Dailah HG, Naeem M. A social media organizational productivity model: insights from public health professionals. *J Med Internet Res.* (2021) 23:e23792. doi: 10.2196/23792

14. Henly SJ. Health communication research for nursing science and practice. *Nurs Res.* (2016) 65:257–8. doi: 10.1097/NNR.0000000000000171

15. Arifulla D, Olli J, Merasto M. Nurses guidelines for using social media by Finnish Nurses Association. *Stud Health Technol Inform.* (2016) 225:617–8. doi: 10.3233/978-1-61499-658-3-617

16. Chaffee M. Health communications: nursing education for increased visibility and effectiveness. *J Prof Nurs.* (2000) 16:31–8. doi: 10.1016/S8755-7223(00)80009-5

17. Ye H, Zhang C, Wu y, Yang H. Investigation on the status quo of WeChat health popularization and education by nurses in some hospitals in Zhejiang Province. *Med Soc.* (2018) 31:24–7. doi: 10.13723/j.yxysh.2018.05.009

18. Alber JM, Paige S, Stellefson M, Bernhardt JM. Social media self-efficacy of health education specialists: training and organizational development implications. *Health Promot Practice.* (2016) 17:915–21. doi: 10.1177/1524839916652389

19. Kazemi SS, Tavafian SS, Hidarnia A, Montazeri A. Exploring nurses' experiences of social media and in-person educational interventions for professional development: a qualitative study. *BMC Nurs.* (2022) 21:126. doi: 10.1186/s12912-022-00903-4

20. Tang Q, Song GX. Some thoughts on the socialization trend of health science popularization. *Chin J Medical Sci Res.* (2005) 2005:252–4. doi: 10.3760/cma.j.issn.1006-1924.2005.04.024

21. Chi Y. What sources to rely on: Laypeople's source selection in online health information seeking. In: *Proceedings of the 2018 Conference on Human Information Interaction & Retrieval.* New Brunswick, NJ: Association for Computing Machinery (2018). p. 233–6. doi: 10.1145/3176349.3176881

22. Oh H, Rizo C, Enkin M, Jadad A. What is eHealth (3): a systematic review of published definitions. *J Med Internet Res.* (2005) 7:e1. doi: 10.2196/jmir.7.1.e1

23. Norman CD, Skinner HA. eHealth literacy: essential skills for consumer health in a networked world. *J Med Internet Res.* (2006) 8:e9. doi: 10.2196/jmir.8.2.e9

24. Zhang X, Yan X, Cao X, Sun Y, Chen H, She J. The role of perceived e-health literacy in users' continuance intention to use mobile healthcare applications: an exploratory empirical study in China. *Informat Technol Dev.* (2018) 24:198–223. doi: 10.1080/02681102.2017.1283286

25. Li X, Liu Q. Social media use, eHealth literacy, disease knowledge, and preventive behaviors in the COVID-19 pandemic: cross-sectional study on Chinese Netizens. *J Med Internet Res.* (2020) 22:e19684. doi: 10.2196/19684

26. Bodie GD, Dutta MJ. Understanding health literacy for strategic health marketing: eHealth literacy, health disparities, and the digital divide. *Health Mark Q.* (2008) 25:175–203. doi: 10.1080/07359680802126301

27. Bandura A, Freeman WH, Lightsey R. Self-efficacy: the exercise of control. *J Cogn Psychother.* (1999) 1999:158–66. doi: 10.1891/0889-8391.13.2.158

28. Huang H, Liu J, Chen Y, Yang X. The effect of nurses' general self-efficacy and organizational trust on knowledge sharing. *J Nurses Training.* (2021) 36:1034–7. doi: 10.16821/j.cnki.hsjx.2021.11.015

29. Kim H, Lee J, Oh SE. Individual characteristics influencing the sharing of knowledge on social networking services: online identity, self-efficacy, and knowledge sharing intentions. *Behav Inf Technol.* (2020) 39:379–90. doi: 10.1080/0144929X.2019.1598494

30. Alshahrani H, Rasmussen Pennington D. "Why not use it more?" Sources of self-efficacy in researchers' use of social media for knowledge sharing. *J Document.* (2018) 74:1274–92. doi: 10.1108/JD-04-2018-0051

31. Norman CD, Skinner HA. eHEALS: the eHealth literacy scale. *J Med Internet Res.* (2006) 8:e27. doi: 10.2196/jmir.8.4.e27

32. Tang Z, Wang F, Fu H. Development and evaluation of electronic media health literacy scale for college students. *Chin J Health Educ.* (2014) 30:35–8. doi: 10.16168/j.cnki.issn.1002-9982.2014.01.002

33. Qiaodan L, Qinghong S, Qingbo L, Lin X, Jing L. Chinese version of Social Media Competency Inventory and its reliability and validity test. *Chin Nurs Res.* (2021) 35:1892–8. doi: 10.12102/j.issn.1009-6493.2021.11.003

34. Alber JM, Bernhardt JM, Stellefson M, Weiler RM, Anderson-Lewis C, Miller MD, et al. Designing and testing an inventory for measuring social media competency of certified health education specialists. *J Medical Internet Res.* (2015) 17:e221. doi: 10.2196/jmir.4943

35. Wen-xi W, Ting Z. Investigating factors affecting scientists' willingness to engage in online science communication: an empirical survey study. *J Northeast Normal Univ.* (2021) 2021:111–6. doi: 10.16164/j.cnki.22-1062/c.2021.02.015

36. Gong Z, Li W, Bu H, He M, Hou H, Ma T, et al. Impact of COVID-19 pandemic on the professional intention of medical and related students. *BMC Med Educ.* (2021) 21:484. doi: 10.1186/s12909-021-02922-2

37. Tang M, Sun Y, Zhang K, Luo R, Liu R, Liu Y, et al. Associated factors of professional identity among nursing undergraduates during COVID-19: a cross-sectional study. *Int J Nurs Sci.* (2022) 9:107–13. doi: 10.1016/j.ijnss.2021.09.005

38. Bai W, Xi HT, Zhu Q, Wang Z, Han L, Chen P, et al. Changes in nursing students' career choices following the COVID-19 pandemic in China. *Front Psychiatry.* (2021) 12:657021. doi: 10.3389/fpsyt.2021.657021

39. Zhao HP, Fu SX, Chen XY. Promoting users' intention to share online health articles on social media: the role of confirmation bias. *Informa Process Manag.* (2020) 57:102354. doi: 10.1016/j.ipm.2020.102354

40. Crook B, Stephens KK, Pastorek AE, Mackert M, Donovan EE. Sharing health information and influencing behavioral intentions: the role of health literacy, information overload, and the internet in the diffusion of healthy heart information. *Health Commun.* (2016) 31:60–71. doi: 10.1080/10410236.2014.936336

41. Niu Z, Willoughby J, Zhou R. Associations of health literacy, social media use, and self-efficacy with health information-seeking intentions among social media users in China: cross-sectional survey. *J Med Internet Res.* (2021) 23:e19134. doi: 10.2196/19134

42. Guo M, Xin H. Correlation analysis of electronic health literacy and health self-management ability in 578 undergraduate nursing students. *J Nurs.* (2019) 26:65–8. doi: 10.16460/j.issn1008-9969.2019.23.065

43. Turan N, Özdemir NG, Çulha Y, Aydin GO, Kaya H, Aşti T. The effect of undergraduate nursing students' e-Health literacy on healthy lifestyle behavior. *Glob Health Promot.* (2021) 28:6–13. doi: 10.1177/1757975920960442

44. Stellefson M, Hanik B, Chaney B, Chaney D, Tennant B, Chavarria EA. eHealth literacy among college students: a systematic review with implications for eHealth education. *J Medical Internet Res.* (2011) 13:e102. doi: 10.2196/jmir.1703

45. Ajjan H, Fabian F, Tomczyk D, Hattab H. Social media use to support entrepreneurship in the face of disruption. *J Dev Entrepreneur.* (2015) 20:15500144. doi: 10.1142/S1084946715500144

frontiers | Frontiers in Public Health

TYPE Curriculum, Instruction, and Pedagogy
PUBLISHED 14 November 2022
DOI 10.3389/fpubh.2022.1044487

OPEN ACCESS

EDITED BY
Constance Shumba,
Aga Khan University Hospital, Kenya

REVIEWED BY
Liang Pan,
People's Hospital of Deyang City, China
Anna Nicolaou,
Cyprus University of Technology, Cyprus

*CORRESPONDENCE
Stuart J. Case
stuartcase@ufl.edu

SPECIALTY SECTION
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

RECEIVED 14 September 2022
ACCEPTED 26 October 2022
PUBLISHED 14 November 2022

CITATION
Case SJ, Collins SL and Wood EA (2022) Global health-based virtual exchange to improve intercultural competency in students: Long-lasting impacts and areas for improvement. *Front. Public Health* 10:1044487. doi: 10.3389/fpubh.2022.1044487

Global health-based virtual exchange to improve intercultural competency in students: Long-lasting impacts and areas for improvement

Stuart J. Case[1]*, Sarah L. Collins[1] and Elizabeth A. Wood[2]

[1]College of Public Health and Health Professions, University of Florida, Gainesville, FL, United States, [2]Eck Institute for Global Health, University of Notre Dame, Notre Dame, IN, United States

Introduction: As public health expands its role in global settings, the need to develop intercultural competency for public health students also grows. One initiative being applied to promote global awareness is the use of virtual exchange (VE) programs. VE programs promote collaborative online international learning (COIL) and allow students from different countries to connect and work together on projects related to their field of study; however, there is little research around the long-term impacts of these programs.

Methods: Undergraduate pre-health students from the United States who participated in a VE program a year prior were interviewed about their experiences engaging with undergraduate medical students in Egypt. They were asked if the experience impacted their current behaviors, skills, or knowledge, and what improvements could be made to the program. Mezirow's Transformative Learning Theory (TLT) served as the theoretical framework, grounding interview instrument development and directed content analysis procedures. Researchers also engaged in inductive analysis to capture other salient themes.

Results: Ten students were interviewed with a majority engaging in either of the two final stages of Mezirow's TLT: "building of self-confidence and self-competence" (60%) and "reintegration" (50%). Other salient themes found were intercultural interactions, VE appreciation, and VE improvements. When describing their experience in one word, students overwhelmingly provided words with positive connotations (80%), with the negative responses being explained by the structure and presentation of the VE.

Discussion: Students were able to apply lessons they learned during the VE within a 1-year follow-up period. This is beneficial, as health professionals require intercultural competency to promote and provide improved health outcomes. Results from this study indicate the need for structure when conducting a VE, addressing the need to increase the number of direct interactions and thereby promoting more intercultural exchanges. Likewise,

10.3389/fpubh.2022.1044487

the interviews demonstrated that changes in course instruction need to be implemented gradually to allow for students to adjust to unfamiliar teaching methods.

KEYWORDS

virtual exchange, transformative learning theory, directed content analysis, global health, post-secondary education, intercultural competency

Introduction

The increased diversification of the United States along with the expanding role of public health in a global setting has brought awareness to the pervasive nature of intercultural interactions within the field (1, 2). The need for intercultural competency within public health is immense, as public health professionals often work in diverse population- and community-based settings (3). In addition, certain subpopulations with diverse and intersecting sociodemographic identities tend to have worse health outcomes for specific conditions (4, 5), creating the need for heightened cultural awareness and humility among public health professionals. As defined in Deardorff's Intercultural Competence Framework, intercultural competency is the capacity to develop skills and attitudes that enable individuals to behave and communicate appropriately in intercultural interactions (6). Intercultural competency, as described by Bennett (7), posits that there are cognitive and behavioral skills that influence interactions with people from other cultural backgrounds. Intercultural competency is often the bedrock of understanding one's own paradigmatic assumptions about the world (8), thus making it a relevant practice within higher education. As such, it should be a priority among institutions of higher education to develop these skills within public health students.

While initiatives such as study abroad programs have been traditionally used to promote intercultural exchanges (9), this approach can be inequitable, with fewer than 10% of US students being able to participate and an overwhelming majority identifying as non-Hispanic, Caucasians (10). To encourage the development of intercultural competency in post-secondary students, collaborative online international learning (COIL) has been implemented to foster connections between students in different countries and create global learning networks (11, 12). Assisted by recent innovations in video conferencing and telecollaborations (13), the capacity for schools to carry out COIL-based programs has expanded. One approach used to promote collaborative, international learning at post-secondary institutions is through virtual exchange (VE) programs. Within VE, students in different countries can engage in telecollaboration to exchange their ideas, opinions, and backgrounds in a learning environment (14).

Mezirow's Transformative Learning Theory

Mezirow's Transformative Learning Theory (TLT) consists of 10 phases addressing how an individual's ability to learn is dependent upon their ability to change their frame of reference and assumptions, allowing them to be more open to new ideas and information (15). With the TLT, learning is believed to transpire through a stage-based process, beginning with an individual questioning their assumptions through a disorienting dilemma and concluding with the final two phases of the TLT, "Building of Self-Competence and Self-Confidence" and "Reintegration," (15). Specifically, the last two phases address the ability of students to apply their experiences beyond the classroom setting in society, with the former inquiring about the execution of new roles and behaviors while the latter focuses on making these new behaviors habitual (15). Mezirow postulates that learning is most effective when there is an active dialogue, equal opportunities to participate, and reflection throughout, thereby permitting the individual to alter their normative beliefs (16). One area of learning which the TLT can be applied to is intercultural exchanges. Oftentimes, students' perceived stereotypes of others can limit their ability to immerse themselves within their program (17). Despite this, Mezirow argues that "through critical reflection, we become emancipated from communication that is distorted by cultural constraints," such as one's preconceptions of another culture (16).

While VE programs have been carried out to promote intercultural learning among health-based students (18–20), there is limited research regarding the long-term impacts these programs have on students. It is necessary to determine whether these programs are able to maintain enduring impacts on students to truly determine the effectiveness of VE as a pedagogical strategy. Moreover, there is limited literature on the capability of COIL-based educational programs in pre-health and public health fields (20–22), creating a need to conduct further research on how VEs should be programmed to best serve these student populations.

Study aims

The goal of this qualitative evaluation study was to examine pre-health students' perspectives on their COIL-based, VE experience and determine the long-term impacts, if any, on the students' intercultural competency. For the purpose of this study, long-lasting impacts were defined by explicit displays of knowledge gained from the VE by the students, 1 year after the initial VE. In addition, this study explored program implementation, participant satisfaction, challenges, and barriers faced by students during the VE program. Provided with the work of Wood et al. (20), it has been demonstrated that VE programs can facilitate a majority of the stages within the TLT, but they were unable to determine students' capability in demonstrating the final two stages related to integrating the theoretical into practice. This study seeks to understand whether VE programs can result in students progressing to and through the final two stages of the TLT: "Building of Self-Competence and Self-Confidence" and "Reintegration."

Methods

Data collection

In the initial VE, 108 undergraduate pre-health students at a large, public university in the Southeast region of the United States enrolled in a global public health course collaborated with 32 undergraduate medical students studying at a university in Egypt during the Spring 2021 semester. Students from the US and Egypt were placed into groups with one another and communicated with each other in English *via* text or Zoom (20). The VE lasted for 5 weeks, with the content each week focusing on different public health issues, such as COVID-19, and how the approach to these issues differs based on students' home countries and the perspectives that exist within them (20). The US Students were required to complete weekly critical reflection-based assignments, a collaborative presentation with the Egyptian students on global health threats, and a summative paper, prompting US students to reflect on their experiences with the Egyptian students (20).

In the Spring of 2022, a year following the VE, the original institutional review board (IRB) study was updated and revised to include follow-up interviews of the US students who had participated in the VE. The IRB revision process was completed and approved in February 2022 (IRB#202003293). Following IRB approval, students who had participated in the virtual exchange in 2021 were contacted through their university-affiliated email, requesting their participation in an interview describing their experiences post-VE. Interviews were facilitated by one study researcher and conducted virtually *via* Zoom in a semi-structured format (23). The interview guide was developed based on Mezirow's final two TLT stages, as well as formative and summative evaluation questions of the program (Appendix A). The instrument was vetted among all of the investigators, providing a source of technical and critical feedback to ensure the guide's validity (24). Additional probing questions were asked to elicit further opinions and suggestions from the students. These probing questions were not structured, as the researchers hoped to have students express their genuine experiences, rather than shape responses through pre-planned probes, in accordance with semi-structured interviewing protocol (25). Interviews were audio-recorded and transcribed using Otter.AI software. Transcripts were reviewed for quality assurance by two researchers.

Data analysis

Two researchers were utilized to independently analyze the data, providing a source of investigator triangulation (26). The researchers used both inductive and directed content analysis approaches to capture salient themes using NVivo software (27–29). The last two stages of Mezirow's TLT were defined a priori to guide the analysis deductively; however, inductive coding was used to capture themes that were outside the scope of Mezirow's TLT, but still offered rich insight into the VE program. After an initial review, the researchers convened to find consensus on overall themes, subthemes, and their respective operational definitions. Once consensus was met, the researchers conducted a second round of independent deductive analysis using the established codebook. Following the second round of independent analysis, the researchers convened until consensus was met.

Results

Ten US students who partook in the 2021 VE participated in the interviews. The sample included four students who identify as male and six who identify as female. Half of the students interviewed were either born outside of the United States or were first-generation Americans. Interviews lasted between 10 and 30 min. Three themes, Intercultural Interactions, VE Appreciation, and VE Improvement, were identified in addition to the a priori themes. Six subthemes were also identified: Intercultural Interactions prior to VE, Intercultural Interactions during the VE, VE Appreciation related to modes of communication, VE Appreciation related to its application to future health professions, VE Improvements related to design, and VE Improvements related to logistics. Several accounts of the a priori Mezirow themes were also recognized, resulting in the two predetermined themes: Building of Self-Competence and Self-Confidence, and Reintegration.

Building of self-competence and self-confidence

The building of self-competence and self-confidence refers to a continued execution of new roles and involves an explicit mention beyond the classroom context, practicing relevant behaviors on a routine basis, which in turn, increases self-efficacy within new assumptions. Six out of ten participants believed the lessons they learned from the VE would directly translate to their future careers in health-related fields, leaving them more assured of their skills.

> (Participant 6: Female, first-generation) This virtual exchange made me understand the importance of cultural humility…I think it is so important to consistently, proactively learn about what you're doing with other people, especially if it's people that you are unfamiliar with, even in the slightest. I think it saves a lot of stress, I think it shows that you have a level of respect for them, that you are willing to learn and adapt and work with them. And I think it just makes me a better student, and hopefully a better health practitioner in the future, that I can accept that I don't know everything. And I'm going to always want to learn and this virtual exchange just kind of put that into practice and solidified it.

Reintegration

A demonstration of reintegration involves an expression that the refined assumption is now perceived as habitual, routine, and easy (i.e., without precontemplation) within one's everyday life. Five of the students had made efforts to reintegrate what they learned during the VE with their work. Students describe similar experiences integrating lessons from the VE in a variety of settings including international travels, online social interactions, as well as everyday settings.

> (Participant 1: Female, American descent) In South Africa, I actually worked with a couple individuals who were from Egypt and I think it really helped me foster those interactions in the first place. [If] I hadn't gone through the virtual exchange, I would have probably still had those preconceived notions going into my work, and interacting with those individuals from Egypt and, you know, a ton of other places. But especially talking to the Egyptian students [in the spring] and knowing that I was going to be going to South Africa in the summer, it really helped, you know, okay, this isn't as foreign as I probably been led to think in the past.

Intercultural interactions

Intercultural interactions involved any interactions held by students with people from another culture, locally or globally. These interactions were divided into those which occurred prior to the VE and those which happened during the VE; those after the VE were included in the themes regarding the TLM stages.

Prior to VE

Student responses were coded as prior to VE if there was any mention of experiences that involved an interaction between individuals from different cultural backgrounds that occurred prior to the virtual exchange ($n = 10$). These interactions could be intentional, such as traveling abroad, or more passive, such as being born outside the US or a first-generation American.

> (Participant 6: Female, first-generation) Before 2020, when the pandemic hit, I actually used to be a very avid traveler…So I would say that, in terms of like being culturally aware, obviously, I don't know every single thing about every culture, but I do really make it a point to constantly learn and like understand and adapt, especially when I'm going to places that I have no idea what the customs and things of that nature are nearby.

Some students also talked about how either being a first-generation student or an immigrant to the United States impacts how they interact with people from other cultures.

> (Participant 8: Female, first-generation) I would say that I'm more comfortable or more familiar with people that have experiences outside of the US or like, that have grown up in a different country, just because that's kind of what my parents' experience looked like. And so, because of that, I ask more questions. I want to know more about their experiences and see what it looks like to have now been in America for a little bit of time, if they're first gen, or if they're an immigrant and see how it compares to their previous experiences.

During the VE

Responses were coded as During the VE if they detailed interactions that occurred during the virtual exchange where the students from UF and Ain Shams University shared their backgrounds, cultures, experiences, or opinions. All of the participants described their intercultural experiences, however, many UF students shared discussions they had with the students from Egypt regarding the COVID-19 pandemic.

> (Participant 2: Male, American descent) I think definitely, obviously, with the time period that the virtual exchange took place in, we focused a lot on COVID, and things like that. And it was very interesting to be able to compare a US experience to what is going on in Egypt, which, obviously, there were differences there and being able to see those differences. And, seeing a different perspective is a lot different than reading about it in a textbook or a news article or something like that.

There was also a collective astonishment among the UF students at how similar they were to the students from Egypt.

> (Participant 3: Male, international-born) I just had the mindset that they would be, I don't know, they would just talk a different way. And like, I don't know, it's really interesting to just realize that, in the end, we're all pretty similar no matter what our background is, our religion, whatever. Like, we're all pretty similar. So I thought that was kind of interesting, and fun to see how we're pretty similar. And just the way we talk about lives, our lives and like, what we may have been going through school, stuff like that. I just thought that was really interesting.

VE appreciation

The students were asked about what aspects of the VE they enjoyed. Any objective expression of how an individual personally benefited from the virtual exchange or any statements claiming the virtual exchange could result in benefits for others were coded as VE appreciation. Sixty percent ($n = 6$) of the students appreciated having the ability to meet with students from completely different backgrounds through the VE.

> (Participant 2: Male, American descent) I think the entire concept of it is very interesting. It's very interesting to be able to meet up with students that are studying the same thing or something similar. They were medical students from Egypt, if I remember correctly, so from a totally different area of the world. And it was really interesting to just get that perspective on issues from something that is not our own. We take a lot of the same classes, especially in a smaller program, like public health with the same people. And not that we don't have a diverse public health program or something like that. But, you know, we all are like living in Gainesville, Florida right now for the most part. So it's different to hear something that is different.

Based on the responses provided, the theme was further divided into the subthemes of Modes of Communication and Application to Future Profession.

Modes of communication

This subtheme centered around the communication tools and technologies that were utilized during the VE. The students often used WhatsApp as their method of communication, providing a more informal way to communicate. Four of the participants specifically describe this as a benefit to the program.

> (Participant 5: Female, American descent) I love the WhatsApp. I think we were all required to have some sort of communication. Some people did like Facebook groups or emails, I'm not really sure about the other groups, but we all got each other's Facebook information, and then made a WhatsApp and it was just I don't know, it was really fun to talk to them. And like where it felt like I was talking to a friend from home or like using emojis, like talking about school, studying for exams. So that was fun, like, just a mix up from the people you talk to every day, and they were so excited to do it. And so were we. So it felt less like an assignment and more like getting to know people.

Application to future health profession

This subtheme included discussion on how experiences during the exchange could be applied to future career settings in health-based areas. All ($n = 10$) of the students hoped to work in healthcare in the future and often talked about the variety of individuals they will work with in the future.

> (Participant 3: Male, international-born) I'm going to OT school starting fall. So as someone who's going to be working in healthcare, I'm going to come across all types of people. Like I can come across anyone. So I think just being able to be patient when talking to someone. We didn't really have conversations the way we interacted, we talked through WhatsApp, we texted, but just in general, being able to be patient and understanding that not everyone is good with English and able to be understanding and patient enough to communicate with that person.

VE improvements

In addition to questions about the aspects of the VE which the students enjoyed, they were also asked how they believe the VE could be improved. This theme involves any suggestions or criticisms made by the students with the purpose of addressing any aspect of the virtual exchange which should be changed, improved upon, or removed if a similar virtual exchange is conducted in the future. The areas of improvement were mainly pertaining to either the design of the VE or the logistics of the VE.

VE design

Critiques of the VE's design relates to any comments made regarding how the virtual exchange was introduced and implemented. To initiate the VE, an instructor at UF created a presentation to give an overview of what the VE would entail and what expectations should be had when interacting with the Egyptian students. Three of the students believed that the VE should have been introduced in a different manner.

> (Participant 1: Female, American descent) I think it would be really beneficial and really cool to, kind of set the tone for the entire virtual exchange if maybe that very beginning part where we introduced ourselves to each other if people we are able to…record yourself and be like, 'hello, I'm [name].' You know, I actually like talking to a camera and uploading that rather than sending a text message, I think that could definitely help to set the stage of the virtual exchange. So you know.... I think it would just make more of a lasting impression and foster that, you know, the connection piece a bit more.

Another area of improvement the UF students mentioned was in regard to the frequency and structure of communication with their Egyptian counterparts. The VE was set up with relatively relaxed requirements, due to expected difficulties with the time zones, but many students desired more structure.

> (Participant 5: Female, American descent) …It was pretty much up to the group members, whether or not they wanted to participate and talk to people in the group. And since we independently made our communication, it wasn't really regulated. All we had to do was prove that we had talked to them at some point in the week. If I'm remembering right, I just think it would be good maybe for it to be going on a little longer or have more structured conversations, maybe like a zoom with everybody.

VE logistics

Half of the participants described improving the logistics of the VE regarding the coordination of connecting the groups of students, whether it be due to the time difference or other issues. Between the two universities there is a 6-h time difference, and this was frequently discussed as a barrier to communication.

> (Participant 5: Female, American descent) Because the hours that we could talk to them, it's like, my guess would be their study hours, dinner, sleeping. So sometimes we would send a message and not get a response for a long time. And then by the time we got the response, we were, you know, just now waking up or sleeping, or in class or something. So the time difference at times was bad.

Discussion

This analysis is among the few to examine whether a COIL-based VE program sustains long-lasting impacts on the behaviors of the students involved. Our findings point to several areas where VE programs can be improved upon as well as some of the limitations of Mezirow's TLT as a foundational theory. While students who were interviewed for this study did describe instances during the VE that were impactful or effective, these points were not included in the findings of this study as they were reinforcing the salient themes captured in Collins et al. (22). Here we expatiate our analysis to consider the larger, complex issues surrounding VE programs.

While most of the students were able to illustrate engaging in at least one of the two final stages of Mezirow's TLT, there were individuals who believed that the VE was not sufficient in promoting behavior change related to intercultural competency. One common explanation was US students' desire for more structure in when and how frequently to meet with the students from Egypt. The initial VE was purposefully structured to be somewhat fluid in its communication requirements and the number of interactions, as it has been demonstrated that, generally, moderately-structured instruction performs better than extremely lax or strict instruction (30). Despite this, the US students believed that given their unfamiliarity of the Egyptian students' background and the VE program, there should have been more requirements for interactions embedded within the VE. This experience is not isolated, as similar sentiments are felt by students studying abroad where time is required to acclimate to the new culture they are being immersed in (31).

These concerns of unfamiliarity, creating the aspiration for more structure, can be seen as unintended consequences of what Mezirow refers to as the "disorienting dilemma" (32). The disorienting dilemma, the first stage of the TLT, is an instance in which new information is brought to an individual or someone is put in a new situation, thereby encouraging them to engage in "perspective transformation" (32). Within the context of this VE, the disorienting dilemma was thought to be solely the interactions between American and Egyptian students; however, it is also likely that the dilemma can be attributed to the sudden change in course instruction caused by the VE. As such, the instructor can support transformative learning by isolating the disorienting dilemma to its desired source (33).

A possible solution, discussed by participants, to address this unfamiliarity of the VE would be to have the US students and the Egyptian students introduce themselves, as opposed to it being done by their respective instructors. Many US students expressed that they had preconceived conceptions regarding the Egyptian students which could have been ensconced through a short video blog (vlog), in which the students would show their daily activities and aspects of their culture. These blog-style videos have demonstrated to be effective in introducing

new information in a classroom setting (34). Moreover, it has been shown that face-to-face interactions are preferable in intercultural exchanges when compared to the text-based introductions that most of the students in the VE employed (35). Given the benefits, the students would be able to represent their own culture and provide an authentic insight into their lives, thereby removing the sense of otherness.

While there are concerns regarding how the structure and presentation of the VE impact its ability to encourage transformative learning, the framework behind the TLT can also explain why the VE was unsuccessful in promoting long-lasting behavioral changes for some students. Interestingly, students who noted having less success in fulfilling the final two stages of the TLT typically identified as male. Students who identified as females were much more likely to say the VE had a more substantial impact and provide examples of how they have applied lessons from the VE. Likewise, the TLT's framework was based on a program to encourage women's re-entry programs in community college (32). Arguments have been made within the study abroad domain that females display higher intercultural activity than their male counterparts due to their ability to acknowledge and value differences among different cultures (36). In a recent study reviewing study abroad participation post-COVID pandemic, the gap between men and women has either widened or remained the same. However, it was speculated that the subject of study and the available study abroad programs tethered to those subjects play an important role (37). Consequently, given the TLT's inherent bias toward women, as well as a lack of focus on gender-based differences in adult education research and engagement (38), more efforts need to be directed to ensure that the TLT results in equitable outcomes for all genders. In doing so, VE programs could be modified in the future to increase the probability that *all* individuals sustain behavior change.

Another non-structural factor which impacted students' tendency to engage in either building of self-competence and self-confidence or reintegration was one's background. US students who expressed having backgrounds involving minimal intercultural exchange were more likely to express long-lasting behavior changes when compared to those who either immigrated to the United States or are first-generation Americans. Similar findings were found with a VE program with medical students from Australia and Indonesia, as students who previously had intercultural interactions with peers were less likely to experience benefits from the VE (18). Study abroad programs have utilized Eccles' value-expectancy theory to investigate how one's motivation within their study abroad program is related to how valuable the experience will be for them personally (39). With the VE program, students who had limited interactions with people from other cultures were able to benefit more from this unfamiliar situation while those who had a more international background already had developed intercultural competency and thereby did not see as much value in the experience.

Strengths and limitations

There are several strengths and limitations that should be considered when interpreting our findings. Though our study had an adequate sample size to attain saturation (40), it was obtained through convenience sampling procedures. Due to the nature of convenience sampling, participants who had a particular interest in the VE, traditionally those with extreme perceptions (positive or negative) were more likely to participate. This likely introduced sampling bias to our study and limits the generalizability of the results. One strength of this study is the use of two researchers during the data analysis stage, which increases the validity of results through internal triangulation (26). Having two researchers reduces the influence of researcher bias and maintains the integrity of the data (41). Other efforts were made to increase the study's validity such as utilizing qualitative computer software for analysis and having one consistent interview facilitator (27).

Conclusion

This study was one of the first to investigate the long-term integration of Mezirow's TLT, as well as evaluate a VE program within a global public health setting. In doing so, our findings suggest that the TLT may be biased toward women's transformative learning processes, adding to the critiques present toward this framework as an adult learning theory (22). Further research is warranted to assess the appropriateness of this theory among diverse student groups and learning environments, as higher education and public health continue to diversify as they transcend national settings and enter global spaces. Furthermore, this study evaluated the programmatic components of a VE program that were successful and can be improved upon. The insights provided by the participants allow for educators to adapt their pedagogical and instructional strategies in real time, thus allowing for an optimal VE program experience. However, quality assurance measures should always be taken, as VE experiences may change according to socioenvironmental and sociopolitical contexts.

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 University of Florida Institutional Review Board IRB#202003293. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

SCa and EW conceptualized the study design and methodologies, coded the data, and then analyzed the data for themes. SCo contributed to discussions on pedagogical frameworks as well as data analysis procedures and wrote the strengths and limitations as well as the conclusion. SCa collected data, wrote the introduction, results, and conclusion. EW wrote the methods. All authors engaged in editing the manuscript. All authors contributed to the article and approved the submitted version.

Acknowledgments

We would like to thank the students who participated in our study and provided insight into the impact of this learning experience.

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

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1044487/full#supplementary-material

References

1. Lee B, Martin M, Matthews S, Farrell C. State-level changes in US racial and ethnic diversity, 1980 to 2015: a universal trend? *Demogr Res.* (2017) 37:1031–48. doi: 10.4054/DemRes.2017.37.33

2. Moore M. The global dimensions of public health preparedness and implications for US action. *Am J Public Health.* (2012) 102:e1–7. doi: 10.2105/AJPH.2011.300644

3. Fleckman J, Dal Corso M, Ramirez S, Begalieva M, Johnson C. Intercultural competency in public health: a call for action to incorporate training into public health education. *Front Public Health.* (2015) 3:210. doi: 10.3389/fpubh.2015.00210

4. Falconer C, Park M, Croker H, Kessel A, Saxena S, Viner R, et al. Can the relationship between ethnicity and obesity-related behaviours among school-aged children be explained by deprivation? A cross-sectional study. *BMJ Open.* (2014) 4:e003949. doi: 10.1136/bmjopen-2013-003949

5. Moolenaar R. *CDC Health Disparities and Inequalities Report - United States, 2013. Centers for Disease Control and Prevention.* (2013). p. 184. Available online at: https://www.cdc.gov/mmwr/pdf/other/su6203.pdf (accessed May 11, 2022).

6. Deardorff DK. Identification and assessment of intercultural competence as a student outcome of internationalization. *J Stud Int Educ.* (2006) 10:241–66. doi: 10.1177/1028315306287002

7. Bennett J. Transformative training: designing programs for culture learning. *Contemporary Leadership and Intercultural Competence: Exploring the Cross-Cultural Dynamics within Organizations*. SAGE Publications (2009). p. 95–110.

8. Christie M, Carey M, Robertson A, Grainger P. Putting transformative learning theory into practice. *Aust J Adult Learn.* (2015) 55:9–30.

9. Tarchi C, Surian A. Promoting intercultural competence in study abroad students. *Eur J Psychol Educ.* (2022) 37:123–40. doi: 10.1007/s10212-021-00554-0

10. NAFSA. *Association of International Educators. Trends in U.S. Study Abroad. NAFSA*. (2020). Available online at: https://www.nafsa.org/policy-and-advocacy/policy-resources/trends-us-study-abroad (accessed June 1, 2022).

11. Appiah-Kubi P, Annan E. A Review of a collaborative online international learning. *Int J Eng Pedagogy.* (2020) 10:109–24. doi: 10.3991/ijep.v10i1.11678

12. Starke-Meyerring D. Globally networked learning environments: reshaping the intersections of globalization and E-learning in higher education. *E-Learn Digit Media.* (2010) 7:127–32. doi: 10.2304/elea.2010.7.2.27

13. Karl K, Peluchette J, Aghakhani N. Virtual work meetings during the COVID-19 pandemic: the good, bad, and ugly. *Small Group Res.* (2022) 53:343–65. doi: 10.1177/10464964211015286

14. O'Dowd R. From telecollaboration to virtual exchange: state-of-the-art and the role of UNICollaboration in moving forward. *J Virtual Exch.* (2018) 1:1–23. doi: 10.14705/rpnet.2018.jve.1

15. Mezirow J. An overview on transformative learning. In: *Lifelong Learning: Concepts and Contexts*. London: Routledge. (2006) p. 40–54.

16. Mezirow J. Contemporary paradigms of learning. *Adult Educ Q.* (1996) 46:158–72. doi: 10.1177/074171369604600303

17. MacNab B, Worthley R. Stereotype awareness development and effective cross-cultural management: an experiential approach. *Int J Cross Cult Manag.* (2013) 13:65–87. doi: 10.1177/1470595812452635

18. Ambrose M, Murray L, Handoyo N, Tunggal D, Cooling N. Learning global health: a pilot study of an online collaborative intercultural peer group activity involving medical students in Australia and Indonesia. *BMC Med Educ.* (2017) 17:10. doi: 10.1186/s12909-016-0851-6

19. Niitsu K, Kondo A, Hua J, Dyba N. A case report of collaborative online international learning in nursing and health studies between the United States and Japan. *Nurs Educ Perspect.* (2022). doi: 10.1097/01.NEP.0000000000000974

20. Wood E, Collins S, Mueller S, Stetten N, El-Shokry M. Transforming perspectives through virtual exchange: a US-Egypt partnership part 1. *Front Public Health.* (2022) 10. doi: 10.3389/fpubh.2022.877547

21. Bowen K, Barry M, Jowell A, Maddah D, Alami N. Virtual exchange in global health: an innovative educational approach to foster socially responsible overseas collaboration. *Int J Educ Technol High Educ.* (2021) 18:32. doi: 10.1186/s41239-021-00266-x

22. Collins S, Mueller S, Wood E, Stetten N. Transforming perspectives through virtual exchange: a US-Egypt partnership part 2. *Front Public Health.* (2022) 10:880638. doi: 10.3389/fpubh.2022.880638

23. Jamshed S. Qualitative research method-interviewing and observation. *J Basic Clin Pharm.* (2014) 5:87–8. doi: 10.4103/0976-0105.141942

24. Ravitch S, Carl N. *Qualitative Research: Bridging the Conceptual, Theoretical, and Methodological*. Sage Publications (2019).

25. Husband G. Ethical data collection and recognizing the impact of semi-structured interviews on research respondents. *J Educ Sci.* (2020) 10:206. doi: 10.3390/educsci10080206

26. Hussein A. The use of triangulation in social sciences research: can qualitative and quantitative methods be combined? *J Comp Soc Work.* (2009) 4:106–17. doi: 10.31265/jcsw.v4i1.48

27. AlYahmady H, Alabri S. Using Nvivo for data analysis in qualitative research. *Int J Interdiscip Educ.* (2013) 1:1–6. doi: 10.12816/0002914

28. Mayring P. Qualitative content analysis. *Forum Qual Soc Res.* (2000) 1. doi: 10.17169/fqs-1.2.1089

29. Mayring P. *Qualitative content analysis: theoretical foundation, basic procedures, and software solution*. Klagenfurt (2014).

30. Eddy S, Hogan K. Getting under the hood: how and for whom does increasing course structure work? *CBE Life Sci Educ.* (2014) 13:453–68. doi: 10.1187/cbe.14-03-0050

31. Istrate A. Culture shock of studying abroad - new trends for the development of intercultural skills. *Romanian Econ Bus Rev.* (2018) 13:22–7.

32. Mezirow J, Marsick V. *Education for perspective transformation. Women's re-entry programs in community colleges*. New York, NY: Columbia University (1978).

33. DeAngelis L. Enabling the exploration of disorienting dilemma in the classroom. *J Educ*. (2021) 202:585–600. doi: 10.1177/0022057421991865

34. Sinulingga A, Nasir P, Trisni S. Vlog as learning instrument in introduction to international relations to improve student learning outcomes. *EUDL.* (2019). doi: 10.4108/eai.11-9-2019.2298449

35. Pillay S, James R. Examining intercultural competency through social exchange theory. *Int J Teach Learn High Educ.* (2015) 27:320–9.

36. Tompkins A, Cook T, Miller E, LePeau L. Gender influences on students' study abroad participation and intercultural competence. *J Stud Aff Res Pract.* (2017) 54:204–16. doi: 10.1080/19496591.2017.1284671

37. Di Pietro G. Changes in the study abroad gender gap: a European cross-country analysis. *High Educ Q*. (2022) 76:436–59. doi: 10.1111/hequ.12316

38. Irving CJ, English LM. Transformative learning with women: a critical review proposing linkages for the personal and political spheres. In: *Adult Education Research Conference*. Toronto, ON (2011).

39. Yue Y, Lu J. International students' motivation to study abroad: an empirical study based on expectancy-value theory and self-determination theory. *Front Psychol.* (2022) 13:841122. doi: 10.3389/fpsyg.2022.841122

40. Hennink M, Kaiser B. Sample sizes for saturation in qualitative research: a systematic review of empirical tests. *Soc Sci Med.* (2021) 292:114523. doi: 10.1016/j.socscimed.2021.114523

41. O'Connor C, Joffe H. Intercoder reliability in qualitative research: debates and practical guidelines. *Int J Qual Meth.* (2020) 19. doi: 10.1177/1609406919899220

frontiers | Frontiers in Public Health

TYPE Curriculum, Instruction, and Pedagogy
PUBLISHED 07 December 2022
DOI 10.3389/fpubh.2022.1068092

OPEN ACCESS

EDITED BY
Sharon Brownie,
University of Canberra, Australia

REVIEWED BY
Penrose Jackson,
Vermont Public Health Institute, United States
Patrick Broman,
Waikato Institute of Technology, New Zealand

*CORRESPONDENCE
Anthony K. Ngugi
anthony.ngugi@aku.edu

SPECIALTY SECTION
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

RECEIVED 12 October 2022
ACCEPTED 17 November 2022
PUBLISHED 07 December 2022

CITATION
Armstrong RW, Mantel M, Walraven G, Atwoli L and Ngugi AK (2022) Medical education and population health—A framework in the design of a new undergraduate program. *Front. Public Health* 10:1068092. doi: 10.3389/fpubh.2022.1068092

Medical education and population health—A framework in the design of a new undergraduate program

Robert W. Armstrong[1,2,3], Michaela Mantel[3], Gijs Walraven[4], Lukoye Atwoli[5] and Anthony K. Ngugi[6]*

[1]Medical College, Aga Khan University, Nairobi, Kenya, [2]Department of Pediatrics, The University of British Columbia, Vancouver, BC, Canada, [3]The Health Associates Ltd, Berlin, Germany, [4]Aga Khan Development Network, Geneva, Switzerland, [5]Department of Medicine, Brain and Mind Institute, Aga Khan University, Nairobi, Kenya, [6]Department of Population Health, Aga Khan University, Nairobi, Kenya

Health sciences curricular planners are challenged to add new content to established education programs. There is increasing pressure for content in public health, health systems, global health, and planetary health. These important areas often compete for curricular time. What is needed is a convergence model that builds a common framework within which students can integrate areas and better align this knowledge to the individual client or patient who they have responsibility to support. A population health framework is proposed for health sciences education programs that supports a common conceptual understanding of population health. The framework links five thematic areas that have influence on health and wellbeing and a sixth element that defines the range of methodologies essential to understanding health and wellbeing, from the individual to the population. The five areas providing convergence are: (1) the biopsychosocial development of the individual, (2) the socioeconomic factors that influence health and wellbeing, (3) the physical natural and built environment including climate, (4) the continuum of public health and health care systems, and (5) the nation state and global relationships. Using this framework, students are encouraged to think and understand individual health and wellbeing in context to the population and to utilize the appropriate methodological tools to explore these relationships. Planning for a new undergraduate medicine program illustrates the curricular elements that will be used to support student learning with foundation knowledge applied and tracked throughout the program. The proposed framework has application across health sciences disciplines and serves to build a common understanding that supports cross professional communication and collaboration.

KEYWORDS

medical education, population health, health science education, health determinants, developing countries, public health, global health

Background

Starting a new undergraduate medical program creates opportunity for providers to assess the frameworks used for structuring population health education. The Aga Khan University Medical College in East Africa had this opportunity when planning for an undergraduate medical program in Nairobi, Kenya.

The Aga Khan University (AKU) is a private not-for-profit university with a strong development mandate and is one of 10 agencies of the Aga Khan Development Network (AKDN) (https://www.akdn.org/). The university has campuses in Pakistan, Afghanistan, United Kingdom, and the East African countries of Kenya, Tanzania, and Uganda (https://www.aku.edu/). The first health sciences campus was established on a greenfield site 40 years ago in Karachi, Pakistan where there is now a well-established tertiary teaching hospital with undergraduate and postgraduate medical and nursing/midwifery schools.

AKU launched a new academic medical center in East Africa through conversion of an existing community hospital and establishment of a Faculty of Health Sciences based in Nairobi, with campuses also in Kampala, Uganda, and Dar es Salaam, Tanzania. The School of Nursing and Midwifery was first to be established in 2002 followed by the Medical College and postgraduate medical programs, with the goal of transforming the Nairobi community hospital to a university hospital and building faculty from graduates of the residency programs in advance of starting the undergraduate program.

Over several years, the Nairobi-based AKU tertiary teaching hospital has matured, achieving Joint Commission International accreditation in 2013. The medical college has been established with nine core residency programs and several fellowship programs. In Dar es Salaam five new residency programs have started and a university campus is under development in Kampala which will support nursing and medical training in a new university hospital. The AKU health system is complemented by four Aga Khan Health Services (AKHS) hospitals (Mombasa and Kisumu in Kenya and Dar es Salaam and Mwanza in Tanzania) and in combination with AKU there are over 100 community-based health centers in the three countries. As development focused not-for-profit organizations, AKU and AKHS collaborate with the public and private health services and universities to advance clinical practice, education and research that supports health and health care of the populations. In this context, AKU is committed to the inclusion of population health as a core foundation of the undergraduate medical program with the goal that graduates will have the knowledge and skills to contribute to addressing the significant health challenges of the East African Community in the twenty-first century. The start of the undergraduate medicine program was delayed due to the COVID-19 pandemic but is now scheduled to begin in September of 2023.

A Department of Population Health was established in the AKU Medical College in 2016 with a mandate to develop the framework that would structure an approach to population health education and advance population health research. Planning began with an internal "thinking group" and a survey of population health education in the context of East Africa (1). There was a consensus that a strong focus on population health within the undergraduate curriculum can potentially contribute to a more capable health workforce that is better aligned to the needs of the region and would generate leaders with national and regional impact. The Population Health Department will support both medicine, nursing, and allied health sciences education within the Faculty of Health Sciences. This paper provides the framework used for defining population health and demonstrates how it will be integrated into the new undergraduate medical education program.

The population health framework

Curricular planning in medical education is increasingly focused on pedagogical approaches that integrate content across disciplines with designs that connect basic science knowledge to the clinical case experience of students. Planners are challenged to add new content to a program that is already information dense and constantly in need of updating. Attention to reform has primarily been directed to integrating the biomedical sciences. However, there is recognition that students of the twenty-first century need a broader and more extensive set of skills in the areas of public health, health systems, global health, and planetary health. These important areas often compete for curricular time and are often proposed as distinct units within the curriculum (2–4).

What is needed is a convergence model of population health that builds a common framework within which students can integrate areas and better align this knowledge to the individual client or patient who they have responsibility to support (5, 6). Population health is by no means a "new" concept but the framing of population health within health professional curricula has had limited attention.

Geoffrey Rose, a clinical epidemiologist, advanced the concept of population health as an important framework "bridging clinical medicine with its focus on individuals, and epidemiology and public health, with their focus on populations." His pioneering paper "Sick Individuals and Sick Populations" challenged the historical separation of these fields (7). As Rose (7) noted "it is an integral part of good doctoring to ask not only, 'What is the diagnosis, and what is the treatment' but also 'Why did this happen, and could it have been prevented?'"

There has been extensive discussion regarding the definition of population health (8–14). Kindig and Stoddart (9) define population health as "the health outcomes of

a group of individuals, including the distribution of such outcomes within the group" and note that "in addition, many determinants of health, such as medical care systems, the social environment, and the physical environment have their biological impact on individuals in part at a population level." They note that the determinants "include medical care, public health interventions, aspects of the social environment (income, education, employment, social support, culture) and of the physical environment (urban design, clean air and water), genetics and individual behavior." This is consistent with the description Dunn and Hayes (8) quote from the Canadian Federal/Provincial/Territorial Advisory Committee on Population Health:

> *"Population health refers to the health of a population as measured by health status indicators and as influenced by social, economic, and physical environments, personal health practices, individual capacity and coping skills, human biology, early child development, health services. As an approach, population health focuses on the interrelated conditions and factors that influence the health of populations over the life course, identifies systematic variations in their patterns of occurrence, and applies the resulting knowledge to develop and implement policies and actions to improve the health and well-being of those populations."*

By the nature of these descriptions, population health sciences draw on expertise from basic, clinical, behavioral, and social sciences, providing a rich environment for understanding mechanisms and better defining potential strategies for intervention at various levels of the system. Population health sciences integrate systems science with human development, extending from the individual shaped by their biology and external experiences to that of an individual's contribution to a population.

The proposed definition of population health relevant to health sciences education draws on the above background. In the contest of health sciences education, population health is defined as the health and wellbeing of the individual/patient in context to the population they are a constituent part of. The categories of influence on health are captured within a model that converges disciplines. Linked to this definition are a set of "tools" that permit the exploration of health status, from the individual to the population. This definition supports a pedagogy that reinforces for students the importance of placing the patient in context to the population the patient is part of, whether, for example, the "population" is defined as those with the same condition as the patient or perhaps the community within which the patient lives.

The model (Figure 1) starts at an individual level, where health can be viewed as a capacity or resource rather than a state and recognizes the range of social, economic, and environmental influences that contribute to health (15). This

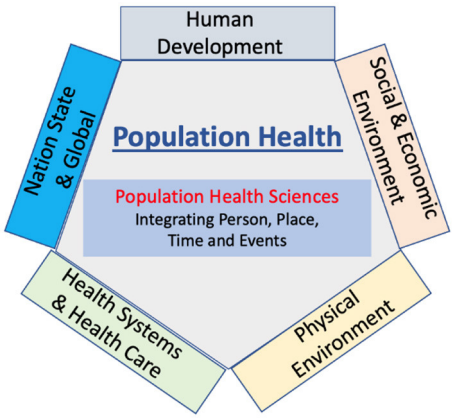


FIGURE 1
Conceptual model of population health.

level captures our understanding of genetic and biopsychosocial processes of human development, a field that is advancing at a tremendous pace with important implications for health and wellbeing. From pre-conception, through *in-utero* development, to early child development and to development through the life span, our knowledge of individual development is critical to understanding health and wellbeing, disorder, disease, and disability. Within this model students gain an understanding of the life course of an individual, appreciating the key processes involved in human development at an individual level.

The social and economic environment is the second component of the model. Here students gain understanding of the social and economic environment within which individuals live. The units of influence encompass the family, community structures such as employment, education, and recreation that provide a social infrastructure and economic opportunity that supports human development. We now understand better the biological embedding of early experience (16) and how social and economic influence actually "get under the skin" and their impact on biological processes of development and human function (17, 18). The population health framework emphasizes the link between human development and the social/economic structures that influence health and wellbeing. Students will gain a greater understanding of the social and economic structures of their communities and of how these relate to the "life story" of the patient presenting to them with a disorder, disease, or disability.

The third component of the model is the physical environment. The physical environment has influenced human development and health from the earliest of time, whether providing desirable and safe opportunities for settlement, or presenting the challenges of natural disasters, or the challenges of manmade influences on the physical environment. "Where we are born, live, study and work directly influence

our health experiences: the air we breathe, the food we eat, the viruses we are exposed to and the health services we can access" (19). Students will gain understanding of the built and natural environments in relation to health, appreciating the importance of "place" and "place across the life-span" (20). Specific areas of importance include the differential impacts of urban and rural environment, climate change, and natural and manmade disasters and health emergencies.

The fourth component of the model is health systems and health care. Elliott et al. (21) define health systems science as an "understanding of how care is delivered, how health professionals work together to deliver that care, and how the health system can improve patient care and health care delivery." However, from a population health perspective this component of the model is seen as a much broader set of services that support health and wellbeing including promotive and preventative services supported within a public health structure (22–24). This component of the model captures the important evolution occurring in health systems that is driving a greater focus on personal decision making, precision medicine, artificial intelligence and access to data that is transforming how individuals receive information and services that influence their health and wellbeing and access to health care (25–27).

The undergraduate curriculum will include content that builds understanding of health care and the systems delivering care. The model removes the artificial distinction between "health care" and "public health," providing students with the concepts and knowledge of a continuum of health services (28). Students will have the skills to analyze health systems function, including those directly related to patient care quality and safety in the hospital and ambulatory setting and those related to public health systems (29).

The fifth component of the model is nation state and global. A nation state is defined by a specific geographic boundary within which exists a population and for which the nation state is responsible. The relationship of the "state" to its "people" varies widely but in the end the population within that boundary defines a "state" responsibility. Global health structures and strategies such as the World Health Organization and the United Nations Sustainable Development Goals and many global professional organizations are important, as there are many cross-boundary issues that relate to health and wellbeing. However, it is the "state" that is the ultimate unit of support and responsibility for the health and wellbeing of its population.

Students will gain understanding of the governance structures within a country and the ways in which these structures impact population health. This will include the professional structures and inter-professional relationships that can influence government policies and practices at the local, regional, and national levels. The role of supra-national, global structures in supporting population health will be integrated with the national population health structures.

The sixth component of the model defines the sciences that come together to understand population health—the field of "population health science." Drawing on multiple disciplines and perspectives, the sciences serve to "integrate" components of person, place, time, and events to better understand how health and wellbeing is achieved. Integration moves from understanding the "individual" to understanding groups of individuals, whether defined by geography, socio-economic conditions, or disorder, disease, or disability. Population health science has a broad range of tools that support exploration through the process of integration. This may be at a biological level measuring for example responses to stressful events, to an individual experience level using qualitative methods, to a broad range of demographic and epidemiological measures that define specific populations of interest, to health systems analytic tools (30) and to the increasing importance of social sciences in complex policy issues (31).

Thus, as captured in Figure 1, population health provides a "convergence" framework for understanding the components that lead to health and wellbeing and to disorder, disease, or disability. The model builds from the individual experience of person, place, time, and events to a set of integrative strategies that allow us to understand, clarify and where necessary influence these components to advance the health and wellbeing of the population. The fields of "public health," "global health," "planetary health," and "health systems" are captured and understood in the context of population health rather than as distinct fields of practice and enquiry and avoids the ongoing attempt to define the distinct nature of these areas (32–37).

For the student, this convergence model provides a clear sense of agency in relation to the needs of their patients and their communities. This supports greater in-country ownership of equity issues and encourages students to see research career opportunities driven by questions within their country and within their control (38), contributing to the health equity goal of "global health" (36).

Population health in the AKU curriculum

In East Africa, students enter undergraduate medicine from high school with a 6-year curriculum leading to internship and residency. Student selection will be based on academic performance in high school plus a personal interview structure. AKU will primarily draw students from public or private high schools in the East Africa countries of Kenya, Tanzania, and Uganda but admission is not restricted to these countries. AKU has a student financial support structure ensuring that financial capacity will not be a barrier to admission.

Degree programs are accredited in Kenya by the Commission for University Education (https://www.cue.or.ke/) with content guided by the Kenyan Medical Practitioners

and Dentists Council (https://kmpdc.go.ke/), the physician licensing authority. Course content and hours are prescribed with flexibility allowed in the structure and mode of delivery.

The AKU curriculum planning has been influenced by the Carnegie Foundation for the Advancement of Teaching (39, 40) and the Lancet Commission on Health Professional Education (41). Education strategies are designed to promote learner-driven acquisition of standardized professional competencies, integration of knowledge with practice, acquisition of a habit of continuous inquiry and improvement, and a strong sense of professional identity.

AKU follows three principles in structuring population health within the undergraduate medical curriculum. First, population health will be delivered as a foundational course with components of the framework embedded in the curriculum, ensuring continuity across courses and years of training. Second, population health would be experiential and laddered in complexity as the student progresses through the curriculum. Third, assessment will capture population health knowledge, attitudes, and practices throughout the curriculum, demonstrating to students the importance of this framework to the overall learning outcomes expected of a professional in the practice of medicine.

The learning outcomes will be achieved through a set of instructional methods that move away from isolated and often disconnected courses to a more integrated and laddered approach to learning and application in context of practice. The following instructional strategies will form the basis of the population health integration.

Personal perspective and population health

The medical students themselves bring a personal perspective to population health that serves as a learning tool for understanding population health in the context of their life history and development as health professionals. This relationship is supported through a longitudinal mentorship program providing students with a range of opportunities to reflect on their individual characteristics within family and community, their journey as a student in medicine, their understanding and application of professional behaviors, and the balance they achieve between their profession and personal lives.

Humanities and the arts

The capacity to self-reflect and the skills to capture and be part of a patient's "story" is strengthened through a broad-based education that integrates the arts and humanities within medical education programs (42). This understanding is what has driven increasing recognition of the importance of the arts and humanities in medical education (43). Success as a clinician requires understanding the context of a person's life—their story. Narrative medicine is a common method used in medical education and is defined as "clinical practice fortified with a narrative competence to recognize, absorb, interpret, and honor the stories of self and others" (44). The AKU curriculum will have significant content related to the arts and humanities and this content will be closely aligned with the population health framework.

TABLE 1 Population health course learning outcomes.

1. Explain concepts and principles related to population health
2. Measure human development and population health outcomes
3. Describe distribution of health across sub-populations
4. Evaluate determinants of health outcomes and the interaction between determinants at various stages of the human life cycle
5. Analyze policies and interventions influencing population health outcomes at the individual and societal level
6. Advocate health education and policy development and interventions to address challenges faced by local communities

Introductory course

A population health foundation course will introduce the AKU population health framework and explore the determinants of health and wellbeing from an individual to a population level. Multiple approaches to delivery will include small group work capturing specific content and the inter-relationship between the components of the model; large group sessions drawing on interdisciplinary expertise; community assessment opportunities using the population health framework; and a range of on-line materials that expose students to key thought leaders and events that illustrate the importance of the determinants and their interaction. The course learning outcomes are listed in Table 1.

Methodological tools of population health

Students will have a solid grounding in the "integrating tools" of population health and the application of these tool to the clinical cases they work through in the curriculum. Students will understand and apply a range of tools including qualitative methods, demography, statistics, epidemiology, economics, and methods for developing evidence-base and evidence-informed decision making (e.g., systematic reviews). The content will be framed in relation to the model of population health. Students

will have the capacity to draw on this base and expand their capacity to use these tools as they move through the curriculum and at increased complexity through the years.

Case-based learning

The AKU undergraduate medical program will have a strong case-based curriculum. This is ideally suited to including population health content within case-based scenarios (45). Students will explore and bring into discussion the breadth of influences on a given problem within the context of case-based learning objectives. There will be a laddering of the methodological tools that students draw on to understand the case. The learning outcomes related to any given unit will capture important determinants as framed by the population health model. Connecting specific curricular content to learning outcomes (category tagging), will ensure that content related to population health can be captured in the overall curriculum, will be linked to assessment methods, and will contribute to the final learning outcomes. Population health content experts will contribute to case development and assessment and ensure that there is attention to producing a spiraling effect, allowing for demonstrated increased sophistication in use of population health tools for analysis.

Patient and population

Based on the AKU population health framework the student will "adopt" a patient within a defined geographic population and through a range of experiential opportunities use their clinical skills and the "tools" of population health to understand population health from the "person" to the "population." Students will have the opportunity to follow a volunteer patient/family gaining experience beyond the patient's clinical problem to the context of the patient's life, providing a "personal" and in-depth understanding of the influences on health and disease. In addition, during an intersession period between Year 2 and Year 3 students will spend time in this geographically defined community setting and develop an applied research project relevant to the population within this region. Practical experience in the community will enable students to bridge the gap between classroom knowledge and the community (38). Students will develop observational and analytic skills as well as skills of communication and collaboration.

Clinical rotations

Moving from case-based learning to the clinical rotations will provide continuity in framing the understanding of patient care as students now become "responsible" for developing patient history, diagnosis, and management plans. This is where the appreciation for inter-disciplinary work begins to shine—students of medicine, nursing, and other allied health sciences disciplines share in understanding the "patient story" and take responsibility for supporting a therapeutic prescription, a care plan and home/community care plan that can differentiate responsibilities but with a more comprehensive focus on the needs of the patient. In the "best practice" setting, whether in a hospital or a community clinic, there would be an understanding of community structures and resources that can be called on to support patients, "personalizing" the patient experience whether it is a medical intervention, a community social intervention or some combination with "continuity" from primary care to hospital care and back. The use of a population health model provides a common framework and language across disciplines that better support the patient experience.

Elective planning

Students are encouraged to seek out areas of interest that may align to their future career choices. Given a population health framework, the AKU program will support students in exploring a broader range of elective opportunities. Providing access to high quality electives across the spectrum of determinants, whether local or global will give students an appreciation of the value placed on understanding the breadth and relevance of population health to their professional practice. Expanding the breadth of elective opportunities increases the chance of "capturing" a student's interests that may stimulate career opportunities that move beyond traditional roles.

Challenges to implementation

Introduction of population health as a foundation structure within an undergraduate medical curriculum must overcome the challenge of abandoning the traditional approach of independent courses, often disconnected from each other. Three key strategies have been used to support the success of this transition.

Building a Department of Population Health

There are few Departments of Population Health within Medical Schools and there remains territorial resistance to bringing together the various disciplinary components required to provide the foundation of knowledge and skills for success—epidemiology, demography, public health, global and planetary health, health systems sciences, health economics and the social

and behavioral sciences. The advantage for AKU is that the "new department" and the "new medical program" will grow together and opportunity to recruit will reduce the disciplinary barriers that established schools may experience. This provides a unique opportunity for a department to work closely with basic sciences and clinical and community medicine in curriculum design and assessment. At the same time, the department will build graduate programs that will align to and support the education and research mission.

Meeting accreditation requirements

In meeting accreditation requirements, AKU must ensure that the expectations of accreditors can be achieved (46). Through tagging and tracking population health content across the 6 years, it will be possible to translate instructional methods into the content and assessment requirements of the courses defined by the regulators, assuring that content has been covered in the curriculum. This data combined with student and faculty continuous feedback will provide the necessary information to adjust the program as needed and to meet learning outcomes and accreditation expectations.

Faculty professional development

The success of curriculum reform is determined by both the quality of the reform and the extent to which faculty support change and incorporate change into their teaching. Demands on faculty are significant given the rate of advancements in medicine, the persistent challenge on curricular change, and demands on their professional practice and time for research (47). A population health framework has the capacity to increase efficiency of content delivery while creating a common language that can facilitate faculty support and commitment to the curriculum. Population health provides a framework to start capturing the breadth of health and wellbeing and the many disciplines that contribute to understanding while not compromising depth where this is required. Faculty development will involve a clear blueprint to support this curriculum reform (47). There is faculty support for the population health model as it has efficiency in delivery and captures a cross-discipline commitment to a common model of health and wellbeing.

Conclusion

The framing of person, place, time, and events is fundamental to our understanding and appreciation of the human experience, to the role a physician has in the "patient story," and to the physician's potential for impact beyond the individual to that of the population. The understanding and appreciation of "story" links the student's clinical practice to population health and to the value now being placed on integrating arts and humanities content in health professional education.

A Population Health framework supports understanding and enquiry from the cellular to the global, builds appreciation across the disciplines of expertise, and supports a focus on inter-disciplinary/cross-discipline understanding and collaboration. From a policy perspective, health and health care are "local" issues and governments can easily align and appreciate a population health perspective, reducing the tensions between public health and health care priorities, making for more effective policy development, and drawing on a new cohort of physicians who have a better understanding of population health. AKU is committed to evaluation of the model within the delivered curriculum and to measuring the longer-term impact on the practice and career choices of the graduates.

In this paper we present a new approach to framing population health within an undergraduate medical curriculum that we believe will produce graduates with a better understanding of their role and capacity for impact, whether for their individual patient or for the broader community.

The model is applied to the development of a new medical program but has potential application across health sciences and related disciplines, whether established or new.

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

Concept development: RA, MM, and AN. Curriculum design, revising the manuscript for critical intellectual content, and decision to submit for publication: RA, MM, AN, LA, and GW. Initial drafting of manuscript: RA. All authors contributed to the article and approved the submitted version.

Conflict of interest

Authors MM and RA are partners in The Health Associates Ltd., Germany, a health consulting service and were employed by AKU during the early work for this paper.

The remaining 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

References

1. Hiatt RA, Engmann NJ, Ahmed M, Amarsi Y, Macharia WM, Macfarlane SB, et al. Population health science: a core element of health science education in Sub-Saharan Africa. *Acad Med.* (2017) 92:462–7. doi: 10.1097/ACM.0000000000001320

2. Rabin TL, Mayanja-Kizza H, Barry M. Global health education in the time of COVID-19: an opportunity to restructure relationships and address supremacy. *Acad Med.* (2021) 96:795–7. doi: 10.1097/ACM.0000000000003911

3. Pillai P, Patz JA, Seibert CS. Climate change and environmental health must be integrated into medical education. *Acad Med.* (2021) 96:1501–2. doi: 10.1097/ACM.0000000000004238

4. Gonzalo JD, Wolpaw T, Wolpaw D. Curricular transformation in health systems science: the need for global change. *Acad Med.* (2018) 93:1431–3. doi: 10.1097/ACM.0000000000002284

5. Dzou VJ, Balatbat CA. Reimagining population health as a convergence science. *Lancet.* (2018) 392:367–8. doi: 10.1016/S0140-6736(18)31372-2

6. Garcia P, Armstrong R, Zaman MH. Models of education in medicine, public health and engineering. *Science.* (2014) 345:1281–3. doi: 10.1126/science.1258782

7. Rose G. Sick individuals and sick populations. *Int J Epidemiol.* (2001) 30:427–32. doi: 10.1093/ije/30.3.427

8. Dunn James R, Hayes Michael V. Toward a Lexicon of population health. *Can J Public Health.* (1999) 90(suppl 1):S7–10. doi: 10.1007/BF03403570

9. Kindig D, Stoddart G. What is population health? *J Public Health.* (2003) 93:380–3. doi: 10.2105/AJPH.93.3.380

10. Kindig DA, Asada Y, Booske B. A population health framework for setting national and state health goals. *JAMA.* (2008) 299:2081–3. doi: 10.1001/jama.299.17.2081

11. Evans RB, Stoddart GL. Producing health, consuming health care. *Soc Sci Med.* (1990) 31:1347–63. doi: 10.1016/0277-9536(90)90074-3

12. Doyle YG, Furey A, Flowers J. Sick individuals and sick populations: 20 years later. *J Epidemiol Commun Health.* (2006) 60:396–8. doi: 10.1136/jech.2005.042770

13. Evans Robert G, Barer Morris L, Marmor Theodore R. *Why are Some People Health and Others Not?* New York: Routledge (1994). doi: 10.1515/9783112421628

14. Kindig DA. Understanding population health terminology. *Milbank Q.* (2007) 85:139–61. doi: 10.1111/j.1468-0009.2007.00479.x

15. Government of Canada. *What is the Population Health Approach*. (2022). Available online at: https://www.canada.ca/en/public-health/services/health-promotion/population-health/population-health-approach/what-is-health.html (accessed August 23, 2022).

16. Hertzman C. The biological embedding of early experience and its effects on health in adulthood. *Ann NY Acad Sci.* (1999) 896:85–95. doi: 10.1111/j.1749-6632.1999.tb08107.x

17. Hertzman C, Boyce WT. How experience gets under the skin to create gradients in developmental health. *Ann Rev Public Health.* (2010) 31:329–47. doi: 10.1146/annurev.publhealth.012809.103538

18. Bush NR, Edgar RD, Park M, MacIsaac JL, McEwen LM, Adler NE, et al. The biological embedding of early-life socioeconomic status and family adversity in children's genome-wide DNA methylation. *Epigenomics.* (2018) 10:1445–61. doi: 10.2217/epi-2018-0042

19. Dummer Trevor JB. Health geography: supporting public health policy and planning. *Can Med Assoc J.* (2008) 178:1177–80. doi: 10.1503/cmaj.071783

20. Pearce JR. Complexity and uncertainty in geography of health research: incorporating life-course perspectives. *Ann Am Assoc Geogr.* (2018) 108:1491–8. doi: 10.1080/24694452.2017.1416280

21. Elliott VS, Jackson J, Santen SA, Richardson J, Heckman K, Hammoud MM, et al. Less triple challenges: How medical students may solve 3 long-standing problems bedeviling health systems and medical education. *Acad Med.* (2021) 96:1643–9. doi: 10.1097/ACM.0000000000004159

22. Keyes KM, Galea S. Setting the agenda for a new discipline: population health science. *Am J Public Health.* (2016) 106:633–4. doi: 10.2105/AJPH.2016.303101

23. Galea S. On the production of useful knowledge. *Milbank Q.* (2017) 95:722–5. doi: 10.1111/1468-0009.12296

24. Gourevitch MN. Population health and the academic medical center: the time is right. *Acad Med.* (2014) 89:544–9. doi: 10.1097/ACM.0000000000000171

25. Dzou VJ, Balatbat CA, Ellaissi WF. Revisiting academic health sciences systems, a decade later: discovery to health to population to society. *Lancet.* (2021) 398:2300–4. doi: 10.1016/S0140-6736(21)01752-9

26. Aristidou A, Jena R, Topol EJ. Digital medicine. Bridging the chasm between AI and clinical implementation. *Lancet.* (2022) 399:620. doi: 10.1016/S0140-6736(22)00235-5

27. Wartman S. The empirical challenge of 21st-century medical education. *Acad Med.* (2019) 94:1412–5. doi: 10.1097/ACM.0000000000002866

28. Alberti P, Fair M, Skorton DJ. Now is our time to act: why academic medicine must embrace community collaboration as its fourth mission. *Acad Med.* (2021) 96:1503–6. doi: 10.1097/ACM.0000000000004371

29. Weeks KS, Swanson MB, Reed A. A critical need for progress in implementing education in health care delivery science. *Acad Med.* (2021) 96:13–4. doi: 10.1097/ACM.0000000000003780

30. Berman P, Bitran R. *Health Systems Analysis for Better Health System Strengthening.* Washington, DC: The World Bank (2011).

31. Nelson A, Kearney W. Science and technology now sit in the center of every policy and social issue. *Issues Sci Technol.* (2021) 18:26–9.

32. Bozorgmehr K. Rethinking the "global" in global health: a dialectic approach. *Global Health.* (2010) 6:19. doi: 10.1186/1744-8603-6-19

33. Kasper J, Green JA, Farmer PE, Jones DS. All health is global health, all medicine is social medicine: integrating the social sciences into the preclinical curriculum. *Acad Med.* (2016) 91:628–32. doi: 10.1097/ACM.0000000000001054

34. Taylor S. 'Global health': meaning what? *BMJ Global Health.* (2018) 3:e000843. doi: 10.1136/bmjgh-2018-000843

35. Brown A. Education for planetary health: a call for papers. *Lancet Planet Health.* (2021) 5:E762. doi: 10.1016/S2542-5196(21)00282-5

36. Abimbola S. On the meaning of global health and the role of global health journals. *Int Health.* (2018) 10:63–5. doi: 10.1093/inthealth/ihy010

37. Myers S, Frumkin H, editors. *Planetary Health: Protecting Nature to Protect Ourselves*. Washington, DC: Island Press (2020).

38. Kumar M, Atwoli L, Burgess RA, Gaddour N, Huang KY, Kola L, et al. What should equity in global health research look like? *Lancet.* (2022) 400:145–7. doi: 10.1016/S0140-6736(22)00888-1

39. Cooke M, Irby DM, O'Brien B. *Educating Physicians: A Call for Reform of Medical School and Residency*. San Francisco: Jossey-Bass (2010). Available online at: http://wwwcarnegiefoundationorg/elibrary/summary-educating- physicians (accessed September 7, 2012).

40. O'Brien BC, Irby DM. Enacting the Carnegie foundation call for reform of medical school and residency. *Teach Learn Med.* (2013) 25:sup 1:S1–8. doi: 10.1080/10401334.2013.842915

41. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet.* (2010) 376:5–40. doi: 10.1016/S0140-6736(10)61854-5

42. Skorton D, Bear A, editors. *Committee on Integrating Higher Education in the Arts, Humanities, Sciences, Engineering, and Medicine*. Board on Higher

Education and Workforce; Policy and Global Affairs; National Academies of Sciences, Engineering, and Medicine (2018). doi: 10.17226/24988

43. AAMC. *The Fundamental Role of the Arts and Humanities in Medical Education*. (2020). Available online at: https://store.aamc.org/the-fundamental-role-of-the-arts-and-humanities-in-medical-education.html

44. Miller E, Balmer D, Hermann MN, Graham MG, Charon R. Sounding narrative medicine: studying students' professional identity development at Columbia University College of Physicians and Surgeons. *Acad Med.* (2014) 89:335. doi: 10.1097/ACM.0000000000000098

45. Sethi A, Khan RA. Curriculum integration: from ladder to Ludo. *Med Teach.* (2020) 42:1421–3. doi: 10.1080/0142159X.2019.1707176

46. Kenya Medical Practitioners and Dentists Council. *Bachelor of Medicine and Bachelor of Surgery Core Curriculum*. (2022). Available online at: https://kmpdc.go.ke/resources/mbchb.pdf#page=1andzoom=auto-397842 (accessed November 4, 2022).

47. Van Schaik S. Accessible and adaptable faculty development to support curriculum reform in medical education. *Acad Med.* (2021) 96:495–500. doi: 10.1097/ACM.0000000000003804

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 04 January 2023
DOI 10.3389/fpubh.2022.993461

OPEN ACCESS

EDITED BY
Constance Shumba,
Aga Khan University Hospital, Kenya

REVIEWED BY
Valerie E. Cadet,
Philadelphia College of Osteopathic Medicine (PCOM) Georgia, United States
Jonathan J. Wisco,
Boston University, United States

*CORRESPONDENCE
Samiksha Prasad
✉ sprasad@nova.edu
Daniel P. Griffin
✉ daniel.griffin@nova.edu

SPECIALTY SECTION
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

RECEIVED 09 August 2022
ACCEPTED 02 December 2022
PUBLISHED 04 January 2023

CITATION
Prasad S, O'Malley CB, DeLeon R, Levy AS and Griffin DP (2023) Inclusive LGBTQIA+ healthcare: An interprofessional case-based experience for cultural competency awareness.
Front. Public Health 10:993461.
doi: 10.3389/fpubh.2022.993461

Inclusive LGBTQIA+ healthcare: An interprofessional case-based experience for cultural competency awareness

Samiksha Prasad[1]*, Chasity B. O'Malley[1,2], Rolando DeLeon[1,3], Arkene S. Levy[1] and Daniel P. Griffin[1]*

[1]Dr. Kiran C. Patel College of Allopathic Medicine, Department of Medical Education, Nova Southeastern University, Fort Lauderdale, FL, United States, [2]Boonshoft School of Medicine, Wright State University, Dayton, OH, United States, [3]Division of Obstetrics and Gynecology, HCA Florida Mercy Hospital, Miami, FL, United States

Introduction: Lesbian, Gay, Bi-sexual, Transgender, Questioning, Intersex, and Asexual (LGBTQIA+) patients report experiences of discrimination within healthcare settings due to a lack of provider knowledge and biases of healthcare workers. There is an identified need among all health professions to provide more culturally competent healthcare for this community. Early interventions during healthcare profession training programs may be effective to address this need. The overall goal of this study was to assess the educational impact of an active learning session that was specifically designed to enhance LGBTQIA+ cultural competency awareness using an interprofessional setting.

Methods: This 2-year study involved students from 16 healthcare professional programs joining virtually to form interprofessional teams. A small group case-based learning approach was used and included pre/post-activity surveys to measure the change in student attitude and confidence, as well as the change in perception of the importance of the activity.

Results: Results indicate an increase in perception of importance ($p < 0.005$) and in overall level of confidence ($p < 0.001$) with respect to LGBTQIA+ issues post-session. Key themes established through the session represent an overall recognition of the importance of interprofessional education and awareness of LGBTQIA+ healthcare needs.

Discussion: The results demonstrate the effectiveness of a case-based approach for enhancing cultural competency awareness across different healthcare professions programs. This session also provided an interprofessional learning environment to allow multiple healthcare professions program students to interact and share perspectives. The positive impact of this intervention in a highly collaborative virtual learning environment also highlights that this immersive active learning approach that can be adopted across different programs and institutions.

KEYWORDS

cultural competency, interprofessional, inclusivity, Case-Based Learning (CBL), active-learning, gender minorities, LGBTQIA+ health

Introduction

When seeking healthcare, Lesbian, Gay, Bi-sexual, Transgender, Questioning, Intersex, Asexual (LGBTQIA+) people are impacted by significant barriers. These barriers can take the form of disrespectful attitudes, discriminatory treatment, inadequate understanding of needs, and inability to provide appropriate care (1, 2). According to the 2019 southern LGBTQIA+ health survey conducted by the Campaign for Southern Equality, out of the 5,617 LGBTQIA+ patients who participated, it was reported that they delayed seeking healthcare because of their LGBTQIA+ identity and fear of discrimination from health care providers (3). LGBTQIA+ patients also reported alarmingly higher rates of suicidal ideation, depression, and anxiety than the general population, with the rates particularly high for transgender participants (3). The national transgender discrimination survey revealed that 19% of transgender persons are denied care based on their gender status, and 28% postponed care due to perceived harassment within a healthcare setting (4, 5). Intersex populations have limited research focused on their healthcare, but there is a tendency for intersexual adults to avoid healthcare due to traumatic healthcare experiences during childhood (6, 7). These disparities in physical health and quality of care for LGBTQIA+ patients highlight the need to improve their healthcare experiences by providing focused training to healthcare professional students (8).

It is important to provide training to healthcare professional students on the ways LGBTQIA+ people may experience barriers in healthcare settings to give students the tools they need to actively engage in reducing and eliminating these healthcare disparities for their future patients (1). Proficiency training of healthcare personnel and students has been shown to mitigate biases, discrimination, and microaggressions in learning environments by increasing the knowledge and cultural awareness of the faculty, staff, and students (9). Such trainings improve cultural awareness and proficiency; and translate to improved healthcare outcomes for the LGBTQIA+ population (10).

Providing comprehensive patient care requires collaborations between the various providers from multiple professions and specialties in healthcare organizations. This team-based approach within the organizations may have an underlying culture of care, that may be advantageous or detrimental to the patient, depending on the situation and those involved. For example, factors such as miscommunication between healthcare professionals could lead to an increase in hospital patients with at least one healthcare-associated infection according to the data from the Centers for Disease Control (CDC) (11). Interprofessional education (IPE) can help those in healthcare to not only better understand the existing organizational culture, but also apply changes to the culture of care to improve the care of their patients and health outcomes (12, 13). To do so, it is important to recognize and understand the distinguishing and mutual goals of individual professional groups caring for our patients. Through that understanding, we can develop solutions that allow for interprofessional education to help enhance collaboration and improve patient care. Establishing an understanding of one another's role in patient care and ways to work together has the potential to reduce error and improve the quality for care of our patients (14).

The Interprofessional Education Collaborative (IPEC), in 2016, updated the core competencies into a single domain of interprofessional collaborative practice with four sub-competencies: (i) values/ethics for interprofessional practice, (ii) roles/responsibilities, (iii) interprofessional communication, and (iv) teams and teamwork (15, 16). These competencies were emphasized for developing the case-based sequential disclosure active session. In accordance with the IPEC guidelines, Nova Southeastern University (NSU) Health Professions Division (HPD) holds an annual IPE Day. Due to the COVID-19 pandemic, NSU held the 2021 and 2022 IPE Day events virtually *via* the Zoom meeting platform. This enabled intercampus collaboration across eight campuses which included more than thirteen hundred (>1,300) students from eight (9) HPD colleges encompassing eighteen (17) professional programs.

In order to promote interprofessional (IP) communication between learners from different healthcare professional programs, an active learning approach is effective. Active learning is a student-centered concept denoting a participative process of engagement in classes and materials where students are involved in constructing their own learning (18, 19). For this intervention, Case-Based Learning (CBL) was determined to be the most appropriate method of delivery. CBL, through its various delivery methods, is used worldwide by many different fields and disciplines. CBL is defined in multiple ways in the literature, since it does not have a formal design, but instead will incorporate a variety of strategies based on the unique needs of the session (17).

With the oversight of facilitator(s) and stated learning objectives, CBL is structured to promote inquiry learning experience which includes patient cases to solve a clinically relevant problem (17). It is important to note that an advantage of CBL is that there is flexibility in its use depending upon multiple factors, such as the presence of pre-work, size of the group, number of facilitators, etc. CBL remains a methodology that is malleable and adaptable which may vary by institution and specific needs of the intervention. For this experience, pre-work was not feasible, therefore, information was given during the session and not prior as is common in the delivery of standard Problem-Based Learning (PBL) format (17).

This experience was designed for an I*P*-CBL, small group discussion with the primary goal of encouraging communication between healthcare professionals to help build an environment of inclusivity and support. Sessions such as this are at risk of having a diminishing impact unless additional sessions of

this nature are added to ensure applicable skills are reinforced longitudinally throughout their professional training. Due to its malleability, this student-driven approach could be adapted by other schools and health professions programs to promote a comprehensive learning experience.

Methods

Educational objectives covered in the session

1. Demonstrate being receptive to the opinions of members of an interprofessional team in a patient-centered fashion. (IPEC domain fulfilled: Communications).

2. Discuss and clarify each profession's scope of practice and the roles of each healthcare professions team member. (IPEC domains fulfilled: Roles/Responsibilities and Communications).

3. Communicate the importance of teamwork in providing unbiased and inclusive patient-centered care. (IPEC domains fulfilled: Teams/Teamwork and Ethics).

4. Recognize boundaries experienced by a marginalized patient population (IPEC domains fulfilled: Ethics).

Participants

One hundred and eighty healthcare professions students from 16 healthcare professional programs and 7 colleges participated in this virtual session for the IPE Day (2021–22) out of which 111 (61.67%) completed the pre/post-activity surveys for this study.

Session context and logistics

Context

The 1-hour case-based sessions were held during IPE day in 2021 and 2022, respectively. This annual event is designed to introduce interprofessional concepts to students in the various health professions programs. The clinical vignette was designed to depict a bi-sexual female patient's experience during a visit to the doctor's office and subsequent experiences with other clinicians (Complete case in Appendix 1_Case). This allowed students to discuss the patient's experience from the perspective of the different health professionals involved.

Logistics

The sessions were hosted *via* the Zoom Meeting platform and repeated three times each year for a total of six sessions. For each session, students were randomly assigned into groups of 30 members each. The activity began with brief introductions and students were provided with the details for informed consent for the study. The anonymous pre-activity survey was then distributed using Microsoft Forms, accessible by hyperlink and QR code. The clinical vignette was revealed to students using sequential disclosure, through PowerPoint. Each part was read by a student member of the group. After each part, prompt questions were provided for group discussion. Clinical and basic science faculty were overseeing the group discussions and facilitated as needed. At the conclusion of the final discussion, the anonymous post-activity survey was disseminated.

Data instrument

The anonymous pre-and post-activity surveys used a five-point Likert scale for obtaining the data. The pre- and post-activity surveys were not linked for individual participant responses to ensure student anonymity. Surveys were created based on revisions of the Health Disparities Attitudes and Knowledge Scale by Gavzy et al. (20) and Parker et al. (21). Human subjects research approval was obtained from the Nova Southeastern University Institutional Review Board for the pre-/post-activity surveys (IRB# 2021-12-NSU). The data instrument is provided as Appendix 2_Data Instrument.

Data analysis

Each data category in the Likert scale was assigned the following numerical value for statistical analysis: Extremely Important/ Very Confident = 5; Somewhat Important/ Confident = 4; Neutral = 3; Somewhat Unimportant/ Minimally Confident = 2; Extremely Unimportant/ Not Confident at all = 1. Data was analyzed using GraphPad Prism Version: 9.3.1 (471). The data was aggregated, and an unpaired student *t*-test was used for analysis (a p-value of <0.05 was considered significant).

Demographics data was categorized into 5 different categories namely: (i) Health Professional College, (ii) Health Professional Program, (iii) Year of Study, (iv) Age Range, and (v) Gender. A prompt was included in the data instrument for any training received within the respective program curriculums prior to this experience. An independent samples *t*-test analysis was performed, to examine the significance of year of study and the number of hours of prior training.

Each individual narrative response was reviewed and tallied. Common themes were words/phrases appearing more than two times. The frequency of input of each common theme was used to plot an occurrence diagram.

10.3389/fpubh.2022.993461

Results

Demographics

Out of the 111 healthcare professional students participating in this study, 70.3% reported as female and 29.7% reported as male (Table 1). The age ranges of the participants included 63.1% comprising of 20–25 years old, 27.9% being in the 26–30-year age range, 5.4% being in the 31–35 years and 3.6% comprising 36–40-year age range (Table 1). The participant pool comprised primarily of students in their 1st year (44.2%) and 2nd year (42.3%) of the study. Representation from the third year and fourth year of study was 11.7 and 1.8% respectively (Table 1). The results obtained from the independent samples *t*-test analysis for the effect on participant responses based on the year of study was not significant (all *p*-values obtained were >0.05).

Out of the participating 16 healthcare programs the top three belonged to the Doctor of Osteopathic Medicine (24.4%), Physician Assistant (20.7%), and Doctor in Pharmacy (12.6%) (Table 1). The complete breakdown of all participating programs is mentioned in Table 1. The participating students came from 7 Healthcare Colleges. The maximum representation was from the College of Healthcare Sciences (38.5%), College of Osteopathic Medicine (27.5%), and College of Pharmacy (12.5%) (Table 1).

The complete breakdown of all participants ($n = 111$) is grouped into 5 demographic categories (1: Participating Healthcare College, 2: Healthcare Program, 3: Year of Study, 4: Age Range, and 5: Gender).

TABLE 1 Participant demographics distribution.

	Demographic Category	Participant distributions	Percent (%)
1.	Participating Healthcare College	Healthcare Sciences	38.5
		Osteopathic Medicine	27.5
		Pharmacy	12.5
		Optometry	7.2
		Nursing	6.3
		Allopathic Medicine	5.4
		Dental Medicine	2.6
2.	Healthcare Program	Doctor of Osteopathic Medicine (DO)	24.4
		Physician Assistant (PA)	20.7
		Doctor in Pharmacy (PharmD)	12.6
		Doctor in Optometry (OD)	7.2
		Nursing (BSN)	6.3
		Doctor of Occupational Therapy (OTD)	4.5
		Anesthesiologist Assistant (AA)	4.5
		Doctor of Physical Therapy (DPT)	4.5
		Doctor of Medicine (MD)	2.7
		Doctor of Dental Medicine (DMD)	2.7
		Masters in Biomedical Sciences (MBS)	2.7
		Certificate of Health Professions (CHPP)	2.7
		Medical Sonography (DMS)	1.8
		Speech and Language Pathology (MS-SLP)	0.9
		Respiratory Therapy (RT)	0.9
		Registered Dietician (RD)	0.9
3.	Year of Study	1st year	44.2
		2nd year	42.3
		3rd year	11.7
		4th year	1.8
4.	Age Range (yrs.)	20–25	63.1
		26–30	27.9
		31–35	5.4
		36–40	3.6
5.	Gender	Female	70.3
		Male	29.7
		Other	0

Prior training in LGBTQIA+ healthcare

Out of the 111 participants, 25.23% had no prior training exclusive to LGBTQIA+ healthcare. 21.62% of participants received <1 h training in the program curriculum. 26.13% had 1–2 h dedicated to LGBTQIA+ healthcare training. 9.91% of participants completed 3–4 h of prior training whereas only 17.12% had more than 5 h of dedicated training received in their current program exclusive to the care of LGBTQIA+ patients (Figure 1). The results obtained from the independent samples *t*-test analysis for the effect on participant responses based on the number of hours of prior training was not significant (all *p*-values obtained were >0.05).

Change in importance

Prompts 1 through 7 (P1 through P7) capture the students' perspectives on the importance of questions related to LGBTQIA+ topics. Data is represented as a mean (Pre-activity vs. Post-activity data) +/− the standard error of the mean with a *p*-value of <0.05 considered as significant. From prompts P1

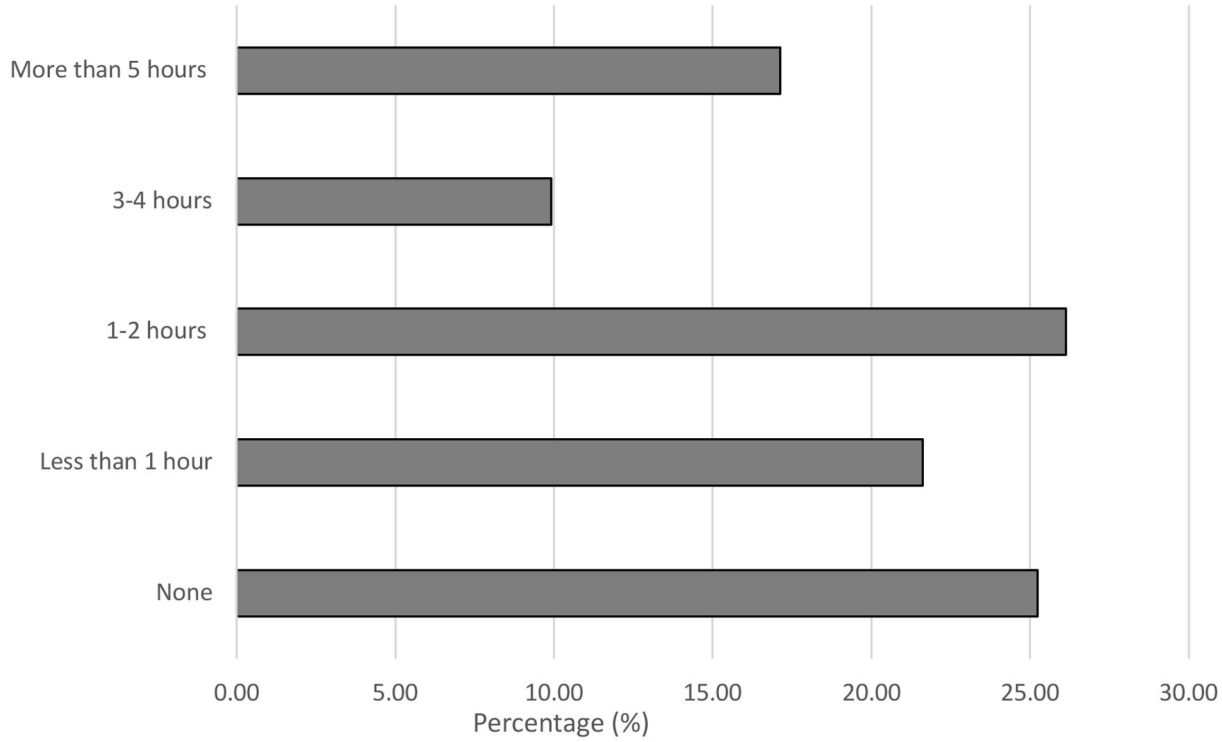


FIGURE 1
Reported prior training received in LGBTQIA+ healthcare. Participants ($n = 111$) responded to the following Prompt: (P0) How much prior teaching have you received in your current program exclusive to the care of lesbian, gay, bisexual, and transgender (LGBTQIA+) patients? Data is represented as a percentage of the total responses received.

through P7, prompts P1 (4.49 vs. 4.83; +/− 0.10), P2 (4.56 vs. 4.84; +/− 0.10), P5 (4.62 vs. 4.88; +/− 0.09) and P6 (4.41 vs. 4.77; +/− 0.12) were significant (p-value <0.005) (Figure 2).

Change in confidence

Prompts 8 through 10 (P8 through P10) capture the student's level of confidence with LGBTQIA+ related areas of concern. Data is represented as a mean (Pre-activity vs. Post-activity data) +/− the standard error of the mean with a p-value of <0.05 considered as significant. From prompts P8 through P10: P8 (3.20 vs. 4.17; +/− 0.13), P9 (3.88 vs. 4.46; +/− 0.10), and P10 (4.15 vs. 4.59; +/− 0.10) were significant (p-value <0.001) (Figure 3).

Key themes post session

From Prompt 11 (P11: List any three Key Words/Phrases which come to your mind after this IPE activity?), the prominent key themes that arose were Communication (22.22%), Inclusivity (17.90%), Trust (14.20%), Bias/Implicit Bias (9.88%), Respect (6.17%), Acceptance (4.94%), Empathy (4.32%), Education (3.7%), Judgement (3.7%), Equality (3.09%), Teamwork (2.47%), Representation (2.47%), Collaboration (1.23%) and Support, Encouragement, Care combined (3.7%) (Figure 4). This qualitative data is representative of the 162 entries entered in the post-activity survey for P11.

Discussion

In 2021 and 2022, NSU hosted annual IPE Days that connected eight campuses and twenty professions, with an estimate of >1,300 students, using a synchronous online platform. The virtual setting provided an opportunity for the participation of multiple and diverse programs and campuses. Traditionally IPE activities can be seen as cumbersome (22, 23). This may be due to the involvement of multiple health professional programs and the logistics involved such as collaboration with programs and coordination for more participation. Based on our experience conducting our IPE activities it was evident that use of the virtual environment helped to overcome some of these obstacles and particularly, this session is transferable to any institution.

Participants' demographics showed a relatively equal distribution between colleges based on cohort size for

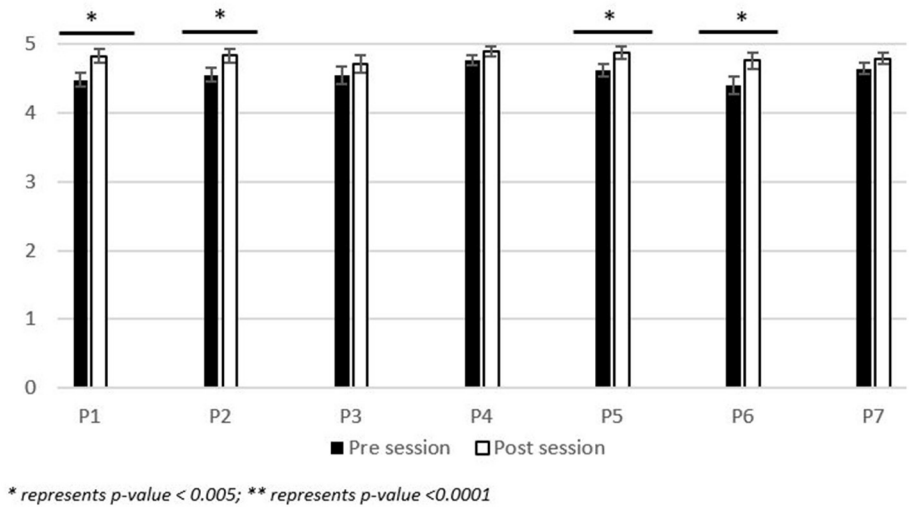


FIGURE 2
Participant reported change in perception of the importance of LGBTQIA+ topics. Range of significance of results of the pre-/post- activity survey responses ($n = 111$) to the following prompts: (P1) How important is it for healthcare professional students to receive education about the primary care of Lesbian, Gay, Bisexual, and Transgender patients? (P2) How important is it for healthcare professional students to receive education about the primary care of Transgender patients? (P3) How important is it for a primary care provider to be able to provide information to (LGBTQIA+) patients about local resources for (LGBTQIA+) community engagement? (P4) How important is it for healthcare professional students to recognize increased health risks associated with sexual orientation? (P5) How important is it to engage in self-reflection processes to correct implicit biases regarding LGBTQIA+ individuals? (P6) How important is it to implement gender-neutral practices in your clinical practice and clinic? (P7) How important is it to discuss safe sex practices with individual women who have sex with women? Participants responded on a 5-point Likert scale with 5, Extremely Important; 4, Somewhat Important; 3, Neutral; 2, Somewhat Unimportant; 1, Extremely Unimportant. Data is represented as the average response from the Likert scale +/− the standard error of the mean.

each program and taking into account that the College of Healthcare Sciences offers ∼10 distinct healthcare professional programs. However, there was a larger population of female (70.3%) participants in the study. Successful implementation of this early intervention through interprofessional education was evidenced by having 86.5% of student participants within their first 2 years of study in their programs (Table 1).

Limitations to the study include the absence of control over the group demographics, which is determined by the IPE Day administrators. This can be overcome in future sessions by pre-assigning the groups with an equal number of representations from each demographic category. Another factor that can have a considerable impact on the effectiveness of the session is the virtual setting of the discussion platform. In this study student engagement and interaction were high during the sessions however, improved efficiency of facilitators in the virtual setting would further enhance an environment conducive to student-driven learning.

Post-session, there was a significant ($p < 0.005$) increase in the student perspective on the importance of receiving education about primary care for LGBTQIA+ individuals and implementing gender-neutral care/procedures in clinical practice. Students also recognized the importance of engaging in self-reflection processes to address implicit biases regarding LGBTQIA+ individuals. This emphasis on self-reflection indicates support for the development of gender-neutral care/procedures in healthcare and being receptive to subsequent education and awareness.

Due to stakeholders in this experience being from various health professions programs at various stages of their education, the CBL was designed to be beneficial regardless of formal training directed toward the objectives of this session. Studies have shown that CBL can be successfully utilized early with students who have never participated in CBL before. Benefits of CBL early in the students' academic careers include providing context, experience using analytical reasoning, and the promotion of active student participation (24). Studies identify that CBL provides "deeper learning" that instead of the focus being that the learner identifies the correct answer, it "is more aligned with either evidence of critical thinking or changes in behavior and generalizability of learning to new cases" (17). The development of critical thinking along with four professional attributes of nursing students was positively influenced by CBL: (i) Salience of clinical knowledge; (ii) Multiple ways of thinking; (iii) Professional self-concept; and (iv) Professional attribute of caring (25, 26).

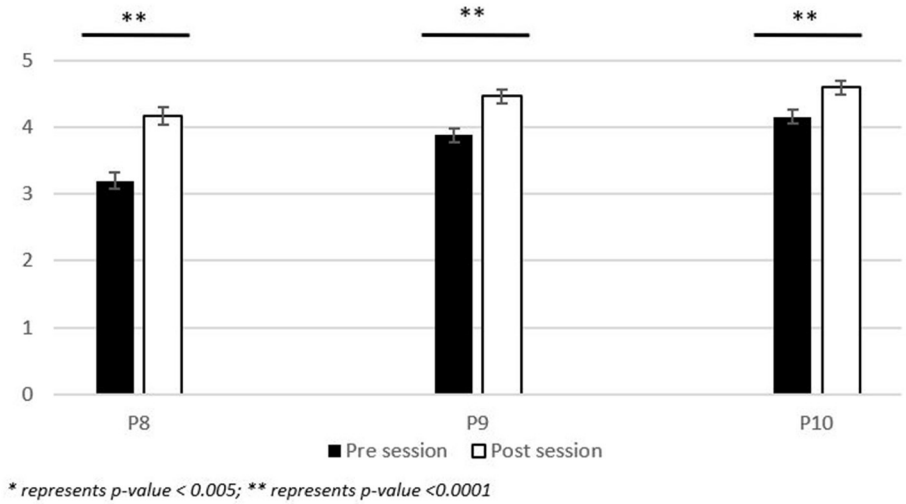


FIGURE 3
Participant reported change in the level of confidence related to LGBTQIA+ areas of concern. Range of significance of results of the pre-/post-activity survey responses ($n = 111$) to the following prompts: (P8) How confident are you in your knowledge of primary care of Lesbian, Gay Bisexual, and Transgender (LGBTQIA+) patients? (P9) How confident are you in your ability to identify implicit bias toward LGBTQIA+ individuals demonstrated by a colleague/classmate? (P10) How confident are you in your ability to create an environment which fosters others to comfortably disclose their gender identity to you? Participants responded on a 5-point Likert scale with 5, Extremely Confident; 4, Somewhat Confident; 3, Neutral; 2, Minimally Confident; 1, Not Confident at all. Data is represented as the average response from the Likert scale +/− the standard error of the mean.

This session was successful in significantly enhancing the confidence ($p < 0.001$) of students in their knowledge of primary care of LGBTQIA+ patients and their ability to create a safe and inclusive environment. Students showed a significant change in their ability to identify implicit bias toward LGBTQIA+ individuals demonstrated by their colleagues and classmates. It may be concluded that only an hour-long activity can have a significant impact on the student interest and understanding of key challenges faced by LGBTQIA+ individuals. It is recommended that such opportunities continue with more frequency throughout the healthcare professional curriculums.

As presented in Figure 4, results obtained from the participant input section display words and phrases that align with the IPEC core competency of values/ethics such as "Equality", "Judgment", "Empathy", "Support/Encouragement/Care", etc. Other competencies such as interprofessional practice and communication were aligned with participant inputs such as "Collaboration" and "Communication" (15, 16). "Teamwork" included inputs that included teams and teamwork (15, 16). The inputs such as "Inclusivity", "Trust", "Bias/ Implicit-Bias", "Representation", "Respect", and "Acceptance" express an appreciation for the LGBTQIA+ focus of the session. Overall participant responses indicate an emphasis on trust and patient care irrespective of the patient's sexual identity.

Students that engaged in this experience did not show a significant increase in the importance for primary care providers to be able to provide information to LGBTQIA+ patients about local resources for community engagement. This may be due to the emphasis of the session not being on community engagement, though it was discussed. In future iterations of the session, more emphasis could be placed on this aspect. For prompts related to the importance of recognizing the increased health risks and discussing safe sex practices associated with sexual orientation, the gap in knowledge was not as distinct between the pre-/post-session survey responses. As healthcare professional students, this was an expected outcome.

These results taken together indicate that the session objectives were fulfilled and received well by the students. This also represents that there is a need for more opportunities for training/sessions of this nature in the health professions to inculcate collaboration and standardized care for vulnerable groups such as the LGBTQIA+ community. This study yielded similar outcomes to those of Leslie et al.'s (27) study which demonstrated an increase in knowledge and in readiness for interprofessional education. One key difference in these studies is that the student population of the Leslie et al. study was from an institution that had laid a strong foundation of LGBT Health programming which contained 50 h of content related to LGBT healthcare, whereas this interactive session was for a population of students (at least 81%) who had limited or no previous exposure to content related to LGBT healthcare

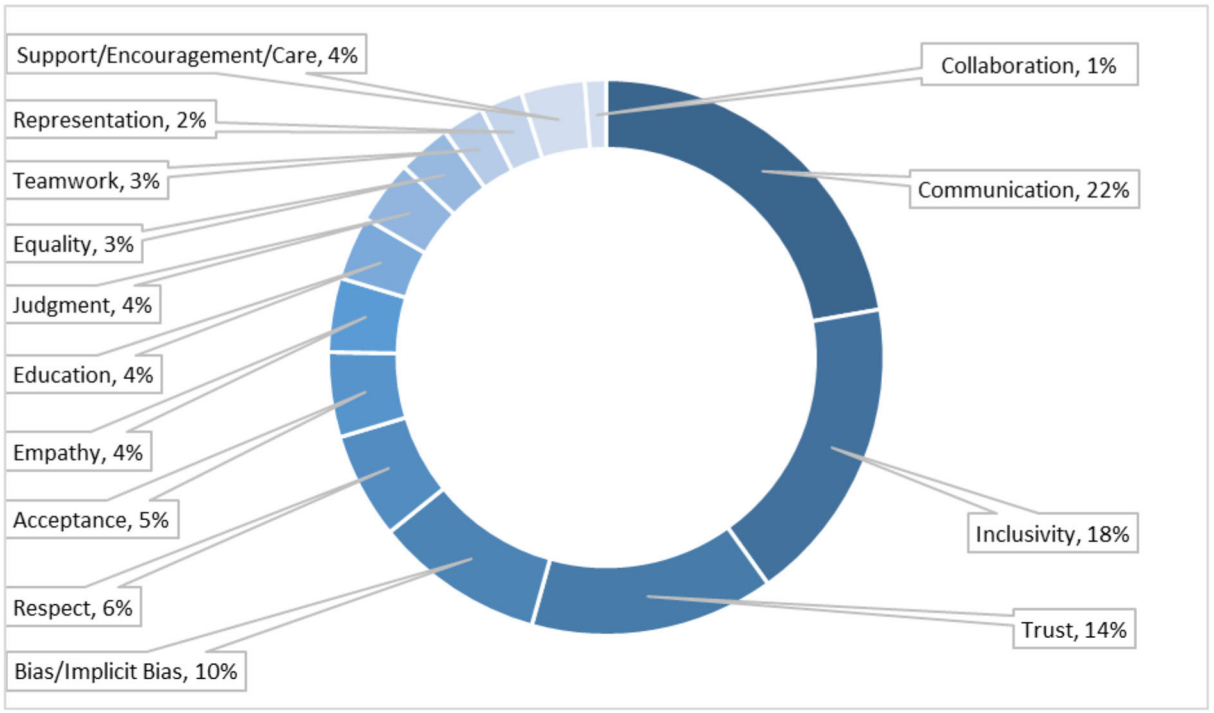


FIGURE 4
Key themes established through the session. Representation of common qualitative responses of the post-activity survey ($n = 162$, input responses) to the following prompt: P11: List any three Key Words/Phrases which come to your mind after this IPE activity? Participants responded with free-text input responses. The frequency of identical/ similar meaning words as a percent of total input responses. *Words with frequency of <2 are not shown.

as shown in Figure 1 (27). McCave et al. (28) demonstrated that students displayed a need for additional training from their study employing IPE for LGBTQIA+ related topics. The study utilized transgender standardized patients for an IPE activity with students from Occupational Therapy (OT), Physical Therapy (PT), Medical Sciences, Physician Assistant (PA), Doctor of Medicine (MD), Social Work, Healthcare Administration, etc. healthcare programs (28). However, despite a positive impact on the students, there are only a limited number of published studies in this area, and more needs to be done to substantiate the intended widespread curricular change (27–29). With continued efforts in this field, expanded culturally competent interprofessional collaboration could be beneficial to improving healthcare for LGBTQIA+ patients. The IPE training network fosters simultaneous multifaceted delivery of appropriate training for numerous healthcare professions.

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 Nova Southeastern University Institutional Review Board (IRB# 2021-12-NSU). The patients/participants provided their written informed consent to participate in this study.

Author contributions

SP: conceptualized the idea, developed and facilitated the case and experience session, formulated data instruments, performed data analysis, and manuscript preparation. CO'M: developed the case, formulated data instruments, performed data analysis, and manuscript preparation. RD: developed and facilitated the case and experience session. AL: formulated data instruments and manuscript preparation. DG: developed and facilitated the case and experience session, formulated data instruments, and manuscript preparation. 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.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.993461/full#supplementary-material

References

1. AAMC. *Association of American Medical Colleges—AAMC*. (2010). Available online at: https://store.aamc.org/downloadable/download/sample/sample_id/129/ (accessed on July 12, 2022).

2. Gonzales G, Henning-Smith C. Barriers to Care among Transgender and Gender Nonconforming Adults. *Milbank Q.* (2017) 95:726–48. doi: 10.1111/1468-0009.12297

3. Polaski A. Read the report of the 2019 Southern LGBTQ Health Survey|New Research on LGBTQ Health. *Campaign South Equal.* (2019) 13:2021. Available online at: https://southernequality.org/wp-content/uploads/2019/11/SouthernLGBTQHealthSurvey%E2%80%93FullReport.pdf

4. Hafeez H, Zeshan M, Tahir MA, Jahan N, Naveed S. Health care disparities among lesbian, gay, bisexual, and transgender youth: a literature review. *Cureus.* (2017) 9:e1184. doi: 10.7759/cureus.1184

5. Borresen K. 14 Microaggressions LGBTQ people deal with all the time. *HuffPost HuffPost.* (2022) 3:2022. Available online at: https://www.psychologicalscience.org/news/14-microaggressions-lgbtq-people-deal-with-all-the-time.html?pdf=true

6. Johnson CV, Mimiaga MJ, Bradford J. Health Care issues among Lesbian, Gay, Bisexual, Transgender and Intersex (LGBTI) populations in the United States: introduction. *J Homosex.* (2008) 54:213–24. doi: 10.1080/00918360801982025

7. Jones T. Intersex studies: a systematic review of international health literature. *SAGE Open.* (2018) 8:215824401774557. doi: 10.1177/2158244017745577

8. Lambda Lagal. *When Health Care Isn't Caring: Lambda Legal's Survey of Discrimination against LGBT People and People with HIV*. New York, NY: Lambda Legal (2010). Available online at: www.lambdalegal.org/health-care-report (accessed July 12, 2022).

9. Lee M, Tasa-Vinyals E, Gahagan J. Improving the LGBTQ2S+ cultural competency of healthcare trainees: advancing health professional education. *Can Med Educ J.* (2020) 2020. doi: 10.36834/cmej.67870

10. Donisi V, Amaddeo F, Zakrzewska K, Farinella F, Davis R, Gios L, et al. Training healthcare professionals in LGBTI cultural competencies: exploratory findings from the Health4LGBTI pilot project. *Patient Educ Couns.* (2020) 103:978–87. doi: 10.1016/j.pec.2019.12.007

11. Centers for Disease Control and Prevention (2018). *Hai Data. Centers for Disease Control and Prevention. Centers for Disease Control and Prevention.* Available online at: https://www.cdc.gov/hai/data/index.html (accessed on October 5, 2018).

12. Buring SM, Bhushan A, Brazeau G, Conway S, Hansen L, Westberg S, et al. Keys to successful implementation of interprofessional education: learning location, faculty development, and curricular themes. *Am J Pharm Educ.* (2009) 73:60. doi: 10.5688/aj730460

13. Cohen RD. Medical students push for more LGBT health training to address disparities. *NPR NPR.* (2019) 20:2019. Available online at: https://www.npr.org/sections/health-shots/2019/01/20/683216767/medical-students-push-for-more-lgbt-health-training-to-address-disparities

14. Bosch B, Mansell H. Interprofessional collaboration in health care. *Can Pharm J.* (2015) 148:176–79. doi: 10.1177/1715163515588106

15. Interprofessional Education Collaborative (2016). *Core Competencies for Interprofessional Collaborative Practice*. Available online at: https://www.ipecollaborative.org/assets/2016-Update.pdf (accessed July 12, 2022).

16. Kusnoor AV, Gill AC, Hatfield CL, Ordonez N, Dello Stritto R, Landrum P, et al. An interprofessional standardized patient case for improving collaboration, shared accountability, and respect in team-based family discussions. *MedEdPORTAL.* (2019) 15:10791. doi: 10.15766/mep_2374-8265.10791

17. McLean SF. Case-based learning and its application in medical and health-care fields: a review of worldwide literature. *J Med Educ Curricular Dev.* (2016) 3. doi: 10.4137/JMECD.S20377

18. Chickering AW, Gamson ZF. Seven principles for good practice in undergraduate education. *Biochem Educ.* (1989) 17:140–41. doi: 10.1016/0307-4412(89)90094-0

19. Powner LC, Allendoerfer MG. Evaluating hypotheses about active learning. *Int Stud Perspect.* (2008) 9:75–89. doi: 10.1111/j.1528-3585.2007.00317.x

20. Gavzy SJ, Berenson MG, Decker J, Domogauer J, Alexander A, Pulaski M, et al. The case of Ty Jackson: an interactive module on LGBT health employing introspective techniques and video-based case discussion. MedEdPORTAL. (2019) 15:10828. doi: 10.15766/mep_2374-8265.10828

21. Parker K, McGuire M, Oandasan I, Zorzi R. The interprofessional collaborative organization map and preparedness assessment tool (IP-Compass). *MedEdPORTAL.* (2012) 8:9257. doi: 10.15766/mep_2374-8265.9257

22. Thistlethwaite JE, Davies D, Ekeocha S, Kidd JM, MacDougall C, Matthews P, et al. The effectiveness of case-based learning in health professional education. a beme systematic review: beme guide no. 23. *Med Teach.* (2012) 34:e421–44. doi: 10.3109/0142159X.2012.680939

23. Thistlethwaite JE. Interprofessional Education: Implications and Development for Medical Education. *Educación Médica.* (2015) 16:68–73. doi: 10.1016/j.edumed.2015.04.007

24. Fortun J, Fortun J, Morales AC, Tempest HG. Introduction and evaluation of case-based learning in the first foundational course of an undergraduate medical curriculum. *J Biol Educ.* (2016) 51:295–304. doi: 10.1080/00219266.2016.1217909

25. Kantar LD, Massouh A. Case-based learning: What traditional curricula fail to teach. *Nurse Educ Today.* (2015) 35:e8–e14. doi: 10.1016/j.nedt.2015.03.010

26. Li S, Ye X, Chen W. Practice and effectiveness of "nursing case-based learning" course on nursing student's critical thinking ability: A comparative study. *Nurse Educ Pract.* (2019) 36:91–6. doi: 10.1016/j.nepr.2019.03.007

27. Leslie KF, Steinbock S, Simpson R, Jones VF, Sawning S. Interprofessional LGBT health equity education for early learners. MedEdPORTAL. (2017) 13:10551. doi: 10.15766/mep_2374-8265.10551

28. McCave EL, Aptaker D, Hartmann KD, Zucconi R. Promoting affirmative transgender health care practice within hospitals: an IPE standardized patient simulation for graduate health care learners. MedEdPORTAL. (2019) 15:10861. doi: 10.15766/mep_2374-8265.10861

29. Levy A, Prasad S, Griffin DP, Ortega M, O'Malley CB. Attitudes and knowledge of medical students towards healthcare for lesbian, gay, bisexual, and transgender seniors: impact of a case-based discussion with facilitators from the community. *Cureus.* (2021). doi: 10.7759/cureus.17425

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 03 February 2023
DOI 10.3389/fpubh.2023.1072721

OPEN ACCESS

EDITED BY
Sharon Brownie,
Swinburne University of Technology, Australia

REVIEWED BY
Wilson Abreu,
University of Porto, Portugal
Marleen Temmerman,
Aga Khan University Hospital, Kenya
Patrick Broman,
Waikato Institute of Technology, New Zealand

*CORRESPONDENCE
Kahabi Ganka Isangula
✉ kahabi.isangula@aku.edu

SPECIALTY SECTION
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

RECEIVED 17 October 2022
ACCEPTED 11 January 2023
PUBLISHED 03 February 2023

CITATION
Isangula KG, Pallangyo ES and Ndirangu-Mugo E (2023) Improving nursing education curriculum as a tool for strengthening the nurse–client relationships in maternal and child healthcare: Insights from a human-centered design study in rural Tanzania. *Front. Public Health* 11:1072721. doi: 10.3389/fpubh.2023.1072721

Improving nursing education curriculum as a tool for strengthening the nurse–client relationships in maternal and child healthcare: Insights from a human-centered design study in rural Tanzania

Kahabi Ganka Isangula[1]*, Eunice Siaity Pallangyo[1] and Eunice Ndirangu-Mugo[2]

[1]School of Nursing and Midwifery, Aga Khan University, Dar es Salaam, Tanzania, [2]School of Nursing and Midwifery, Aga Khan University, Nairobi, Kenya

Background: There are growing evidence of poor nurse–client relationships in maternal and child health (MCH). The nursing curriculum forms an important entry point for strengthening such relationships, consequently improving client satisfaction with nurses' competencies, confidence in the formal healthcare system, healthcare-seeking practices, continuity with care, and MCH outcomes.

Objective: MCH nurses and clients were invited to design an intervention package (prototype) to improve nurse–client relationships using a human-centered design (HCD) approach.

Methods: A multi-step HCD approach was employed to first examine the contributors of poor nurse–client relationships using nine focus group discussions with nurses and clients and 12 key informant interviews with MCH administrators. Then, three meetings were held with 10 nurses, 10 clients, and 10 administrators to co-develop an intervention package to address the identified contributors. The solutions were validated by collecting qualitative information through six focus groups with nurses and MCH clients who were not involved in the initial HCD stages. Finally, refinement and adaptation meetings were held with 15 nurses, 15 clients, and 10 administrators. The data were managed with NVivo 12 software and analyzed thematically.

Results: Nursing curriculum challenges contributing to poor nurse–client relationships in MCH care included inadequate content on nurse–client relationships specifically topics of customer care, communication skills, and patient-centered care; an inadequate practice on communication skills within nursing schools; and the absence of specific trainers on interpersonal relationships. Consequently, improving the nursing curriculum was one of the interventions proposed during the co-design and rated by participants as highly acceptable during validation and refinement meetings. Suggested improvements to the curriculum included increasing hours and credits on communication skills and patient-centered care, including customer care courses in the curriculum and creating a friendly learning environment for clinical practice on strengthening interpersonal relationships.

Conclusion: Improving the nursing curriculum was considered by nurses and clients as one of the acceptable interventions to strengthen nurse–client relations in MCH

care in rural Tanzania. Nursing education policy and curriculum developers need to ensure the curriculum facilitates the development of much-needed interpersonal skills among nursing graduates for them to have positive therapeutic interactions with their clients.

KEYWORDS

nursing, human-centered design, maternal and child health, curriculum, Tanzania, rural, Africa

1. Introduction

There is a broad consensus that nurses form a critical component of the human resource for the health workforce that is charged with the delivery of maternal and child health (MCH) services globally. Nurses have a unique role in MCH service delivery within primary healthcare settings as they monitor pregnancy, perform deliveries, offer postnatal care and family planning services, and provide public health education worldwide (1–4). In sub-Saharan Africa (SSA), nurses are the reliable source of medical and public health information and counseling on a range of health issues, particularly on the care of women, newborns, and under-five children (2–4). Despite the critical role of nurses, there is growing evidence of client dissatisfaction with providers' competencies in MCH care in recent years (5–13). Client dissatisfaction appears to be centered around incompetence related to nurses' technical skills in the delivery of MCH care; their reliability, assurance, and confidentiality; and inadequate patient engagement in making MCH care decisions. There is also overwhelming client dissatisfaction with nurses' behaviors related to their professional conduct, attitudes, communication, and language as well as the violation of some of the client's rights in Tanzania and other African countries (6–11). Such dissatisfaction continues to not only obscure the positive contribution of nurses in MCH care and public health but also contribute to a negative impact on client confidence in formal healthcare systems, poor healthcare seeking practices, and discontinuity with care, which is partly indicated by persistently high home deliveries and poor MCH outcomes in Tanzania and other settings (10–17).

There have been notable efforts to address client dissatisfaction with providers including nurses in different settings. Healthcare governance tools such as complaints mechanisms, policies, guidelines, client service charters, governance committees, and nursing professional boards have been considered within and outside Tanzania (17–20). So far, there has been no reliable evidence of their effectiveness. Similarly, there have been efforts to implement interventions focusing on both providers and clients. Training for providers on communication skills and competencies and essential skills in the delivery of patient-centered care on the one hand and enhancing clients' literateness, information-seeking capacity, participation in care, and questioning skills, on the other hand, have been implemented with unclear results (17–20). The problem with these efforts, however, is that they have failed to consider the complexities of provider–client relationships within MCH care. Evidence on therapeutic relationships from rural Tanzania indicates that provider–clients relationship is complex and interventions to strengthen such relationships may be impacted not only by patients' socioeconomic status, literacy, and behaviors but also by provider interpersonal skills and health system challenges (17–22). A key health system challenge that is more likely to negatively impact nurse–client relationships is the quality of graduates of nursing training institutions. Evidently, the nursing curriculum forms an important entry point for strengthening such relationships consequently improving client satisfaction with nurses' competencies, confidence in the formal healthcare system, healthcare-seeking practices, continuity with care, and MCH outcomes. Equipping nursing students with adequate verbal and non-verbal interpersonal communication and customer care skills is critical in strengthening nurse–client relationships and this can commence with the nursing education curriculum (21, 22). However, researchers have not treated the contribution of nursing curriculum on nurse–client relationships in much detail.

Between January and September 2022, the Aga Khan University (AKU) in Tanzania implemented a human-centered design (HCD) intervention in the rural region of Shinyanga. Nurses and clients from MCH clinics were invited to collaborate with the research team for the co-development of an intervention package (prototype) for their therapeutic relationships. HCD has been described as an innovative approach applied to solving complex problems by leveraging the insights and experiences of end users to co-design solutions that may be prototyped and refined iteratively (23–28). The interventions designed through the HCD process have been documented to be more successful and sustainable in comparison to the traditional approaches for solving problems within the healthcare sector (27). This paper examines the findings indicating that improving the nursing education curriculum may be an important tool for strengthening the nurse–client relationships in MCH care in rural settings. The evidence generated is expected to guide nursing education policy and curriculum developers in restructuring the curriculum to address the much-needed interpersonal skills gaps among nursing graduates to fuel positive therapeutic interactions with their clients.

2. Methods

2.1. Design

A protocol for this study has been published elsewhere (29). In summary, a five-step HCD approach was employed as a framework for co-designing an intervention package and strengthening the nurse–client relationships using qualitative descriptive design using focus group discussions (FGDs), key informant interviews (KIIs), and

Abbreviations: AKU, Aga Khan University; DC, District Council; FGD, Focus group discussion; HCD, Human-centered design; KII, Key informant interview; MC, Municipal Council; MCH, maternal and child health.

consultative meetings. Qualitative descriptive design was regarded more appropriate for this inquiry in answering two key questions: (i) What are the contributors of poor nurse–client relationships in MCH care in rural Tanzania? and (ii) What intervention package (prototype model) for strengthening nurse–client relationships could emerge in the HCD process engaging nurses and clients in the study settings? Furthermore, a qualitative descriptive approach is more appropriate for this study as it was aimed at generating a rich understanding and describing the nurse–client relationships without testing an existing theory (30). As noted earlier, HCD is an approach to solving complex problems using a series of iterative and habitually nonlinear steps to develop solutions (23–28). In the HCD approach, beneficiaries or end users are invited to partner with the research team to design and evaluate the emerging solutions to better comprehend and solve the challenges they have identified.

2.2. Settings

This study was conducted in Shinyanga, one of the regions predominantly inhabited by the Bantus and located in the Lake Zone. Isangula (17) described this rural region in detail. In summary, Shinyanga is one of the low-income regions of Tanzania. The region is administratively divided into six districts: Shinyanga Municipal Council (MC), Msalala DC, Shinyanga District Council (DC), Kahama MC, Ushetu DC, and Kishapu DC. The choice of Shinyanga was because, first, it has a higher rural population with more than 95% of rural occupancy (17). Second, the ethnic population is predominantly Sukuma (Bantus) who share many sociocultural beliefs and practices with minimal differences. Due to higher rural occupancy and its near homogeneity, the region formed an ideal exemplar of other rural regions of Tanzania and Africa. Third, although there have been some efforts to improve provider–client relationships in the region, local data indicate alarming concerns about poor therapeutic relationships in MCH care within primary healthcare facilities (17). Within the Shinyanga region, we purposefully selected Shinyanga MC because MCH clients in this district have wider access to both informal (traditional care) and the formal healthcare system (mostly public and few private and faith-based facilities) (17).

2.3. Study population, sample size, sampling, and data collection

The five-step HCD process was employed, namely, community-driven inquiry, co-design, validation, refinement, and documentation and sharing of lessons learned. We used a combination of qualitative research methodologies to explore community and individual perspectives of the drivers of poor nurse–client relationships during the community-driven inquiry step. Approximately nine FGDs and 12 KIIs were conducted with purposefully selected nurses and midwives, women attending MCH services, and MCH stakeholders, using a semistructured interview guide in the Swahili language. Nurses and clients were recruited through MCH managers, clients through their facilities of MCH care, and administrators invited after obtaining their phone numbers from the district registry. All interviews were conducted at a convenient location. The location was confirmed with the participants in advance to enable them to identify a suitable alternative if required. Upon arrival at the predetermined interview venue, research assistants offered information about the study, requested and obtained informed consent, and engaged participants in a semistructured audio-taped discussion lasting for approximately 45–60 min. The findings of community-driven inquiry informed the co-design step in which a transdisciplinary team purposively selected MCH nurses and clients from those who participated in the first step, five administrators, and other five relevant stakeholders (30 members). The team gathered for 3 days, identified key contributors based on discovery findings, and designed an intervention package (rough prototype) with the highest potential to improve nurse–client relationships. We employed a group-based consensus-building approach to discuss the factors and generate potential interventions. We further used a group-based rating of the emerging interventions considering their acceptability and feasibility. Four co-design groups rated the emerging interventions using a score of 0–10 for both feasibility and acceptability. Scores from each group were summarized and a consensus was reached in a broader group on the interventions with higher scores that formed a rough prototype, The findings of codesign meetings informed step 3 of the HCD process, which involved gathering qualitative insights on the rough prototype in Shinyanga MC. The aim was to gather nurses' and clients' feedback on the rough prototype using FGDs (six sessions), with a new group of purposively sampled respondents who were not part of the initial two HCD steps to identify features appealing to both nurses and clients for strengthening their therapeutic relationship as a pathway for increasing MCH service satisfaction, uptake, and continuity. The recruitment and interview process for the insight-gathering inquiry was similar to what is described for discovery inquiry (as described earlier). The findings of the insight-gathering step informed the refinement step. During this step, the design team reconvened for 2 days to evaluate the feedback on the rough prototype as well as refine and adapt the prototype. Approximately 10 representatives of insight-gathering inquiry were selected by their peers to join the 30 participants of co-design meetings in the refinement and adaptation process (40 members). The refinement meeting resulted in the final prototype model. The research team synthesized the lessons learned and are currently being shared through local and international forums. This paper forms part of the documentation and sharing of the evidence generated.

We recruited three research assistants with Diplomas in health sciences and trained them on the HCD process and techniques pertaining to this study. The discussion, interview, and consultative meeting guides were developed collaboratively, pretested in purposefully selected settings, and refined to enhance readiness for use in the actual data collection process. The PI maintained close and supportive supervision of research assistants throughout the data collection and analysis stages to maximize data quality.

2.4. Data management and analysis

The HCD steps generated a wealthy amount of data from FGDs, KIIs, and consultative meetings. Data transcription and translation occurred simultaneously by research assistants and were verified by the research team. Interview transcripts were deidentified, pseudonyms were generated for each participant, and

data were uploaded into NVivo 12 software (QSR International) for management and thematic coding. We employed a stepwise approach for a deductive thematic analysis of the interview transcripts (31). The first step involved the examination of the research questions by the research team and consensually generated several themes. This resulted in an analytical matrix of the main themes and subthemes. The second step involved exporting the individual transcripts and phrases (codes) representing participants' responses to investigators' questions to relevant themes and related subthemes within NVivo. Again, the research team used a consensus-building used approach to decide on the inclusion of codes that did not fit in the pre-developed subthemes and themes; the codes were excluded when they did not provide critical value to the study, as confirmed by subjective and objective evaluations. The final step was exporting coded data within NVivo to Microsoft Word (Microsoft Corporation) for interpretative analysis and report generation.

2.5. Ethics approval

This ethics clearance for this study was obtained from the AKU Ethics Review Committee and the National Institute for Medical Research (NIMR/HQ/R.8a/Vol. IX/3906). Written approvals to conduct the study were also obtained from the Regional Medical Officer of Shinyanga and the Municipal Medical Officer in Shinyanga. Similarly, verbal approvals were obtained from the managers of the selected healthcare facilities from where nurses and clients were recruited after providing letters from the region and district medical officers and copies of ethical clearance. The research team ensured the responsible conduct of research by obtaining verbal consent from all participants before participation and recording it as part of the interview transcript.

3. Results

3.1. Participant demographics

The community-driven discovery inquiry involved 30 nurses (four FGDs), 36 clients (five FGDs), and 12 stakeholders (MCH administrators and a representative of the Health Facility Governance Committee). Co-design meetings involved an equal number (10) of nurses, clients, and stakeholders to ensure representativeness. The validation inquiry involved 22 nurses (three FGDs) and 26 clients (three FGDs). Refinement meetings involved 15 nurses, 15 clients, and 10 stakeholders. Females accounted majority of participants: 90% discovery, 90% co-design, 96% validation, and 90% refinement participants. On the one hand, most nurses had a higher level of education level (those with college and above were 77% of discovery, 90% co-design, 100% validation, and 85% refinement participants) as compared to clients (those with secondary and below were 86% discovery, 70% co-design, 100% validation, and 90% refinement participants) (Table 1).

3.2. Findings from the community-driven discovery inquiry

The findings of community-driven inquiry have been published elsewhere (19). A range of nursing curriculum challenges contributing to poor nurse–client relationships in MCH care emerged. Some participants linked poor nurse–client relationships to inadequate coverage of interpersonal relationship content in the nursing curriculum. Topics such as customer care, communication skills, and centered patient-centered care were considered inadequate in the existing curriculum. Some participants considered inadequate practice on communication skills within nursing schools and the absence of specific trainers on interpersonal relationships as contributing to poor nurse–client relationships among graduates. Some considered the reduction of years of nursing diploma studies from 4 years (previously) to 3 years to have contributed to inadequate content and duration for practical skills in interpersonal relationships. Some participants commented:

> *Graduates of nursing schools nowadays have very limited communication and customer care skills. You find a recently hired nurse has bad language and poor client reception. This is because communication skills and customer care topics do not have enough hours in the nursing curriculum (Nurse, Hospital).*
>
> *I hear that they used to study nursing for 4 years but now it is only 3 years. This means the content on nurse and client relationships and time for clinical practice on these skills has been cut short and I think that is why many nurses have poor customer care (Client, Dispensary).*

3.3. Findings from consultative co-design meetings

Synthesis meetings formed the first series of co-design meetings. Community-driven inquiry findings were presented, and participants examined the findings building on personal experiences, insights, and questions to generate a comprehensive understanding of the challenges of nurse–client relationships in Shinyanga. The results of the synthesis meeting indicated a broad consensus on the contributors of poor nurse–client relationships with some addition of the contributors. For instance, a few participants went ahead to link poor nurse–client relationships to an inadequate screening of nursing students during enrollment resulting in the enrollment of students with limited nursing ethics (as mentioned later). The ideation meeting involved group discussion to brainstorm to generate the "how might we" questions. This facilitated the generation of 82 ideas on how to improve nurse–client relationships each with several activities. A prototype and co-creation meeting brought together participants in three groups to evaluate the ideas generated during the ideation meeting and the emerging categories considering pros, cons, and feasibility. The ideas for strengthening nurse–client relationships through curriculum improvements included increasing hours and credits on communication skills and patient-centered care, the inclusion of customer care courses in the curriculum, and creating a friendly learning environment for clinical practice on strengthening interpersonal relationships. Furthermore, one administrator recommended reverting to the old system of screening where only highly motivated students were enrolled in nursing schools. One participant commented:

> *We need to go back to a system that was used previously to screen students starting with looking at different dimensions to ensure that only those who are motivated to become nurses*

TABLE 1 Participants' demographics.

Category	Community driven-discovery				Co-design meetings				Validation inquiry			Refinement meetings			
	Nurses (%)	Clients (%)	Admin (%)	Total (%)	Nurse s(%)	Clients (%)	Admin (%)	Total (%)	Nurses (%)	Client s(%)	Total (%)	Nurses (%)	Clients (%)	Admin (%)	Total(%)
	$n = 30$	$n = 36$	$n = 12$	$N = 78$	$n = 10$	$n = 10$	$n = 10$	$N = 30$	$n = 22$	$n = 26$	$N = 48$	$n = 15$	$n = 15$	$n = 10$	$n = 40$
Gender															
Female	26(87)	36	8 (67)	70(90)	10	10	7(70)	27(90)	20(91)	26(100)	46(96)	13 (87)	14(93)	8(80)	35 (87.5)
Male	4 (13)	0	4 (33)	8(10)	0	0	3 (30)	3(10)	2(9)	0	2(4)	2(13)	1(7)	2(20)	5 (12.5)
Age															
<30	6 (20)	22(61)	0	28(36)	1(10)	4(40)	0	5(17)	5(23)	20(77)	25(52)	7(47)	3(20)	0	10 (25)
31–40	14(46)	13(36)	3(25)	30(38)	5 (50)	6(60)	1(10)	12(40)	6(27)	4(15)	12(25)	6(40)	8(53)	1(10)	15(37.5)
41–50	5(17)	0	8(67)	13(17)	3(30)	0	7(10)	10(33)	6(27)	1(4)	7(15)	2(13)	4(27)	8(80)	14(35)
>50	5(17)	1(3)	1(8)	7(9)	1(10)	0	2(20)	3(10)	5(23)	1(4)	4(8)	0	0	1(10)	1(2.5)
Education															
None	0	5(14)	0	5(6)	0	1(10)	0	1(3)	0	0	0	0	3(20)	0	3(7.5)
Primary	1(3)	17(47)	0	18(23)	0	3(30)	0	3(10)	0	16(62)	16(34)	1(7)	9(60)	0	10(25)
Secondary	6(20)	9(25)	1(8)	16(21)	1(10)	3(30)	1(10)	5(17)	0	10(38)	10(21)	5(33)	2(13)	0	7(17.5)
College	21(70)	4(11)	2(17)	27(35)	6(60)	2(20)	4(40)	12(40)	21(95)	0	21(44)	8(53)	1(7)	8(80)	17(42.5)
University	2(7)	1(3)	9(95)	12(15)	3(30)	1(10)	5(50)	9(30)	1(5)	0	1(2)	1(7)	0	2(20)	3 (7.5)
Years of MCH work/leadership (nurses & administrator)															
<2	4(13)	NA	1(8)	NA	1(10)	NA	2(20)	NA	6(27)	NA	NA	NA	NA	2(20)	2(20)
2–4	20 {67)		2(17)		7(60)		6(60)		9(41)					4(40)	4(40)
>5	6(20)		9(95)		2(20)		2(20)		7(32)					4(40)	4(40)

10.3389/fpubh.2023.1072721

> *are enrolled. Nowadays they just enroll anyone who graduates from secondary schools without screening for those who are self-motivated. Maybe because employment in the nursing sector is easy. They need to go back to the old system of screening students (MCH administrator).*

The 82 ideas generated were further grouped into 24 categories considering conceptual convergence and similarities between them. Through consensus building, participants were divided into four groups and rated the 24 categories (and their related activities) considering feasibility (0–10 scores) and acceptability (0–10 scores) among nurses and clients. The total scores ranged from 58 out of 80 for disciplinary measures for abusive nurses and clients (highest), followed by 56 out of 80 for awards and recognition for nurses, 52 out of 80 for strengthening complaints mechanisms followed by 49.5 out of 70 for improving nursing school curriculum, 49.5 out of 80 for ensuring the availability of resources, 49 out of 80 for developing nursing leaders, 48 out of 80 for the promotion of patient-centered care, and 32.5 out of 80 for ensuring the availability of mental health services and support for nurses and clients (lowest). The meeting resolved to consider the seven interventions with the highest scores, including (i) disciplinary measures for abusive nurses and clients; (ii) awards and recognition of good nurses; (iii) strengthening complaints mechanisms; (iv) improving nursing curriculum; (v) improving availability of resources; (vi) improving the efficiency of nursing leaders; and (vii) provision of patient-centered care. This indicated that improvement of the nursing school curriculum was the fourth highest rated intervention forming part of the 'rough prototype model' that was then subjected to a validation step.

3.4. Findings from the validation/insight gathering inquiry

During FGDs with nurses and clients, improving the nursing curriculum was reaffirmed as one of the key interventions for strengthening nurse–client relationships. Most participants supported the ideas proposed for improving nurse–client relationships in the co-design meetings (as mentioned earlier). Some participants recommended the Ministry of Health to monitor and build the capacity of instructors in nursing schools for them to be able to train their students on nurse–client relationships. Some recommended specific programs to orient newly employed nurses on nurse–client relationships possibly recognizing that they may have missed the opportunity to acquire these skills in nursing schools. Some participants commented:

> *The Ministry of Health needs to visit nursing institutions to monitor the provision of education on interpersonal relationships and train the instructors [on nurse-client relationships] so them to be able to train their nursing students on how to better care for their patients [Client, Dispensary].*
>
> *There is a need to have a special induction course on nurse-client relationships for newly recruited nurses because this allows them to understand the actual situation which may be different from what they learnt in a classroom at nursing schools. They need to be trained on how to establish and maintain good relationships with their clients [MCH administrator].*

The insights gathered through FGDs by interviewing the nurses and clients who were not part of the initial HCD steps indicated a broad consensus that the seven interventions are more likely to improve nurse–client relationships. A range of benefits and disadvantages of these interventions were cited. Of note, the benefits of these interventions cited by participants of validation inquiry largely focused on nurses and clients. On the one hand, these interventions were considered to increase nurses' commitment, confidence, and morale, increase closeness and partnership between nurses and clients and improve clients' health-seeking behaviors, continuity with care, participation in care, and adherence to nurses' instructions consequently improving MCH outcomes. The disadvantages of these interventions included fears among some participants that some interventions require more time and resources therefore may be less feasible as compared to other interventions.

3.5. Findings from the prototype refinement/adaptation meeting

The findings of the refinement and adaptation meetings indicated a consensus that all the interventions proposed were considered acceptable. However, there were some concerns about the feasibility of the curriculum-related intervention. Although restructuring the nursing curriculum as a tool for strengthening the nurse–client relationship was rated by all groups as highly acceptable (38 out of 40), it was rated less feasible by all groups (8 out of 40) considering the study contexts. This is because of the time and multistakeholder efforts needed for the successful improvement of the nursing curriculum. Consequently, curriculum improvement was rated seventh and the final prototype model with four interventions included: (i) patient-centered care; (ii) awards and recognition for good nurses; (iii) improving complaints mechanisms; and (iv) simple disciplinary measures for bad nurses. However, curriculum improvement was considered a worthy endeavor to pursue alongside other interventions. One administrator commented:

> *Changing the curriculum will take a very long time because these documents cannot change overnight. However, we need to continue advocating for curriculum improvement because it is one of the important strategies for improving nurse-client relationships (MCH Administrator).*

3.6. Documentation and sharing the lessons learned

The research team embraced a number of strategies to disseminate the findings of this study pilot. We first deposited the emerging publications in AKU networks including eCommons as well as presented the findings in institutional forums. We are currently sharing results with local nursing and healthcare authorities by sending summary reports to the district and regional medical officers, nursing and midwifery councils, the Ministry of Health, and the National Institute for Medical Research for dissemination through government channels. Finally, we are sharing the results of the intervention study through peer-review journals and at international conferences.

4. Discussion

This study was conducted to co-design of an intervention package for strengthening nurse–client relationships in MCH care in rural Tanzania using the HCD approach. The research team partnered with nurses, clients, and other MCH stakeholders in the Shinyanga region in a series of HCD steps to co-develop an intervention package. As noted in the study protocol (29), the choice of Shinyanga was partly because of the homogeneity of the local population with limited socio-cultural variations and the evidence from previous performance reports and research that indicate persistent challenges of poor patient–provider relationships in the region (17, 22). This means a focus on Shinyanga embraced the need for reinforcing our understanding of the unique challenges that nurses and clients continue to face in MCH care and public health in this setting so as to develop a context-specific intervention that may be applicable within the region and in a similar context. This was in keeping with the recommendations of the intervention evaluation and development framework proposed by the UK Medical Research Council, which emphasize the need to consider contexts throughout the adaptation and implementation of interventions (29). Therefore, the findings emerging in Shinyanga may serve as an exemplary model for further testing of curriculum improvement activities in other parts of Tanzania and Africa. Furthermore, the focus on developing an intervention package through the HCD process was because of the wide recognition of how strong nurse–client relationships have been documented to have overarching results in public health promotion and healthcare. Strong nurse–client relationships have been linked to improved quality of care, improved partnership in healthcare decisions, improved adherence to instructions and medical interventions, and improved health outcomes (13, 18, 32, 33). Therefore, acceptable interventions co-designed by nurses and clients themselves provide an opportunity for embracing the nurse–client relationship as a tool for addressing some of the challenges of MCH care and public health.

The first step of the HCD process unmasked a range of nurses, clients, and institutional contributors to poor nurse–client relationships (22). Nurse contributors to poor nurse–client relationships included a range of curriculum-related challenges that were said to contribute to poor nurse–client relationships. Poor customer care and communication skills among nurses emerged as contributing to poor nurse–client relationships and they were cited to result from limited content on topics related to interpersonal relationships between nurses and clients, particularly customer care, communication skills, and patient-centered care in the nursing curriculum. There were also widespread concerns about limited clinical practices on communication skills and the absence of instructors with sufficient expertise in interpersonal relationships in therapeutic settings. To partly address the nurse contributors to poor nurse–client relationships, a suggestion was made for improving the nursing curriculum as a strategy for generating nursing graduates with self-drive and good relationships with clients (22). Specific activities for improving the curriculum were proposed by nurses, clients, and administrators including increasing content and extending the duration of communication skills and customer care courses to the nursing curriculum. Previous literature has highlighted concerns about limited contents of communication and customer care skills in the nursing curriculum without linking it to poor nurse–client relationships (13, 18, 20, 21, 34). Some literature has identified communication skills and customer care as the key ingredients of strong nurse–client relationships without acknowledging that the nursing curriculum provides an opportunity for learning such skills (35–38). However, a recent review of the literature on SSA has recommended the inclusion of communication skills in the nursing curriculum as a key strategy for improving nurse–client relationships (20). This implies that there is a need for continued advocacy on curriculum improvement as a tool for strengthening nurse–client relationships in MCH care and public health promotion.

The second step of the HCD process involved co-design meetings, the contributors of poor nurse–client relationships, and suggestions offered during community-based inquiry were examined closely and about 82 ideas were proposed. Rating of these ideas resulted in a rough prototype model with seven interventions which included simple disciplinary measures, awards, and recognition of good nurses, complaints mechanisms, enhancing the availability of resources, improving the efficiency of leaders, and patient-centered care. Improving the nursing curriculum was rated fourth in the rough prototype model. At this stage, the need for improving the nursing curriculum was rated as highly acceptable. Although there was recognition that improving the curriculum may be less feasible due to the time and resources required, an emphasis was made that it is one of the important interventions to consider explaining why it formed part of the rough prototype model.

The third step of the HCD process involved validation of the rough prototype model using focus group discussions with a new group of nurses and clients. The need for adding customer care courses and extending communication skills courses to the nursing curriculum was reaffirmed at this stage. It was further suggested that there is a need for increasing hours and credits on communication skills, customer care and patient-centered care, and creating a friendly learning environment for clinical practice on strengthening interpersonal relationships. It is important to note that poor communication skills and customer care have not only been documented as key drivers of poor provider–client relationships but also building these skills has been recommended as a key strategy for improving such relationships (6, 10–20).

Although it is widely recognized that nursing education curricula need to be adapted and frequently reviewed to accommodate the changing needs, healthcare environment, and service delivery practices (35–39), adding credits and hours for topics related to strengthening nurse–client relationships has not been strongly regarded as one of the adaptations that need to be made. However, the need for improvement of the clinical learning environment has always been a recommendation of most research examining nursing curriculums with very few linking this to strengthening nurse–client relationships (37–39). For instance, a self-assessment study of nursing students conducted by Suikkala et al. (40) recommended that maintenance of a better clinical learning environment and teaching approaches are needed to ensure that students acquire the necessary skills for strengthening nurse–client relationships. This indicates that nursing curriculum improvement forms not only an entry point for improving technical competence among nursing graduates but also could facilitate effective learning of essential skills needed for positive therapeutic interactions with their clients.

The fourth step of the HCD process involved refinement meetings. The insights and suggestions of nurses who participated in the validation of the rough prototype model were reviewed and discussed. A fresh rating of the interventions of the rough prototype resulted in the final prototype model with four interventions including patient-centered care, awards and recognition for nurses, complaints mechanisms, and simple disciplinary measures but excluding the curriculum improvement which was rated seventh. The reason curriculum improvement was excluded from the final prototype model was that it scored less in feasibility rating because of the complexity of its implementation requiring massive resources, bureaucratic process, and extended time (41). However, there were massive calls from participants for the need to implement curriculum improvement interventions alongside the final prototype model. This explains why this article is dedicated to curriculum improvement as a tool for improving nurse–client relationships in MCH care and public health promotion.

One of the key nursing professional bodies in the country is the Tanzania Nursing and Midwifery Council (TNMC). The council's website (www.tnmc.go.tz/) indicates that TNMC is a professional regulatory authority charged with ensuring that services provided by nurses and midwives in Tanzania are of an acceptable standard and safe to their clients. On top of the accreditation of nurses and midwives in the country, the council is responsible for prescribing the standards of proficiency necessary for admission, administering nursing licensing examinations and setting standards of nursing training and education, and evaluating of quality of education. This indicates that TNMC forms an important entry point for strengthening nurse–client relationships through curriculum improvements. Building on the findings of this study, TNMC could encourage nursing institutions to review the current curriculums and increase credits hours on communication skills and patient-centered care and ensure the inclusion of customer care courses. As a regulatory body charged with accreditation of nursing education providers, setting standards for nursing education and education quality monitoring, TNMC could ensure that nursing institutions have a friendly learning environment for their students to effectively practice strategies for strengthening interpersonal relationships and learn how to address the factors shaping poor nurse–client relationships (17, 22). Relatedly, TNMC may consider giving much weight to skills related to communication, customer care, patient-centered care, and nurse–client relationships in nursing accreditation and licensing examinations. This will ensure that nursing graduates licensed by TNMC are better equipped with essential skills for positive interactions with their clients in MCH care both within nursing training institutions and through licensing examinations. It is only through this approach, the improvements in Nursing Education Curriculum could then be an important tool for strengthening the nurse–client relationships in MCH care consequently contributing to increased healthcare seeking, continuity with care, and better health outcomes among clients.

4.1. Limitations

The application of HCD to develop a prototype for improving nurse–client relationships may have some limitations. The HCD study in Shinyanga involved nurses as exemplars of healthcare providers to codesign a prototype for and improve provider–client relationships in MCH care in a rural setting. However, clients in MCH care interact with multiple teams of providers in healthcare settings and have previous experiences which may pre-determine how they interact with nurses. For instance, Ozawa and Walker (42) indicated that a mixture of patients' prior experiences in healthcare settings and their interactions with non-medical personnel may impact how they construct interpersonal relationships with medical providers. Therefore, if a similar study is conducted with other providers, for instance, doctors, and in a different setting and context may generate a different prototype. However, since this is the first study in this context, we suggest that future inquiries need to extend beyond the nursing profession and rural context. Furthermore, although we are emphasizing nursing curriculum improvement as a tool for improving interpersonal skills among nurses, such intervention alone may not effectively address all the contributors to poor nurse–client relationships identified during the community discovery inquiry component of the HCD study (22). We encourage practitioners and researchers to consider a range of interventions proposed by nurses and clients during the HCD study alongside efforts to improve the nursing training curriculum. These include awards and recognition for good nurses, disciplinary measures for bad nurses, continued mentorship, continued professional development, and strengthening complaints mechanisms just to cite a few.

4.2. Conclusion

In conclusion, the use of HCD provided an opportunity for the researchers to partner with nurses and clients in exploring the challenges of nurse–client relationships and co-development of the acceptable interventions. Improving the nursing curricula was considered by nurses and clients as one of the acceptable interventions to strengthen nurse–client relations in MCH care in rural Tanzania. Nursing education policy and curriculum developers need to ensure that existing curriculums are adapted to facilitate the development of much-needed interpersonal skills among nursing graduates for them to have positive therapeutic interactions with their clients.

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 National Institute for Medical Research. The patients/participants provided their written informed consent to participate in this study.

Author contributions

KI designed the study, solicited funding, and developed the initial draft of the manuscript. EP and EN-M participated in the

project conception and design, critically reviewed the manuscript, and provided inputs for improvement. All authors contributed to the article and approved the submitted version.

Funding

This study was funded by the University Research Council at Aga Khan University.

Acknowledgments

The authors acknowledge the financial support from the University Research Council at Aga Khan University to support this novel pilot project. We thank the National Institute for Medical Research, the regional medical officer, and the municipal medical officer in Shinyanga for approving this project. The authors thank the research assistants, Ms. Zabibu Mruttu, Ms. Lucia Mungo, and Mr. Elibariki Petro, for their tireless efforts during data collection.

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.

Reviewer MT declared a shared parent affiliation to the author EN-M to the handling editor at the time of the review.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Survive and Thrive: Transforming care for every small and sick newborn – Key findings. *World Health Organization & United Nations Children's Fund.* (2018). Available online at: https://apps.who.int/iris/bitstream/handle/10665/276655/WHO-FWC-MCA-18.11-eng.pdf?ua=1 (accessed 15 September, 2022).

2. Investing in Midwives and Others with Midwifery Skills to Save the Lives of Mothers and Newborns and Improve Their Health. *United Nations Population Fund.* (2006). Available online at: https://www.unfpa.org/sites/default/files/pub-pdf/midwives_eng.pdf (accessed 10 September, 2022).

3. Fraser S, Grant J, Mannix T. Maternal child and family health nurses: delivering a unique nursing speciality. *Matern Child Health J.* (2016) 20:2557–64. doi: 10.1007/s10995-016-2081-2

4. Taft AJ, Small R, Humphreys C, Hegarty K, Walter R, Adams C, et al. Enhanced maternal and child health nurse care for women experiencing intimate partner/family violence: protocol for MOVE, a cluster randomised trial of screening and referral in primary health care. *BMC Public Health.* (2012) 12:811. doi: 10.1186/1471-2458-12-811

5. Gilson L, Alilio M, Heggenhougen K. Community satisfaction with primary health care services: an evaluation undertaken in the Morogoro region of Tanzania. *Soc Sci Med.* (1994) 39:767–80. doi: 10.1016/0277-9536(94)90038-8

6. Kumbani L, Bjune G, Chirwa E, Malata A, Odland J. Why some women fail to give birth at health facilities: a qualitative study of women's perceptions of perinatal care from rural Southern Malawi. *Reprod Health.* (2013) 10:9. doi: 10.1186/1742-4755-10-9

7. Bassett MT, Bijlmakers L, Sanders DM. Professionalism, patient satisfaction and quality of health care: experience during Zimbabwe's structural adjustment programme. *Soc Sci Med.* (1997) 45:1845–52. doi: 10.1016/S0277-9536(97)00122-6

8. Bukuku D, Chontawan R, Akkadechanunt T. Nurse caring behaviors and patient satisfaction in a tertiary care hospital, The United Republic of Tanzania. *Nursing Journal CMU.* (2018) 45:217–8. Available online at: http://cmuir.cmu.ac.th/handle/6653943832/66223 (accessed August 10, 2022).

9. Juma D, Manongi R. Users' perceptions of outpatient quality of care in Kilosa District Hospital in central Tanzania. *Tanzan J Health Res.* (2009) 11:196–204. doi: 10.4314/thrb.v11i4.50176

10. Ojwang BO, Ogutu EA, Matu PM. Nurses' impoliteness as an impediment to patients' rights in selected Kenyan hospitals. *Health Hum Rights.* (2010) 12:101–17.

11. Gourlay A, Wringe A, Birdthistle I, Mshana G, Michael D, Urassa M. "It is like that, we didn't understand each other": exploring the influence of patient-provider interactions on prevention of mother-to-child transmission of HIV service use in rural Tanzania. *PLoS ONE.* (2014) 9:e106325. doi: 10.1371/journal.pone.0106325

12. Loghmani L, Borhani F, Abbaszadeh A. Factors affecting the nurse-patients' family communication in intensive care unit of kerman: a qualitative study. *J Caring Sci.* (2014) 3:67–82.

13. Molina-Mula J, Gallo-Estrada J. Impact of nurse-patient relationship on quality of care and patient autonomy in decision-making. *Int J Environ Res Public Health.* (2020) 17:835. doi: 10.3390/ijerph17030835

14. Mannava P, Durrant K, Fisher J, Chersich M, Luchters S. Attitudes and behaviours of maternal health care providers in interactions with clients: a systematic review. *Global Health.* (2015) 11:36. doi: 10.1186/s12992-015-0117-9

15. Madula P, Kalembo FW Yu H, Kaminga AC. Healthcare provider-patient communication: a qualitative study of women's perceptions during childbirth. *Reprod Health.* (2018) 15:135. doi: 10.1186/s12978-018-0580-x

16. Kaur B. Interpersonal communications in nursing practice - key to quality health care. *Arch Nurs Pract Care.* (2020) 6:19–22. doi: 10.17352/2581-4265.000044

17. Isangula K. *Patient trust in doctors in rural Tanzania: Meanings, factors and benefits in the context of NCDs and hypertension care (thesis).* Sydney, Australia: University of New South Wales. (2018). Available online at: http://unsworks.unsw.edu.au/fapi/datastream/unsworks:54751/SOURCE02?view=true (accessed 15 August, 2022).

18. Hartley S, Raphael J, Lovell K, Berry K. Effective nurse-patient relationships in mental health care: a systematic review of interventions to improve the therapeutic alliance. *Int J Nurs Stud.* (2020) 102:103490. doi: 10.1016/j.ijnurstu.2019.103490

19. Jenkins K, Bennett L, Lancaster L, O'Donoghue D, Carillo F. Improving the nurse-patient relationship: a multi-faceted approach. *EDTNA ERCA J.* (2002) 28:145–50. doi: 10.1111/j.1755-6686.2002.tb00230.x

20. Kwame A, Petrucka PM. Communication in nurse-patient interaction in healthcare settings in sub-Saharan Africa: a scoping review. *Int J African Nursing Stud.* (2020) 12:100198. doi: 10.1016/j.ijans.2020.100198

21. Pullen R, Mathias T. Fostering therapeutic nurse-patient relationships. *Nursing Made Incredibly Easy!* (2010) 8:4. doi: 10.1097/01.NME.0000371036.87494.11

22. Isangula K, Pallangyo ES, Mbekenga C. Factors shaping good and poor nurse-client relationships in maternal and childcare: a qualitative study in rural Tanzania. *BMC Nurs.* (2022) 21:247. doi: 10.1186/s12912-022-01021-x

23. Leung CL, Naert M, Andama B, Dong R, Edelman D, Horowitz C, et al. Human-centered design as a guide to intervention planning for non-communicable diseases: the BIGPIC study from western Kenya. *BMC Health Serv Res.* (2020) 20:415. doi: 10.1186/s12913-020-05199-1

24. Altman M, Huang TT, Breland JY. Design thinking in health care. *Prev Chronic Dis.* (2018) 15:E117 doi: 10.5888/pcd15.180128

25. Roberts JP, Fisher TR, Trowbridge MJ. Bent C. A design thinking framework for healthcare management and innovation. *Healthc (Amst).* (2016) 4:11–4. doi: 10.1016/j.hjdsi.2015.12.002

26. Bartlett R, Boyle JA, Simons Smith J, Khan N, Robinson T, Ramaswamy R. Evaluating human-centred design for public health: a case study on developing a healthcare app with refugee communities. *Res Involv Engagem.* (2021) 7:32. doi: 10.1186/s40900-021-00273-2

27. Melles M, Albayrak A, Goossens R. Innovating health care: key characteristics of human-centered design. *Int J Qual Health Care.* (2021) 33:37–44. doi: 10.1093/intqhc/mzaa127

28. Abookire S, Plover C, Frasso R, Ku B. Health design thinking: an innovative approach in public health to defining problems and finding solutions. *Front Public Health.* (2020) 8:459. doi: 10.3389/fpubh.2020.00459

29. Isangula K, Shumba C, Pallangyo ES, Mbekenga C, Ndirangu-Mugo E. Strengthening interpersonal relationships in maternal and child health care in rural tanzania: protocol for a human-centered design intervention. *JMIR Res Protoc.* (2022) 11:e37947. doi: 10.2196/37947

30. Bradshaw C, Atkinson S, Doody O. Employing a qualitative description approach in health care research. *Glob Qual Nurs Res.* (2017) 4:2333393617742282. doi: 10.1177/2333393617742282

31. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* (2006) 3:77–101. doi: 10.1191/1478088706qp063oa

32. Cleary M, Edwards C, Meehan T. Factors influencing nurse-patient interaction in the acute psychiatric setting: an exploratory investigation. *Aust N Z J Ment Health Nurs.* (1999) 8:109–16. doi: 10.1046/j.1440-0979.1999.00141.x

33. Korsah KA. Nurses' stories about their interactions with patients at the Holy Family Hospital, Techiman, Ghana. *Open J Nurs.* (2011) 1:1–9. doi: 10.4236/ojn.2011.11001

34. Adams A, Mannix T, Harrington A. Nurses' communication with families in the intensive care unit - a literature review. *Nurs Crit Care.* (2017) 22:70–80. doi: 10.1093/med/9780199696260.001.0001

35. Fakhr-Movahedi A, Rahnavard Z, Salsali M, Negarandeh R. Exploring nurse's communicative role in nurse-patient relations: a qualitative study. *J Caring Sci.* (2016) 5:267–76. doi: 10.15171/jcs.2016.028

36. Kourkouta L, Papathanasiou IV. Communication in nursing practice. *Mater Sociomed.* (2014) 26:65–7. doi: 10.5455/msm.2014.26.65-67

37. Mirna A. Fawaz, Ayman M. Hamdan-Mansour, Ahmad Tassi, Challenges facing nursing education in the advanced healthcare environment. *Int J Africa Nursing Sci.* (2018) 9:105–10. doi: 10.1016/j.ijans.2018.10.005

38. Farzi S, Shahriari M, Farzi S. Exploring the challenges of clinical education in nursing and strategies to improve it: a qualitative study. *J Educ Health Promot.* (2018) 7:115. doi: 10.4103/jehp.jehp_169_17

39. Bvumbwe T, Mtshali N. Nursing education challenges and solutions in Sub Saharan Africa: an integrative review. *BMC Nurs 17, 3.* (2018). doi: 10.1186/s12912-018-0272-4

40. Suikkala A, Kilpi HL, Katajisto J, Koskinten S. Nursing student-patient relationship and related factors-A self-assessment by nursing students. *J Clin Nurs.* (2020) 29:4030–44. doi: 10.1111/jocn.15426

41. Print, M. Curriculum development: complexity and challenges in shaping the future. *Asia Pacific J Curriculum Stud.* (2018) 1:7–13. doi: 10.53420/apjcs.2018.2

42. Ozawa S, Walker DG. Comparison of trust in public vs private health care providers in rural Cambodia. *Health Policy Plan.* (2011) 26:i20–9. doi: 10.1093/heapol/czr045

frontiers | Frontiers in Public Health

TYPE Curriculum, Instruction, and Pedagogy
PUBLISHED 17 February 2023
DOI 10.3389/fpubh.2023.1119726

OPEN ACCESS

EDITED BY
Georgina Murphy,
Bill and Melinda Gates Foundation,
United States

REVIEWED BY
Jacey Greece,
Boston University, United States
Shams A. M. Issa,
Al-Azhar University, Egypt

*CORRESPONDENCE
Lisa M. Dalton
✉ Lisa.Dalton@utas.edu.au

SPECIALTY SECTION
This article was submitted to
Public Health Education and Promotion,
a section of the journal
Frontiers in Public Health

RECEIVED 09 December 2022
ACCEPTED 30 January 2023
PUBLISHED 17 February 2023

CITATION
Dalton LM, Hills AP, Jayasinghe S, Strong K, Hyland P and Byrne NM (2023) The Allied Health Expansion Program: Rethinking how to prepare a workforce to enable improved public health outcomes. *Front. Public Health* 11:1119726. doi: 10.3389/fpubh.2023.1119726

The Allied Health Expansion Program: Rethinking how to prepare a workforce to enable improved public health outcomes

Lisa M. Dalton[1]*, Andrew P. Hills[1], Sisitha Jayasinghe[1], Kendra Strong[2], Paula Hyland[3] and Nuala M. Byrne[1]

[1]College of Health and Medicine, School of Health Sciences, University of Tasmania, Launceston, TAS, Australia, [2]Department of Health, Tasmanian Government, Hobart, TAS, Australia, [3]Tasmanian Health Services, Department of Health, Hobart, TAS, Australia

Improvements in global public health require universal health care supported by a health workforce with competencies appropriate for local population needs–the right capabilities, in the right place, and at the right time. Health inequities persist in Tasmania, and Australia more broadly, most notably for those people living in rural and remote areas. The article describes the curriculum design thinking approach being used to codesign and develop a connected system of education and training to target intergenerational change in the allied health (AH) workforce capacity in Tasmania, and beyond. A curriculum design thinking process is engaging AH participant groups (faculty, AH professionals, and leaders across health, education, aged and disability sectors) in a series of focus groups and workshops. The design process deals with four questions: *What is? What if? What wows?* and *What works?* It also involves *Discover, Define, Develop* and *Deliver* phases that continue to inform the development of the new suite of AH education programs. The British Design Council's Double Diamond model is used to organize and interpret stakeholder input. During the initial design thinking *discover* phase, stakeholders identified four overarching problems: rurality, workforce challenges, graduate skill set shortfalls, and clinical placements and supervision. These problems are described in terms of relevance to the contextual learning environment in which AH education innovation is occurring. The *develop* phase of design thinking continues to involve working collaboratively with stakeholders to codesign potential solutions. Solutions to date include AH advocacy, a transformative visionary curriculum, and an interprofessional community-based education model. In Tasmania, innovative educational innovations are catalyzing attention and investment in the effective preparation of AH professionals for practice to deliver improved public health outcomes. A suite of AH education that is deeply networked and engaged with Tasmanian communities is being developed to drive transformational public health outcomes. These programs are playing an important role in strengthening the supply of allied health professionals with the right capabilities for metropolitan, regional, rural, and remote Tasmania. They are situated in a broader AH education and training strategy that supports the ongoing development of the AH workforce to better meet the therapy needs of people in Tasmanian communities.

KEYWORDS

allied health, education, public health, workforce, Tasmania

Background and rationale

The interconnected nature of the modern world has increased the interest and investment in global public health (1). Whilst the World Health Organization considers the health workforce to be critical to achieving public health, Australia's health system is facing significant challenges (2) and universal access to all health professionals is commonly not possible for all communities (1, 3). This is particularly apparent in Tasmania, a small island state of Australia. The problems associated with public health in Tasmania are threefold: our health and wellbeing outcomes linger behind the rest of Australia; the current organization and delivery of allied health services are inadequate for addressing the state's public health challenges; and allied health education and training is insufficient to create an appropriate local health workforce.

Tasmania has a decentralized population of 541,000 is growing and aging, with over 25% of people having a disability, 17.7% higher than the national average (4). The health and wellbeing of large sections of the Tasmanian community are subpar, and in some cases, in dire straits. Tasmanians consistently report low levels of self-assessed health, have a lower life expectancy, higher infant mortality rates and are more susceptible to developing chronic disease during their lifetime compared to mainland Australians (5). Considerable social disadvantage, including disengaged youth, unemployment and low income, and contact with the criminal justice system, concentrates in communities outside Hobart and Launceston (6). Reasons for the current predicament vary across different patterns of inequity that exist in income, education and aspiration but can be predominately linked to poor access to health services and strategies for prevention of chronic disease (7).

Tasmania, like much of rural and regional Australia, faces chronic challenges in recruiting and retaining health professionals (3). For AH in particular, current labor market data indicates significant shortages and difficulties recruiting staff with the appropriate skillsets and experience (7). In 2018, ∼4,000 nursing and AH positions were advertised in Tasmania for about 5,000 vacancies (8). Nationally, there is a recognized AH workforce geographic maldistribution. National workforce data shows the number of AH professionals available per capita remains lower in regional and remote areas than metropolitan cities and most are working privately in affluent areas than in lower socioeconomic areas (3). This means that despite a higher prevalence of both aging populations and chronic conditions per capita in rural areas, there are fewer allied health professionals in these needy areas of Tasmania than in the healthier urban areas (7). Against this backdrop, health and wellbeing in Tasmania is expected to worsen as the COVID-19 pandemic continues to impact our communities. Not only did the pandemic expose the weaknesses in rural healthcare, its influence on mental health and wellbeing was recognized early (9). Communities remain concerned about contracting the virus, loss of social interaction, restriction to movement, transition to remote work or study and financial impacts and are now dealing with exacerbation of pre-existing mental health conditions (9).

Compounding public health problems in Tasmania, is that while the University of Tasmania is the sole university in the state graduating health professionals it was not equitably servicing all state regions or health disciplines. In 2019 UTAS was not offering many AH degrees needed to gain the qualifications necessary to be eligible for certification or registration as a health professional in Australia. Collectively, health service access limitations, a maldistributed AH workforce, skillset gaps and limitations in AH education and training options place Tasmania at a distinct disadvantage in terms of chronic disease treatment and management relative to the rest of Australia. Our hypothesis is that by collaborating with government, health professionals, industry and local Tasmanian communities, we believe it is possible to create opportunities to better support the health labor force needs in Tasmania, solving problems associated with the distribution, quality, and performance of Tasmania's AH workforce. We expect to see increased AH education, training and research opportunities across different regions of Tasmania that will lead to improved public health outcomes and health system transformation.

The Australian Academy of Health and Medical Sciences aims to better integrate health and medical research and innovation within the health system for evidence based and research informed system transformation (10). However, to fully realize the vision to transform public health outcomes for the Australian community, a shift in the purpose of higher education is also required (11). Higher education is critical to advancing universal health care and the Sustainable Development Goals through preparing health professionals for 21st-century practice. Our higher education systems supply graduate health professionals, and shape the distribution, quality, and performance of the available health workforce (12). Some pedagogies, such as experiential learning, inquiry-led learning and problem based learning have proven effective in equipping public health students with applied skills and opportunities for application to respond to local population health and wellbeing needs (13). If Tasmania is to succeed in improving public health and transforming its health system, the state requires all health graduates to have training in public health supported by educational programs that respond to the role that the pandemic has played in accelerating the need for improvements in blended and online delivery (14). Educational reform and innovation is therefore required to catalyze investment in the effective preparation of all health professionals for practice to deliver improved public health outcomes (3). The University of Tasmania (UTAS) is leading strategic initiatives to concurrently improve health care services, build capacity in communities and work sustainably while delivering on educational innovation.

For many years, the Australian government has funded a range of health professional education initiatives as part of its strategy to build a sustainable, high-quality health workforce that is distributed across the country according to community need (15, 16). Some of these initiatives include rural clinical schools, increased selection and support for rural background students, and financial support for students to train in rural and remote communities *via* a network of training facilities (16). For Tasmania, these supports have enabled the UTAS to increase the number of medical and nursing graduates in regional communities to benefit some rural communities (17). AH has not benefited to the same extent as the medical and nursing professions. Compared to Australia as a whole, Tasmania has more nurses per 100,000 population (18) and comparable to the national average the density of medical practitioner FTE to population is 430 per 100,000 population (7).

The Australian government recently examined priorities for improving the access, distribution, and quality of rural and remote AH services to develop a national policy and investment response

for the rural AH workforce (3). The national aspirations augment the goals and aspirations of the Healthy Tasmania Five-Year Strategic Plan 2022–2026 (7). The state health plan articulates the Tasmanian government's vision for strengthening preventive health in Tasmania and brings together communities, services, and all levels of government to work in partnership for improved health and wellbeing (7). For Tasmania, this means appropriately prioritizing effort toward health promotion and development of a health workforce spanning the state that can support the primary, secondary and tertiary prevention of chronic disease. Accordingly, all schools (nursing, midwifery, medicine, paramedicine, psychology, public health, medical sciences, exercise science and physiology, nutrition sciences and laboratory medicine) within the College of Health and Medicine are now developing and embedding distinctive, sustainable curricula across their programs to create agile leaders in health and accelerate discovery and translational research capacity. The article describes a strategic and evidence-based approach the School of Health Sciences (SHS) in the College of Health & Medicine commenced in 2019 to organize AH workforce education and development in a way that puts public health at the center with responsibility shared amongst major stakeholders including the university, health services and the health professions.

The Allied Health Expansion Program (AHEP)

In 2019, the AHEP was launched by UTAS as a major strategic initiative to increase AH education and workforce development opportunities in Tasmania and will continue until 2029. The goal of the AHEP is to strengthen the AH education system to develop a well-performing, stable, and equitably distributed workforce with an appropriate mix of skills to concurrently improve health care services, build capacity in communities and work sustainably while delivering on educational innovation.

Objectives are to:

- increase Tasmanian's interest in AH careers and access to AH courses that cannot be sustainably offered by UTAS
- provide the Tasmanian community with access to innovation in learning about preventative health and health promotion to develop self-health capability and generate interest in AH careers
- codesign, develop and offer a suite of new AH degrees that are viable, sustainable, prepare graduates for practice that transforms the health system and public health outcomes, and
- provide the currently available Tasmanian AH workforce with access to convenient, industry-relevant professional development that can be applied in everyday work practices, and build skill sets to enhance current and future career ambitions.

Whilst the university program initiatives are led by a team of UTAS AH academics, the overall AH workforce education and development strategy is a collaboration with government, health professionals, industry, and local communities.

Pedagogical framework: Curriculum design thinking

Globally, most governments are aspiring to develop healthy populations (1). For example, the United States articulates a Healthy People 2030 (19) that has an overarching vision for "a society in which all people can achieve their full potential for health and wellbeing across the lifespan". Likewise, Australia has a long term national health plan in place to build the world's best health system to improve the health and wellbeing of Australian citizens (15). However, this is particularly challenged by approximately 7 million people, or 28% of the Australian population, living in rural and remote areas (4). Educating Australian health professionals to address universal health care and the social determinants of health in and with communities requires curricula that aligns with community needs (3). In the early 2000's, the hallmarks of exemplary Australian health professional education programs (20) were identified as:

- commitment to multidisciplinary and community-based education,
- community-based placements,
- formal linkages with government entities, and
- a structured approach to community participation.

The pedagogical framework for the AHEP curricula was based on best practice approaches in the Scholarship of Learning and Teaching and was largely drawn from the vast experience of Schools of Public Health engaged in education of graduates who are prepared to improve health through a population health focus (21). Within public health education there is general consensus that to advance toward addressing the complex, systemic public health problems future health professionals must be equipped with leadership and interprofessional skills that support collaboration and a culture of health (21). Public health curricula is typically characterized by integration, problem based learning and embedded practice experiences, which are essential components of all Australian AH university courses to meet accreditation requirements (22). AHEP was also designed at a time when the COVID-19 pandemic had forced health schools to close their campuses and move online delivery, therefore "online and digital innovation, discipline economic viability and clearly defined operating structures" (14) were important priorities in the pedagogical framework.

Australia has decades of experience in establishing rural, community-engaged health professional schools and higher education initiatives that embrace active community participation, curricula that meets community needs and advance national and international health equity agendas (20). The need for community engagement that is locally sensitive and ensures community leaders recognize the value of engaging with universities through honest and trustful dialogue is consistently evidenced (20). These learnings directly align with the concept of *innovative learning environments* (ILEs), which has been applied by the Organization for Economic Co-operation and Development (OECD) in their ILE framework (23). ILEs value systems that are based on the social nature of learning and assume collaborative arrangements with a range of partners (23).

For AHEP, we envisaged a curriculum that could be *experienced* by learners and not just a program of study that is *enacted* by educators on campus and in practice settings. Following Dewey

(24), we did not consider knowledge as a thing-in-itself but instead a transactional construction and a function of inquiry. Thus, as Australian AH accreditation requirements stipulate, the occupation-specific subject matter is centralized as the intended formal curriculum (25), however the programs are also designed to engender informal and hidden curriculum elements (25) that continually reinforce a rich theory of inquiry (24), interprofessional collaboration (26), and public health to intentionally facilitate the transactional relationship that exists between AH students as inquirers and the social world of AH practice situated in different Tasmanian communities. The pedagogical framework therefore incorporates three conceptions of AH curriculum (27):

- **Intended curriculum**—the planned program syllabus underpinned by clear educational philosophies, and program aims set out in course level learning outcomes;
- **Enacted curriculum**—the way AH educators and professionals who supervise students in practice settings enact the curriculum based on their interpretation of what the curriculum is, and
- **Experienced curriculum**—what AH students experience as they traverse their study program.

Curriculum design thinking provides a participatory approach to the design, build and delivery process the AHEP requires. Both an ideology and a process, design thinking is simply a way of working with stakeholders using a human-centered problem-solving process to collaboratively solve wicked problems (28). Curriculum design thinking involves the application of this approach to engage community, students, health professionals and health industry employers, as end users, in the coproduction of learner-centered education (29). Considering changes needed in the Tasmanian distribution, quality, and performance of the AH workforce, curriculum design thinking offers a way to lead educational innovation and catalyze attention and investment in effective AH workforce education and development to deliver improved public health outcomes and health system transformation.

Allied health learning environment and curriculum design thinking approach

The British Design Council's Updated Double Diamond model (30), comprising *Discover, Define, Develop* and *Deliver* guides the curriculum design thinking process. The four phases are not sequential but are instead considered as different modes that contribute to the entire design project. Unlike the more traditional deductive approach to curriculum design, a design-driven approach relies on abduction method (31, 32). The only known variable in our approach is the Value (32): improving Tasmanians access to AH services by offering local AH workforce solutions *via* new AH education and training options. The What (32) (Curriculum) and How (32) (Course Type, Delivery Model, Staffing, Delivery Locations, Clinical Placements) are components of the education system being approached as unknowns in need of investigation (30). Accordingly, the curriculum design thinking process deals with four questions, which corresponded to four stages of the AHEP design, build and delivery process: *What is? What if? What wows?* and *What works?* (33).

The *"What is?"* (33) stage involves empathizing with the difficulties and challenges that Tasmanian AH professionals, health facilities, and community members experience in accessing and delivering health services. In this paper, we focus on the findings of the extensive participatory stakeholder engagement exploring what it means to deliver AH services in Tasmania and how those conditions influence the AHEP innovative learning environment. Valuing "end user" perspectives (34) allows us to harness valuable holistic insight about workforce needs, resourcing, and pragmatic issues that challenge health service delivery in Tasmania and consider their ramifications for innovating our new AH education programs.

To envision a new future, the *"What if?"* (33) exploration involves thinking and reasoning with stakeholders to form hypotheses drawn from incomplete sets of information. All possibilities are considered as opportunities to codesign a clear strategy to concurrently improve health care services, build capacity in communities and work sustainably while delivering new AH programs. This period of retrograde analysis includes a problem-solving process that oscillates between abductive logic (34) to consider what might be in order to make inferences about each of the identified problems and inductive logic (34) to draw generalized conclusions about each of those problems.

At the *"What wows?"* (33) stage, discussions and debates work to "stimulate the imaginations" (34) of our stakeholders to codesign new possibilities using an attitude of solution-based thinking. The *"What works?"* (33) phase involves critical analysis, assessment, and modeling to ascertain what is required to act and test the possible solutions. At this point we balance what is desirable from our stakeholder's point of view with what is logical, feasible and economically viable for the university to deliver. As AHEP continues to progress, the transition from *"What is?"* to *"What works?"* (33) is iterative, ongoing and involves various cycles of rethinking and refining to guide the process of untangling the unknowns to become knowns. Several overarching problems have already been discovered and defined and we are now developing, testing, and refining viable ideas and working through whether weak or unviable ideas should be abandoned or rejigged.

Educating allied health professionals to address public health: Challenges, pressures and solutions

In line with the Updated Double Diamond model (30), the *Discovery* and *Define* phases of the curriculum design thinking process led to the identification of problem themes that allowed stakeholders work together to deeply and wholistically understand the challenges and pressures affecting the innovative learning environment for AH education in Tasmania. Component parts were isolated to focus the codesigning of potential solutions (Figure 1).

There were four overarching problems affecting the innovative learning environment. First, the rural nature of Tasmania means many people leave to study AH in other states, there is an underrepresentation of rural origin students in higher education, and for some rural communities intermittent and service gaps are challenging their ability to access timely AH services. Second, the serious AH workforce challenges mean there are long wait lists and health facilities are short staffed, experiencing recruitment

FIGURE 1
AHEP challenges, pressures, and solutions to transform public health.

and retention challenges and are reporting gaps and variations in skills mix. The university faces similar challenges in building an academic AH workforce. The problems associated with Tasmania's rural topography and AH workforce issues combine to give rise to a third set of problems related to placements and supervision.

Many universities use Tasmania to place students for work-based experiential learning. While some use long-arm supervision models most rely on AH professionals in public and private practice. These long-established partnerships are valued in Tasmania. AH professionals want to maintain relationships with other universities to support Tasmanian students already studying interstate and to access diverse research and curriculum. Nevertheless, increasing the number of local AH students is increasing demand for statewide placements across a range of practice areas. Fourth, through their engagements with supporting placements and supervision, the Tasmanian AH professionals note some students do not seem well prepared for the landscape of health service delivery changing from siloed, fragmented and disease-centered toward integrated, people-centered care and requiring more effective interprofessional collaboration.

The *Develop* and *Deliver* (30) phases of the curriculum design thinking process are iterative and ongoing to codesign potential solutions with stakeholders and implement initiatives in ways that ensure program viability and sustainability. Advocacy for AH is ongoing and includes direct lobbying through communications and meetings with government representatives and agencies, and by

ensuring AH academics, leaders and practitioners are represented on university advisory groups. Collaboration between UTAS and the Departments of Health (DoH) and Education occurs when making submissions to government and other funding bodies. Both the DoH and the UTAS are proactively investing in and attracting resources to strategic projects that address key AH issues identified during the discovery and define phases of the AHEP.

UTAS is now developing new pathway programs to facilitate prospective applicants in successfully meeting AH course entry requirements. Course offerings now include a new Master of Physiotherapy, a new Master of Speech Pathology and the university is working toward developing degrees in Occupational Therapy and Clinical Exercise Physiology. Each degree is using an interprofessional-community-based education model to deliver a transformative visionary curriculum that is carefully designed to better equip AH graduates to improve public health, safely respond to complexity and uncertainty, and contribute to health system transformation. There is substantial evidence that rural community-based medical education programs can facilitate effective relationships between students, practitioners, clients (35), involve community (36) and improve students understanding of the social determinants of health (26). In turn, these relationships are known to influence students' competency acquisition and professional identity, increase graduates' interest in rural careers, and improve rural health service delivery (37).

Designing programs to prepare for the unpredictability of practice is challenging when curriculum must also respond to various education drivers—technology, policy, competency standards, accreditation standards, evolving evidence. Transformative education is the educational philosophy underpinning the AHEP degrees. It offers new possibilities for curriculum to generate AH practice transformation toward renewed values of health equity and social justice to address social inequities in health (38) and allows for an androgogy of uncertainty that acknowledges the uncertain and complex nature of professional practice (39).

Primary health care is the program philosophy to ensure the underlying concepts of the social model health and disability, and the principles of universal health care and social determinants of health, as they relate to clients, health conditions, and service delivery, are centralized in the curriculum. The program philosophy is explicitly and consistently enacted as the program ontology to continually shape AH values, norms and practice approaches that are of relevance to the social determinants of health. The curriculum ontology is one of the most important design features used to organize knowledge in the UTAS AH programs. It is a powerful tool that allows curriculum knowledge to be structured to underscore the key points of knowledge (40), namely public health, primary health care and interprofessional collaboration –the hallmarks of preparing graduates for 21st-century healthcare practice.

At the time of program design, Australian universities had been forced to move all programs to online delivery models due to domestic travel and social movement restrictions (14). To accelerate and facilitate digital delivery we required cost effective mechanisms to innovate, rapidly develop and implement new online learning opportunities. The AH degrees were therefore developed as a suite and the build process was progressed by a specialist team with clear role delineations and responsibilities. Discipline specific academics, as the key content developers, co-created raw materials and designed learning activities with AH students and AH professionals. Educational designers transformed raw content and learning activities to align the learning experience to course and unit learning outcomes and objectives, assessments, and evaluation criteria. The educational technologists acted as engineers who determined which digital tools were needed and then built a functional and engaging learning program for delivery. The specialist team and coordinated approach to multi-program development enabled SHS to capitalize on shareable content, streamline the digital infrastructure build and use a lean workflow plan for program development.

A flipped curriculum (41) is being used as the educational approach to engage students in active, dynamic and proactive learning activities where they engage in various forms of interaction, undertake practical learning tasks and enact autonomy in their learning experience. The approach is based on the flipped classroom derived from Dewey's (24) theory of inquiry and it means that educational experiences that traditionally took place inside the classroom now take place in other learning environments (42), including online learning environments, on-campus classrooms, health care facilities and community environments. Our early approach to flipping classrooms involved creating learning activities that facilitate *engagement, exploration*, and *explanation* (43)in the digital learning environment and then linking those learnings to activities so that students can *consolidate* (43) knowledge and skills in classrooms or professional practice learning environments. However, to achieve coherence across the entire curriculum we soon identified this approach required a broader application beyond selected classrooms. Dewey's (24) educational philosophy demands that classrooms are not merely flipped, but that entire curricula is flipped (41). Instead of isolated classroom situations requiring students to demonstrate a quantitative increase of facts or skills, we now ensure the full program of study can offer students an ongoing process of personal and cultural growth and maturation (i.e. a process of professional transformation in which the ontological values of public health, primary health care and interprofessional collaboration are continually adopted, extended and enacted in practice) (24, 41).

For AHEP, the value of the flipped curriculum architecture of education is twofold. First, it allows students to directly experience the kinds of ambiguous, value-laden, and relationally complex problems that are constitutive of rural community-based AH practice and the very practices of inquiry that constitute each of the AH disciplines, and the multidisciplinary nature of health care. Second, it provides a strong impetus for the program design, build and delivery teams to find new ways to ensure students remain engaged and activated throughout the whole program by integrating pedagogical technology at every stage of the model: online, on campus, and during experiential learning placements.

In working toward solving some of the challenges and pressures associated with clinical placements and supervision, UTAS is developing of a network of student assisted multidisciplinary AH clinics across regional and rural Tasmania. These models offer an innovative approach to expand healthcare access and equity and build clinical placement capacity for health professional students (44).

The DoH acknowledges that the AH workforce is integral to Tasmania's health, education, disability and aged care services and how the lack of a local training program for most AH professions exacerbates local recruitment and retention issues. The

Department is therefore proactive in supporting initiatives that may lead to increased supply of AH professionals and is committed to collaborating with the university to lead cultural changes to ensure the public health system can provide a suitable educational environment that meets the needs of all learners. A successful funding bid is enabling new Clinical Lead—Education and Support roles to be established across the three priority AH areas in the North, North-West and South of Tasmania. Such leadership in education, underpinned by leadership engagement, measures and feedback and clinical targets is a critical element to develop a workplace learning culture (45). The funding is also supporting rapid upskilling of AH professionals in supervision-related skills and capacity across the DoH and Department of Education, Children and Young People (DECYP). Educational delivery that is underpinned by quality supervision, valuing learning, and effective resourcing is another important component of our approach to strengthening the workplace learning culture (45). There are already tangible signs that the collaboration between the DoH and the UTAS is effective and as the partnership continues it is expected that integrated learning will become embedded in AH working practices and the shared vision for AH education in Tasmania will be fully realized.

Practical implications and constraints

Public health is everybody's business. It operates at every level and matters at individual, community society, and global levels (1). There is tangible agreement that UTAS, DoH, Tasmanian health system, health services and the health workforces need to work together to support the health and wellbeing needs of all Tasmanians, and address the complexities associated with persistent chronic diseases and injuries. Our curriculum design thinking approach evidences that while some alterations to the structure and delivery of AH education is warranted, the need to achieve a long-term, whole system change for AH education and workforce development, supply and distribution is extremely challenging. Returning to the *What* and *How* (32) in curriculum design, the design thinking process is proving to be critical for UTAS to design and deliver solutions to achieve the *Value* (32) variable: improving Tasmanians access to AH services by offering local AH workforce solutions *via* new AH education and training options. It is also enabling a range of Tasmanian AH stakeholders to have input into the process of codesigning the *How* (32) variable: advocating and influencing state strategic priorities to ensure resource allocation can be attracted and invested in AH initiatives; establishing an end-to-end interprofessional community-based education model that attracts, prepares and extends AH professionals across a career continuum, creation of a suite of new AH programs, and student assisted multidisciplinary clinics. Amidst the complexity, however, it is the *What* (32) variable that has possibly been the most challenging.

Our findings evidence the way our AH stakeholders, like others in health (46), are making calls for education programs to move beyond curriculum that prepare graduates for practice in large city centers with a primary focus on acute care orientated in the prevailing biomedical model that tends to dominate healthcare. The United Nations Educational, Scientific and Cultural Organization (UNESCO) Education 2030 Agenda and Framework for Action, in particular Target 4.7 of Sustainable Development Goal 4: Quality Education (47), calls on higher education to be concurrently responsible for shaping more peaceful, tolerant, and inclusive societies. Health professional education that focuses on the human condition and targets treatment on body parts overlooks the social and psychological sources of most healthcare problems (46). Globally, there are calls for a more meaningful emphasis on public health (1), with the key point being as that as important as good health care is it is now time to place more emphasis on people's health and wellbeing (2). There is a growing consensus that all health professional graduates must be better prepared for more consideration of the social determinants of health so the health of the world's population can be sustainably improved (2).

Our stakeholders identified the need to bolster programmatic and AH professional capacities with a broader set of skills and knowledge that support the multi-sector vision and leadership needed to be agile and responsive as health care continues to change and evolve. WHO acknowledges that it is time to professionalize all the health workforce as part of the public health workforce (2). In rethinking the *What* (32) in AH curriculum we committed to the dual focus of producing profession-ready graduates and equipping them with future facing capabilities required to adapt and respond to rapidly occurring changes in health, and the health system. This means we are carefully tackling the question of *what else* needs to be taught to enable improved public health outcomes, and *how* it needs to be taught. UTAS is opening new ways of learning and teaching that develop in students a sense of belonging to a much wider community than their chosen professions and to stretch beyond local, state and national confines. Rather than embracing a technical rationality and following a one-size-fits-all approach, the AHEP flipped curriculum approach actively supports transformational engagement. Transformative learning is not new in health professional education. It is regarded as a pedagogical tool for the 21st century (48) therefore used in medicine and nursing because of its value in "producing enlightened change agents" (11). Accordingly, the UTAS AH programs use learning, teaching, and assessment strategies across the intended, enacted and experienced curriculum (27) to achieve core competencies for effective interprofessional collaboration and to challenge the dominant biomedical status quo that continues to prevail in healthcare. We aspire to create graduates who are adept in critical analysis for the creative adaptation of resources to address local health priorities.

The SHS continues to grapple with the problem of how the new AH programs can be organized to ensure all education assets and outcomes can be brought to bear on meeting the needs of Tasmania while balancing the need to ensure the program goals are achieved, quality maintained, and the affordability of program implementation sustained. There are already tangible benefits emerging from the AHEP, however, more work is required to continue to deliver on all program objectives, which can be achieved with ongoing concerted effort and collaboration between the University and various entities across the state who are partnering together to build statewide AH capacity.

Conclusion

As the world becomes ever more interconnected, the interest in global public health grows and this signals a shift in the purpose of higher education. To improve public health and effectively prepare AH graduates for safe, quality, and agile practice across a range of

contexts, programs of study are needed that are practical, raise a future health workforce, and graduate a generation of people that can transform systems, communities, and regions. Designing programs to prepare for the unpredictability of practice is challenging when curriculum must also respond to various education drivers. Curricula has become swollen with lectures and units of study with less time for independent thought, inquiry and study to prepare for professional practice. Innovation in education is now needed to think beyond what we are currently doing and find new ways to improve the quality and productivity of student learning. Design thinking as a curriculum design methodology is proving critical to SHS moving the AHEP forward as we continue to rethink how to prepare an AH health workforce to enable improved public health outcomes.

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

Data collection and design of the Allied Health Expansion Program was led by NB and LD in collaboration with KS and PH. LD made substantial contributions to the conception or design of the original manuscript, including acquisition, analysis, and interpretation of data. AH and SJ provided assistance with framing, interpretation of findings, and subsequent revisions. All authors provided critical review and approved the final submission.

Acknowledgments

The authors acknowledge and appreciate the ongoing contributions of all Tasmanian AH professionals and/or allied health leaders in the AHEP codesign process.

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

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Duff J, Liu A, Saavedra J, Batycki J, Morancy K, Stocking B, et al. A global public health convention for the 21st century. *Health Policy*. (2021) 6:E428–33. doi: 10.1016/S2468-2667(21)00070-0

2. World Health Organisation. *Health Workforce 2030: Towards a Global Strategy on Human Resources for Health.* (2015). Available online at: https://cdn.who.int/media/docs/default-source/health-workforce/15-295strategy_report-04_24_2015.pdf (accessed 13 October, 2022).

3. National Rural Health Commissioner. *Report for the Minister for Regional Health, Regional Communications and Local Government on the Improvement of Access, Quality and Distribution of Allied Health Services in Regional, Rural and Remote Australia.* (2020). Available online at: https://www.health.gov.au/resources/publications/final-report-improvement-of-access-quality-and-distribution-of-allied-health-services-in-regional-rural-and-remote-australia (accessed December 09, 2022).

4. Australian Institute of Health and Welfare. *Australia's Health 2022 in Brief.* (2022). Available online at: https://www.aihw.gov.au/reports-data/australias-health, Australian Government (accessed 13 October, 2022).

5. Primary Health Tasmania. *Health in Tasmania. Primary Health Tasmania Health Needs Assessment 2022-23 to 2024–25.* (2021). Available online at: https://www.primaryhealthtas.com.au/wp-content/uploads/2022/04/Primary-Health-Tasmania-Needs-Assessment-2022-25.pdf (accessed 13 October, 2022).

6. Vinson T, Rawsthorne M, Beavis A, Ericson M. *Persistent Communal Disadvantage in Australia*. (2015). Available online at: https://dote.org.au/.

7. Tasmanian Government, Health workforce (2040). *Strategy. Department of Health*. (2019). Available online at: https://www.health.tas.gov.au/sites/default/files/2021-12/Health_workforce2040_strategy_DoHTasmania2019.pdf (accessed 13 October, 2022).

8. Jessup B, Barnett T, Cross M, Obamiro K, Mallick S. Rural employment: A get-go for recent nursing and allied health graduates? *Aust J Rural Health.* (2021) 29:688–700. doi: 10.1111/ajr.12773

9. Fitzmaurice C. COVID-19 and mental health and well-being in rural Australia. *Aust J Rural Health.* (2021) 29:811–2. doi: 10.1111/ajr.12809

10. Australian Academy of Health and Medical Sciences. *Research and Innovation as Core Functions in Transforming the Health System: A Vision for the Future of Health in Australia*. Available online at: www.aahms.org (accessed 28 November, 2022).

11. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet.* (2010) 376:192–1958. doi: 10.1016/S0140-6736(10)61854-5

12. Cometto G, Witter S. Tackling health workforce challenges to universal health coverage: setting targets and measuring progress. *Bull World Health Organ*. 91:881–5. doi: 10.2471/BLT.13.118810

13. Car LT, Kyaw BM, Dunleavy G, Smart NA, Semwal M, Rotgans JI, et al. Digital problem-based learning in health professions: systematic review and meta-analysis by the digital health education collaboration. *J Med Internet Res.* (2019) 21:e12945. doi: 10.2196/12945

14. Australian Government. *Forward impact of COVID-19 on Australian Higher Education*. (2021). Available online at: https://www.teqsa.gov.au/sites/default/files/forward-impact-of-covid-19-on-australian-higher-education-report.pdf (accessed December 09, 2022).

15. Australian Government. *Australia's Long Term National Health Plan to Build the World's Best Health System*. Canberra: Department of Health (2019).

16. Battye K, Seffton C, Thomas J, Smith J, Springer S, et al. *Independent Evaluation of the Rural Health Multidisciplinary Training Program: Final Report to the Commonwealth Department of Health*. KBC Australia. (2020). Available online at: https://www1.health.gov.au/internet/main/publishing.nsf/Content/6D694D865D7A1726CA2584E90077F238/\protect\T1\textdollarFile/Final%20Report%20-%20Rural%20Health%20Multidisciplinary%20Training%20(RHMT)%20Program%20-%20Evaluation.pdf (accessed December 09, 2022).

17. Cheek C, Hays R, Allen P, Walker G, Shires L. Building a local medical workforce in Tasmania: where are international fee-paying medical graduates likely to work? *Rural Rem Health.* (2017) 17:4292. doi: 10.22605/RRH4292

18. Nursing and Midwifery Board of Australia. *Statistics*. Available online at: https://www.nursingmidwiferyboard.gov.au/About/Statistics.aspx. (accessed November 23, 2022).

19. Office of Disease Prevention and Health Promotion. *Healthy People 2030 U.S. Department of Health and Human Services*. US Dept of Health and Human Services (2022). Available online at: https://wwwhealth.gove/healthypeople

20. Richards R. Best practices in community-oriented health professions education: International exemplars. *Educat Health.* (2001) 14:357–65. doi: 10.1080/13576280110085508

21. Levy M, Gentry D, Lm K. Innovations in public health education: promoting professional development and a culture of health. *Am J Public Health.* (2015) 105:S44–5. doi: 10.2105/AJPH.2014.302351

22. Nagarajan S, McAllistair L. Integration of practice experiences into the Allied Health Curriculum: curriculum and pedagogic considerations before, during and after work-integrated learning experiences Asia-Pacific. *J Cooperat Educ.* (2015) 16:279–90.

23. Organization for Economic Co-Operation and Development. *Innovative Learning Environments*. (2013). Available online at: http://dx.doi.org/10.1787/9789264203488-en. doi: 10.1787/9789264203488-en

24. Dewey J. *Logic: The Theory of Inquiry.* (1986).

25. Hafferty F. Beyond curriculum reform: confronting medicine's hidden curriculum. *Acad Med.* (1998) 73:403–7. doi: 10.1097/00001888-199804000-00013

26. Stubbs C, Schorn MN, Leavell JP, Espiritu EW, Davis G, Gentry CK, et al. Implementing and evaluating a community-based, inter-institutional, interprofessional education pilot programme. *J Inteprofessional Care.* (2017) 31:652–5. doi: 10.1080/13561820.2017.1343808

27. Billett S. Constituting the workplace curriculum. *Curr Stud.* (2006) 38:31–48. doi: 10.1080/00220270500153781

28. Ku B, Lupton E. *Health Design Thinking, second edition: Creating Products and Services for Better Health*. New York: M. P. Ltd. (2022). doi: 10.7551/mitpress/14494.001.0001

29. Tedjasaputra A, Sari E. Design Thinking 2.0 for Curriculum Design and Development. In: *Proceedings of the 28th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education*. (2020).

30. British Council's Updated Double Diamond. *Framework for Innovation: Design Council's evolved Double Diamond*. (2019). Available online at: https://www.designcouncil.org.uk/our-work/skills-learning/tools-frameworks/framework-for-innovation-design-councils-evolved-double-diamond (accessed 13 October, 2022).

31. Melles G. Curriculum design thinking: a new name for old ways of thinking and practice?", in *8th Design Thinking Research Symposium (DTRS8)*. Sydney, Australia: U.o.Sydney. (2010).

32. Dorst K. The core of 'design thinking' and its application. *Design Studies.* (2011) 32:521–32. doi: 10.1016/j.destud.2011.07.006

33. Liedtka J. Innovative ways companies are using design thinking. *Strategy Leadership*. (2014) 42:40–5. doi: 10.1108/SL-01-2014-0004

34. Liedtka J, Salzman R, Azer D. *Design Thinking for the Greater Good: Innovation in the Social Sector.* (2017). New York: Columbia University Press. doi: 10.7312/lied17952

35. Somporn P, Ash J, Walters L. Stakeholder views of rural community-based medical education: a narrative review of the international literature. *Med Educ.* (2018) 52:791–802. doi: 10.1111/medu.13580

36. Ryuichi Ohta YR. Chiaki Sano, the contribution of citizens to community-based medical education in japan: a systematic review. *Int J Environ Res Public Health.* (2021) 4:1575. doi: 10.3390/ijerph18041575

37. Worley P. Flinders university school of medicine, northern territory, Australia: Achieving educational excellence along with a sustainable rural medical workforce. *MEDICC Rev.* (2008) 10:30–4. doi: 10.37757/MR2008.V10.N4.7

38. Massé J, Dupéré S, Martin É, Lévesque MC. Transformative medical education: must community-based traineeship experiences be part of the curriculum? A qualitative study. *Int J Equity in Health*. 19:2–14. doi: 10.1186/s12939-020-01213-4

39. Van Schalkwyk SC, Hafler J, Brewer TF, Maley MA, Margolis C, McNamee L, et al. Bellagio global health education initiative transformative learning as pedagogy for the health professions: a scoping review. *Medical Edu.* (2019) 53:547–58. doi: 10.1111/medu.13804

40. Zouri M, Ferworn A. An Ontology-Based Approach for Curriculum Mapping in Higher Education. In: *2021 IEEE 11th Annual Computing and Communication Workshop and Conference (CCWC).* IEEE: Nevada, US. (2021). doi: 10.1109/CCWC51732.2021.9376163

41. Stoller A. The flipped curriculum: Dewey's pragmatic university. *Stud Philos Educ.* (2017) 37:451–65. doi: 10.1007/s11217-017-9592-1

42. Lage M, Treglia JPM. Inverting the classroom: A gateway to creating an inclusive learning environment. *J Eco Edu.* 31, pp 30–43.

43. Song Y, Kapur M. How to flip the classroom–productive failure or traditional flipped classroom" pedagogical design? *J Educ Technol.* (2017) 20:292–305. doi: 10.2307/jeductechsoci.20.1.292

44. Broman P, Tokolahi E, Wilson OWA, Haggie M, Andersen P, Brownie S. Patient outcomes from student-run health services: an integrative review. *J Multidiscipl Healthcare.* (2022) 30:641–65. doi: 10.2147/JMDH.S348411

45. Gawne S, Fish R. Developing a workplace-based learning culture in the NHS: aspirations and challenges. *J Med Educ Curric.* (2020) 31:1–8. doi: 10.1177/2382120520947063

46. Rocca E, Anjum R. Complexity, Reductionism and the Biomedical Model. In: Anjum R, Copeland S, Rocca E, Editors. *Rethinking Causality, Complexity and Evidence for the Unique Patient: A CauseHealth Resource for Healthcare Professionals and the Clinical Encounter.* (2020). Switzerland: Springer. doi: 10.1007/978-3-030-41239-5_5

47. UNESCO. *Education 2030: Incheon Declaration and Framework for Action—Towards inclusive and equitable quality education and lifelong learning for all.* Paris, France: Author. (2015).

48. Enkhtur A, Yamamoto B. *Transformative Learning Theory and its Application in Higher Education Settings: A Review Paper*. Osaka: University Knowledge Archive. (2017).

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 09 March 2023
DOI 10.3389/fpubh.2023.1097917

OPEN ACCESS

EDITED BY
Sharon Brownie,
Swinburne University of Technology, Australia

REVIEWED BY
Karen Franck,
The University of Tennessee, Knoxville, United States
Gigi Lam,
Hong Kong Shue Yan University, Hong Kong SAR, China

*CORRESPONDENCE
Lin Junchang
✉ linjc2002@163.com
Zhang Yuhui
✉ zyh@nhei.cn

SPECIALTY SECTION
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

RECEIVED 14 November 2022
ACCEPTED 13 February 2023
PUBLISHED 09 March 2023

CITATION
Jie D, Mengzhe Y, Huiwen L, Junchang L and Yuhui Z (2023) Analysis of university students' participation in emergency education and its influencing factors in Shandong province. *Front. Public Health* 11:1097917. doi: 10.3389/fpubh.2023.1097917

Analysis of university students' participation in emergency education and its influencing factors in Shandong province

Du Jie[1], Yang Mengzhe[2], Luo Huiwen[2], Lin Junchang[3]* and Zhang Yuhui[1,4]*

[1]School of Public Health, Weifang Medical University, Weifang, China, [2]School of Humanities and Social Sciences, Guangxi Medical University, Nanning, China, [3]School of Management, Weifang Medical University, Weifang, China, [4]China National Health Development Research Center, Beijing, China

Objective: The aim of this study is to understand the current situation of university students' participation in emergency education and its influencing factors in Shandong province, to improve the enthusiasm of university students' involvement in emergency training and exercise activities, and to provide a reference for universities to carry out education on public health emergencies.

Methods: From April to May 2020, 6,630 university students were selected from six universities in Shandong province by stratified random sampling. Descriptive analysis, χ^2 test, and logistic regression for statistical analysis were also used.

Results: Overall, 35.5 and 55.8% of university students believed that it is necessary to participate in emergency education activities, and 65.8% of university students participated in emergency training and exercise activities. Through multivariate analysis, the results showed that university students who are men, sophomores, medical students, from within the province, the only child, have good health, take emergency education courses, think it is necessary to participate in emergency education, think the school attaches great importance to emergency education, believe that the professional teacher level to meet needs, know about public health emergencies, have received emergency education such as prevention and treatment of infectious diseases, and have a higher participation rate of emergency education and training activities.

Conclusion: The willingness of university students to participate in emergency education in Shandong province is high, but the willingness in emergency training and exercise activities is low. Gender, grade, profession, and students' nationalities, whether it is only children, health, the school courses in emergency education situations, the value of emergency education, emergency education to participate, the degree of teachers' professional level to meet the requirements, a public health emergency condition as well as the prevention and treatment of infectious diseases such as emergency education are the main influencing factors for university students' participation in emergency training and exercise activities in Shandong province.

KEYWORDS

emergency education, training activities, to participate, Shandong province, university students

Introduction

Major public crisis events caused by novel coronary pneumonia can seriously threaten the social order and harm human health (1, 2). As an essential part of the national emergency governance system, colleges and universities should be obliged to undertake the critical mission of safeguarding the lives and health of students and teachers and campus safety; however, with complex and mobile personnel on campus, since the emergence of the Omicron mutant strain, the risk of a cluster epidemic in schools has increased significantly. Emergency education refers to all emergency-related educational activities and behaviors in the field of emergency management. It is the educational activities and behaviors that teach all stakeholders emergency awareness, knowledge, skills, and values to prevent and respond to emergencies (3). In this study, emergency education for university students refers to the education to improve students' emergency literacy level to reduce the damage caused by emergencies *via* teaching them knowledge, skills training, and emergency drills. Colleges and universities as the main body to promote social development, college students as the main force to prevent and respond to emergencies, have an important influence on the overall prevention and control of emergencies and the effectiveness of their disposal as university students have a high demand for emergency education. The Emergency Response Law of the People's Republic of China stipulates that schools of all levels and types should incorporate emergency knowledge education into their teaching content. Schools should educate students on emergency knowledge and develop their safety awareness and ability to save themselves and each other (4, 5). Colleges and universities must assume the responsibility of emergency knowledge education for university students, build a better platform for their participation in emergency education, and effectively improve the emergency protection ability of university students in emergencies (6). The current research on emergency education mainly focuses on improving the emergency response system and emergency response capacity and studying countermeasures for emergency education in colleges and universities, which are macroscopic and lack targeted policy recommendations (7, 8). Therefore, this study mainly focuses on both macroscopic and microscopic aspects, and in the context of the new coronary pneumonia, it mainly investigates the participation of emergency education training and exercise activities of university students in Shandong province in public health emergencies and explores its influencing factors to put forward more targeted recommendations to improve the emergency literacy of university students and to better guide the emergency education work in colleges. This study conducted a questionnaire survey on public health emergency education in April–May 2020, using a stratified random sampling method to select 6,630 university students in six colleges and universities in Shandong province and reported the results as follows.

Materials and methods

Research subjects

The survey adopted a stratified random sampling method in April–May 2020 and divided Shandong province into three strata (comprehensive, science, and medicine), according to the nature of the disciplines. Each stratum randomly selected two colleges and universities, a total of six colleges and universities, based on the selected colleges and universities, and then according to the freshman, sophomore, junior, senior, and above grades stratified randomly selected university students for questionnaire survey. We collected 8,000 questionnaires, with 7,719 valid and an effective rate of 96.5%. Since some university students answered that they were unsure whether they had participated in emergency training and exercise activities, we excluded this sample size for rigorous consideration. The final sample size for analysis was 6,630. The ethics committee approved the study and obtained informed consent from the respondents.

Research methodology

After coordinating and communicating with relevant departments and faculties of universities, we conducted a questionnaire survey on university students in anonymous form through the Questionnaire Star platform. The research contents include the basic information of the survey respondents, such as gender, age, ethnicity, and grade level, etc., as well as the awareness of university students about health knowledge and public health emergencies, university students' ability to cope with public health emergencies, the implementation of emergency education in schools, and the emphasis on health education and emergency education in schools. Before starting the survey, we clarified the questionnaire filling requirements and matters needing attention from the respondents. Each person can only answer the questionnaire once. Later, we sorted the submitted submissions and eliminated invalid questionnaires with missing basic information of survey respondents, incomplete answers to questionnaire entries, completeness rates <95%, or response times of <120 s.

Statistical methods

Data were double-entered using Epidata 2.0, and SPSS25.0 software was used for statistical processing. We described count data as percentages, and multiple covariance tests were performed on the independent variables. We used the χ^2 test and multi-factor unconditional logistic regression to analyze the influencing factors, with statistically significant differences at $P < 0.05$.

Results

Essential characteristics of the interviewed university students

A total of 6,630 interviewed college students were included. Most participants were men (65.1%), 19–21 years old (81.6%), Han Chinese (96.7%), freshmen (30.9%), and sophomores (24.6%). Most participants majored in science and technology (37%), and most participants were from rural households (68.8%), Shandong

TABLE 1 Basic information of survey respondents.

Variable		Number	Participation rate (%)
Gender	Male	2,209	34.9
	Female	4,121	65.1
Age (years)	≦18	450	7.1
	19∼21	5,168	81.6
	22∼24	691	10.9
	≧25	21	0.3
Ethnicity	Han Chinese	6,124	96.7
	Ethnic Minorities	206	3.3
Grade	First-year	1,957	30.9
	Sophomore	1,559	24.6
	Junior	1,548	24.5
	Senior and above	1,266	20.0
Specialties	Medicine	1,789	28.3
	Literature and History	1,477	23.3
	Science and Engineering	2,340	37.0
	Art and Sports	724	11.4
Domicile location	Rural	4,352	68.8
	City	1,978	31.2
Place of origin	Within Shandong Province	4,896	77.3
	Outside Shandong Province	1,434	22.7
Is the only child	Yes	2,313	36.5
	No	4,017	63.5

nationality (77.3%), and non-only children (63.5%), as shown in Table 1.

Knowledge of public health emergencies among university students

Among the 6,630 university students included in the study, 93% learned about public health emergencies through the Internet, TV, and radio; 4,169 of them knew what public health emergencies were, with a knowledge rate of 59.8%; 5,675 students knew about the generation and transmission channels of the new pneumonia epidemic, with a knowledge rate of 73.5%; 6,052 students knew about the protective measures of the new pneumonia epidemic, with a knowledge rate of 78.4%; 3,836 students knew the harmful effects of hepatitis B and other infectious diseases, with a knowledge rate of 60.6%; 3,826 students knew about the prevention measures of hepatitis B and other infectious diseases, with a knowledge rate of 60.4%; 5,440 students knew the correct way to wash their hands (seven-step method), with a knowledge rate of 85.9%; and 5,764 students knew the right way to wear a mask, with the highest knowledge and awareness rates of 91.1%. The knowledge of general first aid methods and emergency measures for things poisoning was the least satisfactory, with 56.6 and 53.5%, respectively.

Receptance of emergency education among university students(includes science promotion and knowledge teaching)

Among the 6,630 university students interviewed, 4,883 had received emergency education related to infectious disease prevention and treatment. The receptance of emergency education about contagious disease prevention and treatment was 77.1%. A total of 2,703 students received emergency education related to accidental injury avoidance, and the receptance of unintentional injury-related emergency education was 42.7%. A total of 3,785 students received emergency education about earthquakes, typhoons, and other natural disasters, and the receptance of emergency education related to natural disasters was 59.8%. A total of 2,944 students received emergency education about fire, laboratory chemical leakage, and other accidents, and the receptance of accident and disaster-related emergency education was 46.5%.

University students' willingness to participate in emergency education activities and participation in emergency education training and drill emergency training and exercise activities

Of the 6,630 university students interviewed, 2,358 students (35.5%) thought it was essential for them to participate in emergency education activities. Three thousand seven hundred five students (55.8%) thought it was necessary for them to participate in emergency education activities. One hundred forty-sevenstudents (2.3%) thought it was generally required for them to participate in emergency education activities, and only 1.9% thought it was unnecessary to participate in emergency education activities. Of the 6,630 university students interviewed, only 4,146 students said they had participated in emergency training and exercise activities, with a participation rate of 65.8%. The participation rate in emergency activities was much lower than the percentage of those who felt it was necessary to participate in emergency activities.

Single-factor analysis of university students' participation in emergency training and exercise activities

Based on the differences in the primary conditions of individuals, university students' participation rates in emergency training and exercise activities differed by gender, age, ethnicity, grade, major, place of birth, whether they were only children, and health status. The differences were statistically significant (all $P < 0.05$).

10.3389/fpubh.2023.1097917

TABLE 2 Participation in emergency training and exercise activities of university students with different characteristics.

Variable heading	Variable classification	Number of people surveyed	Number of participants	Participation rate (%)	$\chi 2$ value	*P*-value
Gender	Male	2,209	1,656	75.0	127.966	<0.001
	Female	4,121	2,506	60.8		
Age (years)	≦18	450	307	68.2	11.544	0.009
	19∼21	5,168	3,423	66.2		
	22∼24	691	422	61.1		
	≧25	21	10	47.6		
Ethnicity	Han Chinese	6,124	4,052	66.2	14.427	<0.001
	Ethnic minorities	206	110	53.4		
Grade	First-year	1,957	1,356	69.3	54.034	<0.001
	Sophomore	1,559	1,093	70.1		
	Junior	1,548	949	61.3		
	Senior and above	1,266	764	60.3		
Specialties	Medicine	1,789	1,267	70.8	75.482	<0.001
	Literature and history	1,477	879	59.5		
	Science and engineering	2,340	1,479	63.2		
	Art and sports	724	537	74.2		
Domicile location	Rural	4,352	2,851	65.5	0.357	0.285
	City	1,978	1,311	66.3		
Place of origin	Within Shandong province	4,896	3,337	68.2	55.616	<0.001
	Outside Shandong province	1,434	825	57.5		
Is the only child	Yes	2,313	1,617	69.9	27.994	<0.001
	No	4,017	2,545	63.4		
Health status	Good	4,595	3,184	69.3	94.414	<0.001
	Difference	1,735	978	56.4		
Emergency education course	Open	5,842	3,942	67.5	100.305	<0.001
	Not opened	488	220	45.1		
Willingness to participate in emergency education	It is necessary	6,063	4,025	66.4	25.810	<0.001
	Not necessary	267	137	51.3		
School importance	Very important	3,286	2,597	79.0	541.980	<0.001
	General Importance	2,936	1,522	51.8		
	No attention	108	43	39.8		
The extent to which the level of teachers meets demand	Yes	4,522	3,309	73.2	387.612	<0.001
	No	1,808	853	47.2		
Evaluation of the school's emergency activities	Very good	4,942	3,609	73.0	531.517	<0.001
	General	1,243	502	40.4		
	Not good	145	51	35.2		
Public health emergencies	Understanding	3,902	2,938	75.3	411.509	<0.001
	Don't know	2,428	1,224	50.4		

(Continued)

TABLE 2 (Continued)

Variable heading	Variable classification	Number of people surveyed	Number of participants	Participation rate (%)	$\chi 2$ value	*P*-value
Dissemination channels	Understanding	4,804	3,325	69.2	106.107	<0.001
	Don't know	1,526	837	54.8		
Protective measures	Understanding	5,093	3,474	68.2	70.086	<0.001
	Don't know	1,237	688	55.6		
Emergency education related to infectious disease prevention and control	Received	4,883	3,493	71.5	317.285	<0.001
	Not accepted	1,447	669	46.2		
Emergency education for accidental injury avoidance and survival in hazardous environments	Received	2,703	1,907	70.6	48.282	<0.001
	Not accepted	3,627	2,255	62.2		
Emergency education related to natural disasters such as earthquakes and typhoons	Received	3,785	3,141	64.0	31.238	<0.001
	Not accepted	2,545	1,021	72.0		
Emergency education for fires, laboratory chemical spills, etc.	Received	2,944	2,059	69.9	42.876	<0.001
	Not accepted	3,386	2,103	62.1		

Based on the influence of school level, the participation rates in emergency training and exercise activities of university students differed according to the availability of emergency education courses in schools, the degree of importance attached by schools, and the degree of teachers' professionalism to meet the needs. The differences were statistically significant (all $P < 0.05$).

Based on individual cognitive differences, the participation rates of emergency training and exercise activities of university students with different willingness to participate in emergency education and evaluation of emergency activities are different, also among university students with additional knowledge of public health emergencies, epidemic transmission routes, prevention and control measures, and acceptance of emergency education. The differences were statistically significant (all $P < 0.05$), as shown in Table 2.

Multi-factor unconditional logistic regression analysis of university students' participation in emergency training and exercise activities

A multivariate logistic regression analysis was performed using 22 univariate factors with statistical significance, including gender, age, ethnicity, grade, major, place of origin, whether the student is the only child, health status, whether the school offers emergency education courses, and willingness to participate in activities. The VIF of all independent variables is <10, and there is no multicollinearity. The dependent variable was whether university students had participated in emergency training and exercise activities (no participation = 0, yes participation = 1). The results showed that men, sophomores, medical, provincial students, the only child, good health, perception of the need to participate in emergency education, perception of the importance of emergency education at the school, perception of the professionalism of instructors as meeting the requirements, knowledge of public health emergencies, emergency education on infectious disease prevention and control, accidental injury avoidance, and perception of the importance of emergency education at the school. The percentage of participation in emergency training and exercise activities for university students in Shandong province was high, as shown in Table 3.

Discussion

Public emergency literacy is essential to emergency management, which can help the public effectively avoid risks (9–11). Recently, several school-related cases of the new coronary pneumonia (NCP) epidemic occurred in China. Because of the confined space and frequent personnel contact in schools, which create favorable conditions for virus transmission, schools have become a crucial and challenging point for preventing and controlling the NCP epidemic. Moreover, popular emergency education can effectively improve the emergency literacy of university students and help them better cope with the risk of epidemic normalization (12, 13).

The findings of this study indicate that university students' knowledge of the causes, modes of transmission, and protective measures for this new coronary pneumonia epidemic reached over 70%, but their familiarity with general first-aid techniques and emergency measures for things poisoning was <57%. From this, it can be seen that under the influence of this new crown epidemic, university students' knowledge of public health emergencies, such as the transmission channels of infectious diseases, hazards, and preventive measures, has improved significantly. Knowledge of escape methods, first-aid skills for accidents and disasters such as fire, and emergency measures for public emergencies such as food poisoning is still unsatisfactory.

10.3389/fpubh.2023.1097917

TABLE 3 Multi-factor unconditional logistic regression analysis of university students' participation in emergency training and exercise activities.

Factors		Reference group	β	*S.E*	Wald χ^2 value	*P*-value	OR value	95% *CI*
Gender	Male	Female	0.408	0.077	28.058	0.000	1.504	1.293~1.749
Grade	First-year	Senior and above	0.306	0.092	11.053	0.001	1.358	1.134~1.627
	Sophomore		0.406	0.092	19.349	0.000	1.501	1.253~1.799
	Junior		0.006	0.088	0.005	0.942	1.006	0.847~1.195
Specialties	Medicine	Art and sports	0.169	0.105	2.593	0.007	1.184	0.964~1.455
	Literature and history		-0.427	0.106	16.355	0.000	0.652	0.530~0.802
	Science and engineering		-0.366	0.099	13.642	0.000	0.694	0.572~0.842
Place of origin	Provincial	Out of province	0.431	0.066	42.582	0.000	1.539	1.352~1.752
Only child	Yes	No	0.199	0.059	11.350	0.001	1.221	1.087~1.371
Health status	Good	Difference	0.476	0.060	62.884	0.000	1.609	1.431~1.810
Emergency education course	Open	Not opened	0.265	0.127	4.335	0.037	1.304	1.016~1.674
Willingness to participate in emergency education	It is necessary	Not necessary	0.126	0.165	0.577	0.447	1.134	0.820~1.568
School importance	Very important	No attention	0.517	0.256	4.088	0.043	1.677	1.016~2.768
	General importance		0.094	0.251	0.141	0.707	1.099	0.672~1.796
The extent to which the level of teachers meets demand	Satisfaction	Unsatisfied	0.171	0.078	4.823	0.028	1.186	1.019~1.381
Public health emergencies	Understanding	Don't know	0.517	0.081	41.208	0.000	1.678	1.433~1.965
Emergency education for infectious disease control	Received	Not accepted	0.990	0.066	227.238	0.000	2.691	2.366~3.060
Emergency education for accidental injury avoidance and survival in hazardous environments	Received	Not accepted	0.154	0.068	5.173	0.023	1.166	1.021~1.332
Emergency education for fire and laboratory chemical spills	Received	Not accepted	0.174	0.065	7.159	0 0.007	1.191	1.048~1.353

Second, the willingness of university students to participate in emergency education is generally high. Higher than the demand of university students in Liaoning province, 91.3% of university students in Shandong province believe that taking part in emergency education activities is necessary (11). However, the participation rate of university students in emergency training and exercise activities is 65.8%, which is still a big gap with 91.3% willingness to participate in emergency education. As a result, those university students who think it is necessary to participate in emergency education activities but have not participated in them should become the focus of emergency education in schools at the next step, so as to better realize the "unity of knowledge and action" and improve the enthusiasm of university students to participate in emergency training and exercise activities.

The multi-factor results showed that gender, grade, major, place of origin, whether the student is the only child, health status, school's emergency education courses offerings, school's attention to emergency education, university students' willingness to participate in emergency education, teachers' professional level to meet the needs, university students' knowledge of public health emergencies and the acceptance of emergency education courses are the main influencing factors for the participation of university students in emergency training and exercise activities in Shandong province.

The participation rate of male students in emergency training and exercise activities is higher than that of female students, 1.504 times that of girls and which is consistent with the findings of the study of Wang et al. (14). This may be due to the gender differences between male and female students, who tend to be more interested in emotional and linguistic cognition and less interested in emergency training and exercise activities that favor rational logic (15). The participation of freshmen and sophomores in emergency training and exercise activities is significantly higher than that of other grades, 1.358 and 1.501 times higher than that of seniors and above, respectively, and the proportion of sophomores participating in emergency training and exercise activities is the highest, probably because freshmen and sophomores are mainly studying relevant basic courses, and their academic pressure is relatively light, so they have more time and vigor to participate in social practice activities. The difference in the participation of junior, senior, and above students in emergency training and drills is not obvious because junior, senior, and above students have finished their basic courses and are in the critical period of internship, graduate school, and employment, so their time and

experience are relatively scattered, and they are less motivated to participate in emergency education and training activities (16).

Students majoring in medicine are more likely to participate in emergency training and exercise activities than other majors, consistent with previous studies (17), maybe because medical students, influenced by the characteristics of their profession, have a greater love and respect for life. In addition, some medical schools offer specialized preventive medicine courses that can help medical students learn to pay attention to and participate in emergency training and exercise activities. The participation in the acceptance rate of education on public health emergencies among university students from inside the region is higher than that of university students from outside the province, which is 1.539 times higher, possibly due to the transformation of their living environments and cultural differences. University students from outside the province cannot quickly and steadily integrate into campus life. Weak campus integration leads to their limited participation in emergency education activities. Only children in emergency training and exercise activities are more than non-only children, 1.221 times higher than that of non-only children because only children bear more family responsibilities, which motivates them to participate in emergency education activities to better protect themselves and their family members. Health status affects university students' enthusiasm to participate in emergency training and exercise activities. University students with poor health status have a lower participation rate in emergency training and exercise activities, and the percentage of college students with good health status was 1.609 times higher than that of college students with poor health status. Due to the poor physical quality of this group, their ability to participate in practical activities related to emergency education is limited.

In addition, the degree of importance that schools attach to emergency education, the availability of emergency education courses, and the professionalism of school teachers to meet educational needs also affect the enthusiasm of university students to participate in emergency training and exercise activities. The importance of emergency education in colleges is 1.677 times higher than that of emergency education in colleges because the importance of emergency education in colleges will, to a certain extent, cause teachers and students to pay attention to emergency education, thus prompting college students to transform their ideological importance into behavioral participation and actively participate in emergency education and training activities. The participation rate of students in emergency training and exercise activities in colleges and universities with emergency education courses is 1.134 times higher than without emergency education courses because curriculum teaching is the most direct and effective way to improve emergency literacy, and starting emergency education courses provides an effective way for university students to learn about public health emergencies and related knowledge (18). At the same time, the professional quality of teachers and the degree to which they meet students' needs for emergency knowledge also implicitly influence university students' cognition and behavior in participating in emergency education and training activities.

University students with a higher willingness to participate in emergency education, knowledge of public health emergencies, and acceptance of emergency education on infectious disease prevention and control, accidental injury avoidance, survival in hazardous environments, and fire and laboratory chemical spills tend to have higher health literacy and better appreciate the hazards caused by public emergencies and the importance of improving their coping abilities, and as a result, emergency education training and exercise activities are more motivated, they are 1.304, 2.691, 1.166, and 1.191 times more likely to believe that it is not necessary to participate in emergency education and have received no relevant emergency education, respectively. Because individual perception is an important factor in promoting behavioral change, a strong tendency for active learning behavior and a strong sense of risk contribute to participation in emergency education and training activities. University students have a strong sense of risk, are susceptible to emergencies, and at the same time, they will recognize that there will be valuable consequences after the behavioral change, so they will take measures to improve their coping abilities, thus increasing their participation in emergency education and training activities. This increases their motivation to participate in emergency education and training activities (19).

To sum up, the participation rate in emergency training and exercise activities for university students in Shandong province is low, and the current situation of emergency education in colleges and universities needs to be improved. Colleges and universities should pay more attention to emergency education for university students to "prepare for rainy days and prevent problems before they occur." Universities need to establish a long-term mechanism for emergency education, analyze the critical problems in emergency education, solve the contradictions in emergency education, and integrate emergency education into all aspects of education. The leadership of higher education institutions should pay attention to both thoughts and actions so that emergency education is not a mere formality (20). At the same time, university students are guided to raise their awareness of public health emergencies and to adopt a positive attitude and response. Moreover, the classroom content of emergency education should be tailored to the needs of students and be effective. Schools should hire more qualified teachers for emergency education positions and enrich their teaching work. Emergency education curricula can be combined with compulsory and elective courses to establish a curriculum system based on mandatory courses and supplemented by elective courses. In this way, the knowledge of emergency education can be comprehensively disseminated and meet the unique needs of students (21, 22). On this basis, colleges and universities should establish a perfect emergency disposal system, increase special investment in emergency education, regularly carry out emergency education and training activities, strengthen the practical exercises of emergency education for university students, and schools should plan a special emergency drill base and regularly carry out large-scale training and simulation drills (23, 24). Finally, the campus network, WeChat, microblogs, and other emerging media should be used to strengthen the daily publicity of emergency awareness and values among university students (25, 26), to guide them more positively, to explore more efficient, popular, and up-to-date forms of publicity, to create a healthy school environment and an atmosphere for preventing public health emergencies, to improve the emergency awareness of university students and to enhance their ability to respond to public health emergencies (27, 28).

Conclusion

University students in Shandong province had a high willingness to participate in emergency education but low participation in emergency training and exercise activities. Men, sophomores, medical students, provincial students, only children, good health, and emergency education courses considered it necessary to participate in emergency education. The school attached great importance to emergency education, assumed that the professional level of instructors met the needs, knew about public health emergencies, and had received emergency education such as infectious disease prevention and control. University students' participation rate in emergency training and exercise activities is higher. Therefore, universities should raise the importance of emergency education for university students and carry out emergency training and exercise activities regularly.

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

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

Funding

This research was supported by the National Social Science Foundation (Grant No. 19BMZ078) and the Major Project of Education Science in the 13th Five-Year Plan of Shandong Province (Grant No. 2020VZ007).

Acknowledgments

We are very grateful to the six universities in Shandong province for promoting the survey in their schools.

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

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Ji L, Jinchen X. International emergency education systems and governance. *Global Educ Outlook.* (2021) 50:47–60.

2. Erin. A study on the governance mechanism of Chinese trade unions from the perspective of public health emergencies–a case study on the prevention and control of New Crown Pneumonia. *J Northwestern Univ.* (2021) 51:117–27. doi: 10.16152/j.cnki.xdxbsk.2021-06-011

3. Zeyu D. A preliminary study on emergency education in emergencies. *China Disast Reduc.* (2014) 19:48–50.

4. Jianguo X, Yuhao L. Challenges and reinvention of emergency education in universities in the post-epidemic era. *J Hubei Vocat Techn College.* (2021) 24:39–43. doi: 10.16347/j.cnki.cn42-1742/z.2021.03.008

5. Mo X, Dayong Y. Public health crisis and rethinking higher education governance. *J Educ Renmin Univ China.* (2021) 4:79–94.

6. Li W, Ling L, Jian Z. Research and practice on the improvement of emergency protection ability of college students. *Disast Sci.* (2018) 33:172–6. doi: 10.3969/j.issn.1000?811X.2018.02.030

7. Junchang L, Na W. Suggestions for establishing a sound education system for public health emergencies. *J Central South Univ National.* 1–10. doi: 10.19898/j.cnki.42-1704/C.20221107.02

8. Li YY, Guo Q. Analysis of the current situation and development trend of emergency education at home and abroad. *Firefigh Today.* (2022) 7:1–3.

9. Xiaorong Z, Zuning G. Research on the generation and evolution of online public opinion on public health emergencies and its governance. *J Jiangsu Ocean Univ.* (2022) 20:23–35. doi: 10.3969/j.issn.2096-8256.2022.04.003

10. Ju S. Epidemic drives modernization and reform of public health governance. *People's Forum.* (2020) S1:38–41.

11. Zongzhe R, Xiaoyu L. The evolution, problems, and optimization of public crisis governance in China. *J Northwestern Univ.* (2022) 52:60–72. doi: 10.16152/j.cnki.xdxbsk.2022-05-006

12. Liangwen N, Zhiqiang C, Jinyu N, Ze L, Chaoyi C, Xuejing B, et al. Analysis of public participation in emergency education and influencing factors in China. *China Public Health.* (2020) 36:178–82. doi: 10.11847/zgggws1126596

13. Wengang L, Xiaomin L. Japan's model for responding to major public health emergencies and implications. *Social Governance.* (2021) 7:78–92. doi: 10.16775/j.cnki.10-1285/d.2021.07.014

14. Na W, Wen Z, Xiaohua C, Hongli Z, Pengyu L, Yang L, et al. Analysis of the acceptance of education on public health emergencies and its influencing factors among college students in Shandong Province. *China Public Health.* (2021) 37:1770–3. doi: 10.11847/zgggws1131623

15. Wen Z, Xiaohua C, Jie D, Na W, Min Z, Chang LJ. Analysis on coping ability and influencing factors of public health emergencies of college students in Shandong Province. *School Health China.* (2022) 43:514–7. doi: 10.16835/j.cnki.1000-9817.2022.04.008

16. Wanshan H. An empirical study on the quality of learning activities of college students in Beijing universities. *Beijing Soc Sci.* (2018) 6:24–37. doi: 10.13262/j.bjsshkxy.bjshkx.180603

17. Ya D. *Research on the Current Situation and Countermeasures of Emergency Education for College Students [Master]: Dalian Medical University* (2020). doi: 10.26994/d.cnki.gdlyu.2020.000912

18. Xiaoqing D. *Research on the Emergency Management Mechanism of Local Universities in Case of Emergencies [Master]: Xiangtan University* (2020). doi: 10.27426/d.cnki.gxtdu.2020.001516

19. Xiong MZ. *Research on the Characteristics and Influencing Factors of Public Emergency Cognition in Urban and Rural Communities in Guangdong [Master]: South China Agricultural University* (2017).

20. Chaoyi C, Yanhua H, Qunhong W, Wei X, Tie S, Jianrong Y. Analysis of community residents' emergency literacy level and its influencing factors in Guangdong Province China. *Public Health.* (2020) 36:596–600. doi: 10.11847/zgggws1120913

21. Bingwei T. Exploration and practice of safety and emergency education model for college students. *China Emerg Manag.* (2021) 6:56–8.

22. Shihua C. The development direction of experiential emergency education in China in the post-epidemic era. *Cities Disast Mitigation.* (2021) 1:53–7.

23. Wei L. On the improvement of the rule of law of public health emergency in China–thinking on the basis of the new crown epidemic. *J Soochow Univ.* (2020) 7:50–8. doi: 10.19563/j.cnki.sdfx.2020.03.005

24. Yanping L. A study of factors influencing the effectiveness of community emergency education. *Security.* (2021) 42:26–31. doi: 10.19737/j.cnki.issn1002-3631.2021.11.005

25. Fang W, Lu A, Ruhua H, Yuting H, Xianwen W, Guangyao Z, et al. Scientific response and thinking in public health emergencies: graphic experts talk about the new crown outbreak. *Know Library Inform.* (2020) 2:4–14. doi: 10.13366/j.dik.2020.02.004

26. Lingzhi S, Hanqing H, Na L, Fengguang C, Yudong W, Chonggao H, et al. Analysis of the current situation of public services in public health emergencies: the case of the New Crown *Pneumonia* outbreak. *Rural Health Care Manag China.* (2021) 41:734–9. doi: 10.19955/j.cnki.1005-5916.2021.10.009

27. Ling Z, Yuetong H, Bo Z, Xiaoyun W, Qi W. Reflections on emergency education for emergencies in China in the post-epidemic era. *J Nanjing Univ Trad Chin Med.* (2022) 23:206–10.

28. Monicah KR. Preparedness of institutions of higher learning for emergency education in COVID-19 pandemic: a case of Uganda. *Educ J.* (2022) 11:231–4. doi: 10.11648/j.edu.20221105.13

frontiers | Frontiers in Public Health

TYPE Curriculum, Instruction, and Pedagogy
PUBLISHED 13 April 2023
DOI 10.3389/fpubh.2023.1144716

OPEN ACCESS

EDITED BY
Sharon Brownie,
Swinburne University of Technology,
Australia

REVIEWED BY
Susie Sykes,
London South Bank University,
United Kingdom
Katalin Papp,
University of Debrecen,
Hungary

*CORRESPONDENCE
Danish Ahmad
✉ Drdanish.research@gmail.com

SPECIALTY SECTION
This article was submitted to
Public Health Education and Promotion,
a section of the journal
Frontiers in Public Health

RECEIVED 15 January 2023
ACCEPTED 24 March 2023
PUBLISHED 13 April 2023

CITATION
Ahmad D, McFarlane RA, Smith J, Saxena D, Somerset S and Mavalankar D (2023) Evaluation of a virtual, simulated international public health peer-to-peer exchange learning experience.
Front. Public Health 11:1144716.
doi: 10.3389/fpubh.2023.1144716

Evaluation of a virtual, simulated international public health peer-to-peer exchange learning experience

Danish Ahmad[1,2,3]*, Rosemary A. McFarlane[4], Jennifer Smith[5], Deepak Saxena[3], Shawn Somerset[4] and Dileep Mavalankar[3]

[1]School of Medicine and Psychology, College of Heath and Medicine, Australian National University, Canberra, ACT, Australia, [2]Health Research Institute, University of Canberra, Canberra, ACT, Australia, [3]Public Health Foundation of India, and Indian Institute of Public Health-Gandhinagar (IIPH-G), Gandhinagar, India, [4]Faculty of Health, University of Canberra, Canberra, ACT, Australia, [5]Learning and Teaching, University of Canberra, Canberra, ACT, Australia

Introduction: Public Health's (PH) global rise is accompanied by an increasing focus on training the new generation of PH graduates in interdisciplinary skills for multisectoral and cross-cultural engagement to develop an understanding of commonalities in health system issues and challenges in multi-cultural settings. Online teaching modalities provide an opportunity to enhance global health skill development through virtual engagement and peer exchange. However, current teaching pedagogy is limited in providing innovative modes of learning global health issues outside of traditional classroom settings with limited modalities of evidence-informed implementation models.

Methods: This study designed, implemented, and evaluated a novel global health online synchronous module as proof of concept that incorporated elements of virtual Practice-based learning (PBL) using a case study approach offered to currently enrolled public health students at the University of Canberra (UC) and a partnering public health university from India, the Indian Institute of Public Health Gandhinagar (IIPH-G). Using constructive learning theory and the Social Determinants of Health framework, four online sessions were designed and implemented in August–September 2022. Formal process and outcome evaluation using a quantitative adapted survey of the validated International Student Experience survey (IES) at session end and findings provided.

Results: Over 100 participating public health students from Australia and India provided narrative feedback and quantitative responses from the adapted IES instrument across four key dimensions, namely "motivation," "personal development," intellectual development, and "international perspectives" reporting an overall high mean impact of 4.29 (out of 5) across all four themes seen together. In essence, the sessions supported students to explore global health issues from a different cultural perspective while developing intercultural communication skills and enhancing their global exposure in real-time.

Discussions: This innovation, implemented as a proof of concept, provided evidence, and demonstrated the implementation feasibility of a flexible virtual integrated practice-based module that can supplement classroom teaching. It provides participating students with the opportunity to develop intercultural understanding and communication competence as well as support global mindedness by engaging with international peers around focused global health case studies.

KEYWORDS

global health education, virtual learning and education environment, constructivist learning approach, global health evaluation, cross-cultural learning and teaching

1. Introduction: Background and rationale for the educational activity innovation

Public Health (PH) has gained global prominence in the health sector as a multidisciplinary field able to meet emerging global health challenges (1, 2). Despite regional differences in health outcomes, common global health challenges such as the reemergent viral pandemics, rising non-communicable diseases and health inequities form a core part of health system functions and health workforce responsibilities (3). Moreover, common global health goals set by the United Nations now provide a unique opportunity for global health professionals to collaborate, learn from programmatic experience, and advance health promotion activities based on local cultural contexts (3).

At the same time, global health's rise is accompanied by an increasing focus on training the new generation of global and public health graduates in interdisciplinary skills for multisectoral and cross-cultural engagement in varied healthcare settings (2–4). While interdisciplinary skills allow students to appreciate the multiple influences on health and working in diverse healthcare settings, transnational PH experiences allow students to develop a cultural appreciation and an understanding of cultural commonalities and differences in health system issues (3, 5–7). Current teaching pedagogy, however, is limited in providing innovative modes of enhancing competency-based outcomes for contemporary global health issues in a traditional classroom setting, especially for postgraduate public health courses (1, 3, 7, 8). Conventional classroom teaching provides students with knowledge of global health challenges but without the benefit of real-time exchange and learning from peers in different global settings (5–9).

This, in many instances, limits the opportunity for students and future global health practitioners to develop applied skills in developing culturally appropriate, health promotion strategies specific to local contexts, as well as developing communication skills when part of culturally and linguistically diverse professional work environments. Moreover, learning designers note the crucial role of integrated practice-based learning in cross-cultural cooperative learning groups (9, 10) *via* facilitated and scaffolded learning in developing knowledge and skills.

One of the ways to foster authentic cross-cultural learning is to provide opportunities for peer-to-peer engagement. The adoption of cross-cultural learning has usually been fostered through in-person classroom sessions where social connections and communication are better leveraged among attending participants. Moreover, greater cultural immersion has conventionally been linked to study abroad programs that have also been the primary mode for international health system exposure (11, 12). An evaluation by Tran et al. (13) in Australia, for example, the Australian Government's flagship university student (undergraduate only) travel and study abroad (in semester) grant, the New Colombo Plan (NCP), showed an increasing number of students reporting greater cultural appreciation of regional host countries post-program participation, along with an increase in students choosing to work in jobs "based in the (Indo-pacific) region" (13). While such study abroad programs advance student global student mobility, most operate from Government funded programs based *in* high-income Global North countries like Australia. While in-country immersion is effective, we recognize asymmetry in global learning for students in countries in which such opportunities are not readily available, as well as for most post-graduate students and even those students from high-income countries who may have time limitations, financial constraints, and family carer responsibilities.

Moreover, this conventional model of study abroad programs has largely been replicated in the online iteration with virtual internship programs over the period of COVID-19 travel restrictions (14–17). Virtual placements increasingly offered through third-party for-profit providers during this time demonstrated the potential to provide powerful transnational learning. However, a scan of available literature for implementation modalities for public health experiential learning and study abroad pedagogies experiences highlighted a lack of opportunities to embed skills-based global health learning outcomes (18–22). Thus, we sought to develop an equitable, cross-cultural peer learning opportunity. Tailored to our courses and universities' own teaching and learning curriculum and outcome (23).

This study showcases a series of virtual authentic cross-cultural online learning exchange sessions called the "International Peer Exchange Learning Innovation, the University of Canberra" or I-PELICAN, for global health, including Master of Public Health students between an Australian and Indian University. The University of Canberra (UC) is a public-funded Australian university with a focus on allied health courses and a strong focus on enhancing student equity in university enrollment, and participation (24). UC's student equity focus includes removing structural inequalities that act as barriers to university entry, and subsequent course completion which is evident by the Times Higher Education ranking which placed UC at #1 globally in reducing inequalities in 2022 (24).

As such, our aim was to provide UC's diverse cohort of global health students in-semester with an international virtual authentic cross-cultural learning experience with an overseas participating university.

Thus, the proposed innovation was to develop I-PELICAN sessions as proof of concept as an adaptable online module, delivered over four weeks during the academic semester that integrated into an existing Global Health unit at UC and in-semester for the postgraduate public health course at the participating Indian University – the Indian Institute of Public Health-Gandhinagar (IIPH-G). IIPH-G is India's first and largest autonomous public health university offering postgraduate public health degrees, advanced research, and capacity building. IIPH-G and UC's pre-existing academic relationship was leveraged to advance this academic innovation which provided students from both countries the opportunity to develop a deeper appreciation of health system gaps, not only highlighting differences

in cultural contexts but, importantly, also showcasing common health issues faced by a high-income and lower-middle-income country relating to health care access and equity. This bidirectional student exchange in real time included several innovative educational activities which would build cross-cultural, peer exchange competencies for participating students.

2. Pedagogical framework(s), pedagogical principles, competencies/ standards underlying the educational activity

I-PELICAN's online module design was informed by the pedagogical expertise of an educational designer at UC, who worked with the PH teaching team to design an online social constructivist learning environment (9, 10) using practice-based learning. This approach views learning as a process of interpreting, building, modifying, and understanding reality through social interactions with others *via* cooperative learning (9). A review by Thomas et al. (2014) suggests that social constructivist learning theories in knowledge translation are essential for best practice in health professionals (10).

Practise-based learning (PBL) using a case study approach allows students to translate classroom theory to real-world issues, promoting competency development (9–15). While different models of PBL demonstrate success, mentor-based PBL sessions have increasingly been adopted by PH universities with higher student success outcomes. Research also shows that experiential learning is valued by both students and employers alike from a graduate readiness perspective (7–10). Yet only a minority of universities offer PBL integrated into PH courses. A systematic review in 2021 reported only 40 graduate PH programs globally offering practice-based learning (1). Incorporating traditional PBL is further challenged by the rise of online delivery of PH units (1). While online delivery opens educational access to a wider cohort of students, the mode is limited in offering advantages linked to place based PBL sessions (15–17, 25, 26). Thus, the pedagogy guided the development of a new global health online synchronous module that incorporates elements of a virtual PBL which can be integrated within an existing semester unit.

Each of the four linked online tutorial sessions embedded constructivist learning theory using practice-based learning focussing on real-world cases such as COVID-19, to which a contemporary global health framework was applied, the Social Determinants of Health (SDH), to scaffold the session activities (27). The selection of the SDH framework allowed the incorporation of contemporary global health theory, supporting students to develop a greater appreciation of how cultural factors could influence health care seeking at multiple levels of societal influence. The mentors facilitated online sessions by prompting structured problem-solving and skill development using the SDH framework. This approach involved incorporating complementary theories and pedagogical design to structure sessions where authentic student-led peer exchange could occur in real-time and in a collaborative yet culturally sensitive environment. As these sessions were embedded in an ongoing global health unit at UC and in the MPH at IIPH-G, the learning objectives developed an understanding and application of cultural awareness using a contemporary global health framework for health promotion design that could be applied in different cultural and social contexts. The learning objectives were assessed during the final I-PELICAN session through students' application of new learning in producing group-based E-posters focussing on contemporary global health issues as per the case study assigned to them. The E-posters provided visual evidence of this application of learning and were used as a presentation aid for the groups to share and reflect on their learning with the whole cohort.

Based on the notion that constructivism is an active process of knowledge constructing rather than acquiring knowledge, and facilitated instruction is a process of supporting that construction rather than communicating knowledge (28), the intention was to design a supportive online environment that fostered engagement through active learning strategies which encouraged peer to peer exchange for cross-cultural learning, supported by the mentorship of a team of cross-institutional academic facilitators.

To illustrate the pedagogical approach in action, we outline below the structure and intended outcomes for the virtual sessions, all of which were based on Zoom and used collaborative software including Padlet[1] and Google Docs[2] to enable equal access by both groups for real-time sharing and collaboration.

The first pilot session set learning expectations and introduced cultural practices that mark gatherings, such as an Acknowledgement of Country (Australia) and Lighting of the Lamp (India), with time for the facilitator and student introductions. Academics from both institutes modeled cross-cultural collaboration by working through the required activity in Zoom's main room before students were sent in mixed UC-IIPH-G groups to breakout rooms to do the same activities under the guidance of a facilitator/mentor. Students were asked to bring a photo/image that could be used to share cultural insights, and this created rich discussions and enabled students to not only introduce each other's lived experience but to learn about virtual collaborative software and create new knowledge, reporting back to the main room with the groups' reflections. This also scaffolded students toward the next tutorial activity, which was to bring photos depicting cultural influences on health care-seeking behaviors.

For consistency and clarity purposes, the same structure was applied to all tutorial sessions, which included a plenary session where academics from both institutions "modeled" the activity for that session by applying the SDH framework to analyze the various case studies. This provided clarity on the learning expectations and objectives for the group work which followed in break-out rooms. Each tutorial ended with a presentation in the main room by each group and resulting in active reflection and collection of feedback from students and facilitators. The immediacy of this feedback provided the authors an opportunity to refine subsequent sessions which highlighted to students that their feedback was valued and acted upon.

The embedded real-time process evaluation included facilitator and student qualitative free text captured in a specific feedback template pre-designed using Padlet and provided to each group at each session's end. These reflections and feedback informed the subsequent session delivery and design. The I-PELICAN session's formal evaluation comprised a Quantitative Qualtrics survey based on

1 https://www.padlet.com

2 https://www.google.com.au/docs

an adapted International Education Survey (IES) administered at the end of session four and created E-posters as visual evidence of the application of learning. Separately, a written reflective component as part of an in-semester assessment was included for UC students only two weeks after the final session.

3. Pedagogical format and learning environment; learning objectives; and results.

Study authors from the Australian and Indian universities jointly codesigned, implemented and evaluated four online sessions for a mixed cohort of over 100 students from both universities in August and September 2022. These sessions were styled around conventional Australian university tutorials, which provide greater space for student engagement and interaction. The I-PELICAN tutorial sessions thereafter "sessions" were structured to facilitate peer-to-peer learning using a case study approach, with 10 online break-out groups, each supported by a facilitator/mentor (drawn from both institutions). The mentor's role, who was a UC or IIPHG academic, was to facilitate a supportive online environment, encourage student interaction in the break-out rooms and help provide input as a collaborator if required by individual student groups.

3.1. Pedagogical format and the learning environment

Guided by the UC educational designer, academics from both institutions workshopped the suggested pedagogical framework and approaches, including practice-based learning (PBL) using a case study approach and active learning *via* cross-cultural cooperative learning groups (9). Several key considerations and anticipated challenges of taking this pedagogical approach were identified in the initial month-long design phase of module development, and strategies were developed to address these challenges, which were further refined over the delivery of the module. This led to an emphasis on session planning, facilitator pre-briefing sessions, teaching resource preparation, and immediate collection of student and facilitator feedback after each session with the view to refining subsequent sessions.

Anticipated challenges identified in these academic/facilitator pre-briefing workshops included possible issues with cross-cultural cooperative learning group dynamics that may result in reduced student participation and case study contributions. Strategies identified to address these challenges included communicating to students ahead of the session to be clear about the purpose and expectations, scheduling a pilot/training session for students and staff, role-modeling by academics and the use of effective questioning techniques and allocating a facilitator per group as a mentor and learning support.

3.2. Session plan and learning objectives.

The overall learning objectives were co-designed by UC and IIPH-G academics (see Illustration 1 below) and scaffolded from session to session to help students progressively build their understanding, confidence, and cross-cultural perspectives through the application of the SDH framework to related PH case studies.

ILLUSTRATION 1 I-PELICAN session plan and learning objectives.

	Training (pilot) Session	Session #1	Session #2	Session #3
Tutorial Theme		**Understanding India and Australia's COVID journey**		
Tutorial Focus	Orientation/ Context Setting	**New Knowledge Development**	**Skill Development**	**Applied Focus**
Learning objectives	Welcome, introductions, and refinement	Develop an understanding of how cultural and societal factors influence the perception of healthcare-seeking attitudes in an Indian and Australian context	Learn about analytical frameworks for systematically approaching contemporary public health issues in an international context	Apply theory and real-life experience to develop a health system intervention to address a contemporary global health challenge
Pre-session activity	Elements from all three main tutorials were trialed	Bring two photographs peer exchange for a cultural introduction themed around "person, place and health care setting" in the local community	Collect interview insights from family/friends on COVID-19 behaviors, attitudes, and knowledge using prompts	Read two open-access case studies on Tuberculosis management in India and refugee health in Australia

To meet the learning objective of the **training (pilot)** session – welcome, introductions, and refinement students were briefed at each institution prior to the session, requesting students to source two photos/images that depicted culture in their context that students would be willing to share online to the broader cross-institutional group. Figure 1 below shows a filled template that has been reproduced with permissions for this study. This activity met the tutorial focus of context setting – orienting students to the overall module aims and making initial introductions in groups. Students were invited to share their initial feedback *via* Padlet at the end of the session.

With the focus of the first tutorial session being new knowledge development and to meet the learning objective of the session – to develop an understanding of how cultural and societal factors influence the perception of healthcare-seeking attitudes in an Indian and Australian context – students were again briefed to source and share two pictures each illustrating a disease problem in their

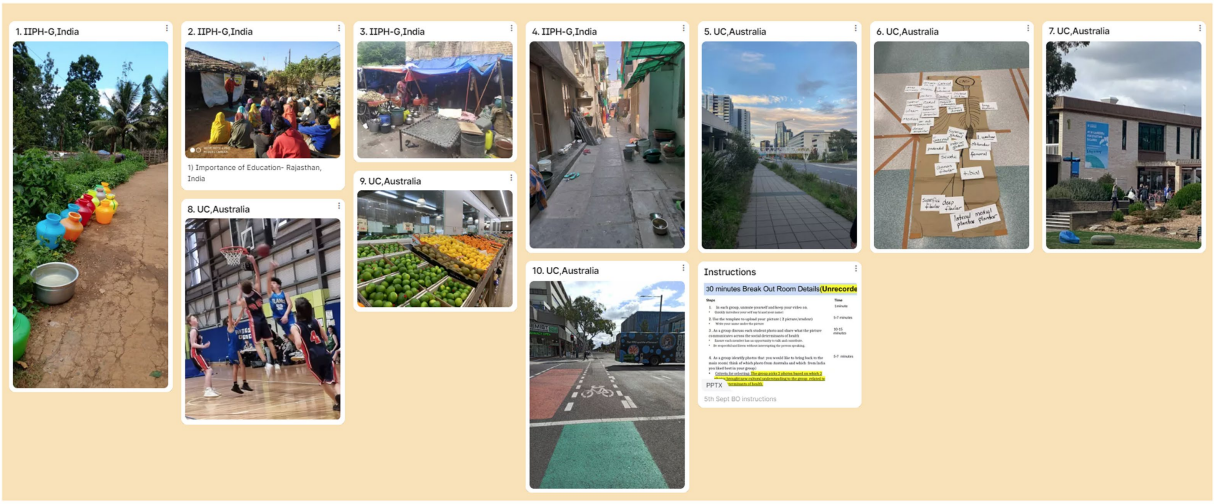


FIGURE 1
Shows cultural awareness group activity using photographs uploaded on Padlet in a Zoom breakout room in the first(pilot) I-PELICAN session.

country – using COVID-19 as the case study which enabled students to work from a shared experience. Again, this facilitated rich discussions, this time within a shared PH theoretical framework (SDH). Having identified cultural influences on healthcare-seeking behavior, students were required to prepare for tutorial #2 by collecting short interview insights from their family or friends regarding attitudes, behaviors, and knowledge about COVID-19 safe behaviors, vaccination, and post-COVID-19 perceptions.

In preparation for the **second tutorial session**, students were required to collect short interview insights from their family or friends regarding attitudes, behaviors and knowledge about COVID-19 safe behaviors, vaccination and post-COVID-19 perceptions, thus testing and extending their new insights. This session focused on skill development and, as such, to meet the learning objective – learning about analytical frameworks for systematically approaching contemporary public health issues in an international context – students shared their observations from interviews with family and friends and using the SDH framework, identified barriers and enablers of cross-cultural healthcare seeking behaviors at the individual, community, and system levels. In groups, students synthesized their findings as text into the SDH framework template using Google docs (see text footnote 2) as the collaborative platform, sharing collective reflections in the main room.

The third and final tutorial session was on applied focus. As such to meet the learning objective – apply theory and real-life experience to develop a health system intervention to address a contemporary global health challenge – students were required to prepare in advance of the session by reading two case studies that were identified and shared by study authors from the open access BMJ Global Health case study series (29, 30) which reflected global health-based cases suited to the session's overall learning objectives. Students were asked to extract cultural and SDH insights from each case study and bring related photos they identified illustrated healthcare-seeking behaviors related to the case series in preparation for this session. In the session, mixed student groups were randomly allocated to one case study and were tasked with developing a (draft) E-poster on Padlet applying the SDH framework and exploring ways to improve health outcomes (see Figure 2). Each group produced and presented their collaborative work to all participants in the main room: demonstrating the use of online, collaborative tools, demonstrating the assimilation of new knowledge, skill development, and relationships, and the development of cultural insights over the 4 weeks. Groups presented their E-poster in the final Zoom main room to each other and to invited guests who represented senior UC and IIPH-G academics. This final session was a virtual simulation of the approach global health practitioners take in co-preparing and presenting healthcare interventions.

3.3. Learning outcomes and evaluation framework.

The learning outcomes were assessed in session by the completion of an E-poster forming visual evidence of the application of student learning, and formally using the Qualtrics survey at the end of the final session. The Qualtrics survey sought to capture the impact of participation in the program by adopting a validated International Education Survey (IES) questionnaire [31] that measured four key themes related to; "motivation," "international perspective," "personal development" and "intellectual development." Evidence from the survey generated quantitative evidence to evaluate the impact of the program and complimented the free text qualitative information that was collected from students after each session *via* Padlet.

While these suggestions fed into iterative improvements for each session, the formal evaluation of the program comprised the application of learning evidenced by a co-produced E-poster which demonstrated facilitated reflection and meaning-making through the process of social interaction with others (32) (b) and the completion of Qualtrics Survey (c) in the final session. The three evaluations are detailed below.

a. In-session process evaluation: free text qualitative feedback (see Figure 2).

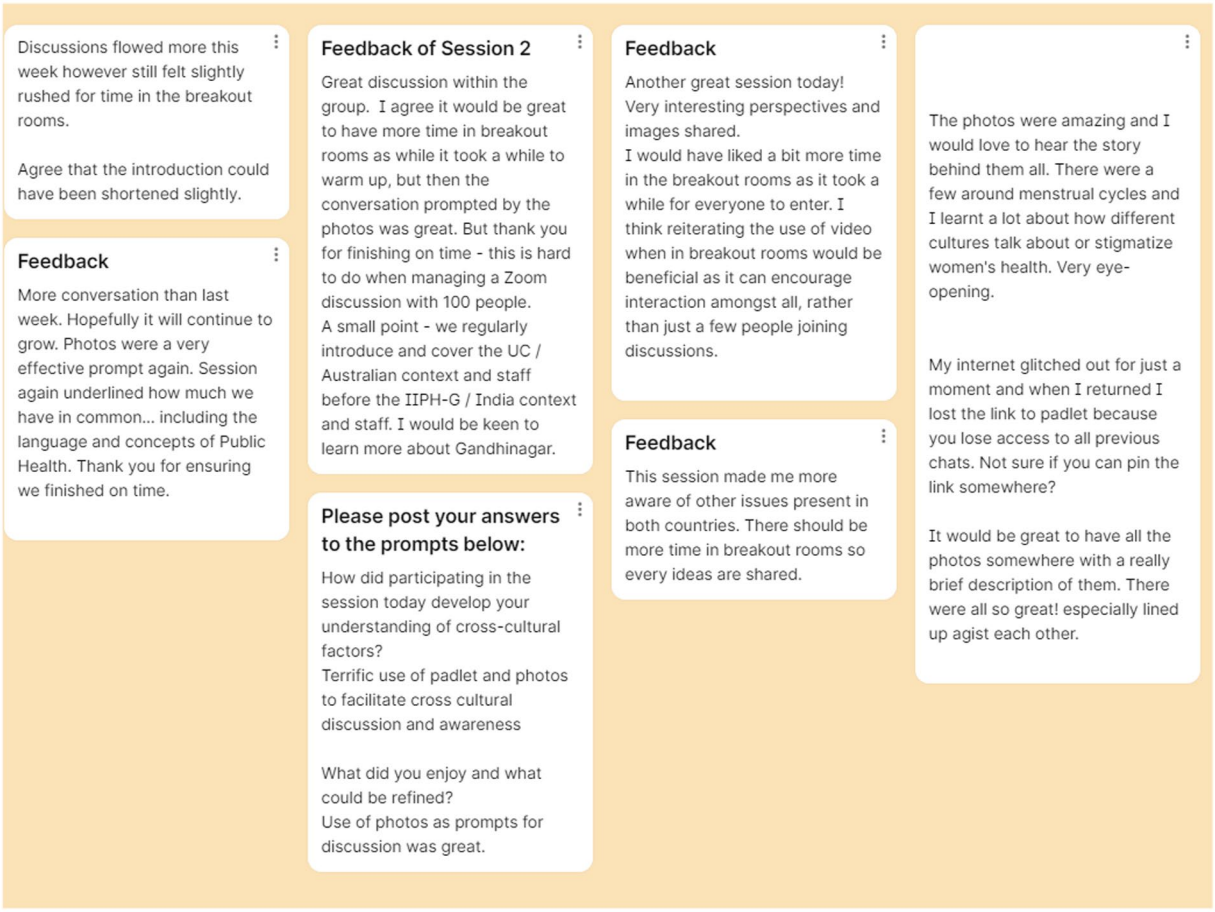


FIGURE 2
Example of post-session free text feedback provided by UC students using Padlet.

All students were provided dedicated feedback Padlet links at the end of each session with the option of providing feedback around session engagement and suggestions for improvement.

Both universities were separately provided with a Padlet link where they could provide optional feedback using open-text comments around prompt questions centered around engagement, learning outcomes and other suggestions. For each session, the feedback was reviewed by the study authors / facilitating academics and thus, subsequent sessions were refined to incorporate suggestions where feasible. This progressively enabled modifications of the sessions, including for and by each university student group.

b. In-session outcome evaluation: Creation of an E-poster.

The E-poster template was created by the study authors, using prompt questions linked to two contemporary global health case studies adapted from the BMJ's case studies series (29, 30), which related to the Tuberculosis program management in India and Migrant health care in Australia. The E-poster template was novel in that it linked a global health case study to the social determinants of health framework but also allowed students to construct new meaning or knowledge virtually and collaboratively while determining a health promotion strategy. The E-poster tool was not only part of the assessment strategy but also provided visual evidence of students' collaborative application of this new learning, which they used as a presentation aid in sharing and reflecting back to the whole cohort. The completion of the E-poster and the degree to which the students successfully completed the E-poster was an indicator of a successful curriculum and purposeful student engagement. As an illustration, Figure 3 in the result section 5.3 provides an example of a completed E-poster on Tuberculosis program management presented online by one of 10 student groups in the final I-PELICAN session.

c. In-session outcome evaluation: Modified International Education Service-Learning survey:

The main evaluation outcome was an online Qualtrics survey adapted from the IES questionnaire which was provided to all students and facilitators at the end of the final session in week four. This sought students' self-assessment of their participation outcomes in the I-PELICAN series across four themes, namely "motivation," "personal development," "intellectual development," and "international perspectives." Previous studies have validated the scale reliability of the IES questionnaire and constituent themes (31, 33). The survey data were descriptively analyzed to identify means and standard deviation for the individual items and the four themes in Microsoft Excel version 2,301. Results from the Qualtrics survey across the themes are presented in this paper. The study authors also designed a special certificate of appreciation using graphic designing software CANVA (34) for

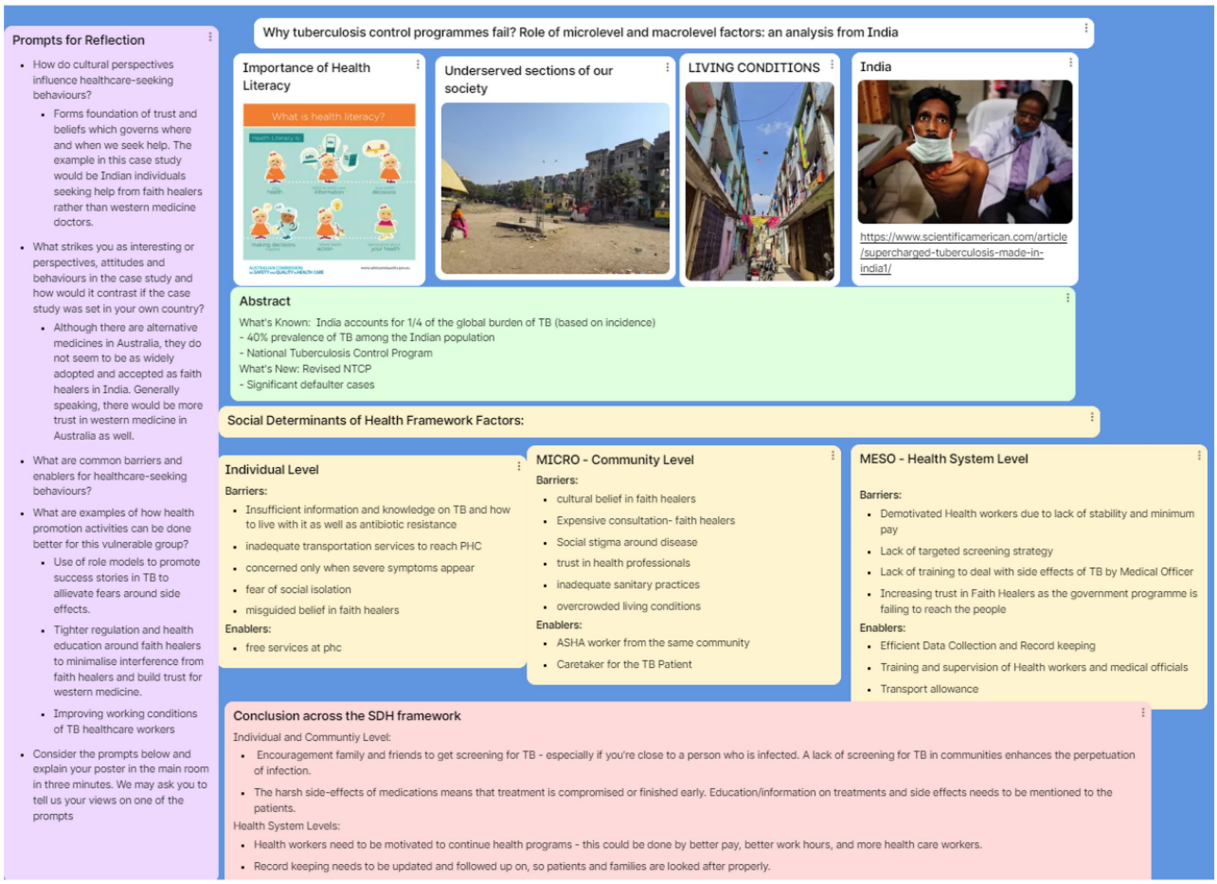


FIGURE 3
A completed E-poster on tuberculosis program management presented online by one of 10 student groups in the final I-PELICAN session.

students who completed three out of four sessions and completed the online Qualtrics survey to use as evidence of virtual work integrated learning participation.

Broadly the aim of the post-session evaluation was to determine:

- students' motivations to participate in these sessions,
- to what extent their professional development and intellectual development was enriched by participating in the experience and the collaborative application of new learning evidenced by the completion of the E-poster as relevant to the case study they were assigned,
- if the experience enhanced/influenced their international perspectives,
- if students valued learning about cross-cultural influences in healthcare-seeking behaviors.

4. Results

For the purposes of this paper, the I-PELICAN session's formal evaluation comprises the IES Qualtrics survey and the created E-posters. The results are provided across each of the domains of the Qualtrics survey, which are supplemented by free-flowing narrative feedback that students provided.

4.1. Modified International Education Survey findings

The demographic results of the students who participated in the end-of-session Qualtrics survey are provided in Table 1 below. In all, there were 102 students from both Australian and Indian universities combined, out of which the majority, 64 students (75%), were Indian students from IIPH-G. The sessions were attended by both undergraduate and postgraduate students from UC who were enrolled in the co-taught undergraduate /postgraduate Global Health unit, with more undergraduate students (17) participating compared to postgraduate students (8). Among these, most UC students were enrolled in the Bachelor of Physiotherapy course but taking the global health unit as an elective unit/subject, followed by MPH students. As IIPH-G specializes in postgraduate-only courses, overall, most participating students (68) came from the MPH course at IIPH-G. Additionally, the age and gender details showed that 68 students identified as female gender with a median age of 25 years across both universities. UC as a university focuses on enhancing equity and social inclusion in their student cohorts which was also seen in the wider age range of participating UC students (19–53 years), suggesting the presence of mature-age students in the UC participating cohort as well. The survey also showed that from a linguistic perspective, English was the most common language spoken at home for UC students, while in India, most students shared that they came

TABLE 1 Basic sociodemographic details of participating students overall and from each university.

	Variable	Total responses from both Universities	University	
			University of Canberra (UC) (*n* /%)	Indian Institute of Public Health -Gandhinagar (*n* /%)
1	Number of Students Participating	102	21 (24%)	64 (75%)
2	**Level of students**			
	Undergraduate	17	13 (76%)	–
	Postgraduate (MPH)	68	8 (38%)	68 (100%)
3	**Course enrolled in**			
	Undergraduate		Bachelor of Physiotherapy	–
	Postgraduate		Master of Public Health	Master of Public Health
3	**Gender**			
	Male	15	8 (38%)	7 (11%)
	Female	68	13 (62%)	55 (88%)
	Non-Binary/Third Gender	1	–	1
4	The median age in years	25.6 years	25 years	23 years
		(SD 4.6)	(SD 2.7)	(SD 8.3)
		Range (19–53)	Range (20–34)	Range (19–53)
5	Have Australian/Indian students lived or traveled outside of their respective countries?		Yes: 21 (70%) out of 30 student responses from UC	Yes, 17 (27%) out of 62 student responses from IIPH-G.
6	Preferred language to speak at home		English	Hindi (English was the second most common language)

from "Hindi" speaking households. The survey also enquired about international exposure through travel and living abroad from each cohort of Australian and Indian students separately. The results showed that more UC students (70%) had international exposure compared to Indian students (27%).

Table 2 provides survey results from the adapted IES instrument across four key dimensions, namely "motivation," "personal development," "intellectual development" and "international perspectives." While the final session reported 102 participants, the individual number of responses for each of the domains varied.

4.2. Modified International Education Survey results

Students reported an overall high mean impact of 4.29 (out of 5) across all four themes seen together. As shown in Table 2 below, the grand mean (*M*) was highest for the domain of "Motivation" ($M = 4.36$, SD = 0.9), followed by "International Perspectives" ($M = 4.30$, SD 1.30) and similar scores for Personal Development ($M = 4.25$, SD = 0.90), Intellectual Development ($M = 4.25$ SD = 1.30).

Individual items within domains showed means ranging from the lowest mean of 3.20 with regards to participating in the I-PELICAN sessions as a motivating factor to the highest mean of 4.60 for reasons related to learning more about a different culture and experiencing learning in a different context.

As shown in Table 2, the domain "Personal Development" reported the highest mean ($M = 4.40$) for the item responses "*Contributed to your level of self-confidence to engage with cross-cultural peer learning*" and "*Enhanced your interaction with people from other cultures*." The lowest mean ($M = 3.88$) referred to "*give me an idea of whether I am interested in studying overseas*." This is an encouraging result as it indicates that the planned cross-cultural learning environment worked as it was intended to provide students with a virtual experience of cross-cultural healthcare practices.

Regarding the domain of "Intellectual Development," both items reported similar high mean scores of 4.25, reflecting the impact of participating in the I-PELICAN sessions on providing a greater awareness and interest in global health topics. In terms of the final domain of "International Perspectives," the high overall mean was reported for an enhancement of Indian culture, this reflects both students from Australia and India jointly reporting that the sessions enhanced their worldview and understanding of how culture in India influenced health-seeking behaviors.

The above quantitative survey results represented the final outcome evaluation findings using the adapted IES instrument. Separately, insights from the final in-session E-poster activity reflecting the applied focus or skill development aim of the I-PELICAN session are presented.

4.3. Insights from the in-session E-poster activity

The final session represented the "applied focus" of the I-PELICAN sessions, where cross-cultural groups of students were provided with

10.3389/fpubh.2023.1144716

TABLE 2 Aggregated student results for the key domains of "Motivation," "Personal Development," "Intellectual Development," and "International Perspectives" from modified international education survey.

Motivation: I decided to participate in this I-PELICAN session'	Responses (n=73)	Average (out of 5)	SD	Score Range
1. To learn more about a different culture	73	4.60		2–5
2. To improve my employability	69	3.65	1	1–5
3. To experience learning in a different context	74	4.60	0.6	3–5
4. For personal growth	74	4.50	0.7	2–5
5. Because of a course completion requirement	59	3.20	1.4	1–5
6. Because it suits my learning style	54	3.80	1.2	1–5
7. Because a friend/lecturer/classmate mentioned it	66	3.80	1.3	1–5
8. Other	10	3.00	1.8	1–5
Grand Mean for Motivation		4.36	0.9	1–5
Personal Development: To what extent has your I -PELICAN learning experience as a student	**Responses (n =85)**	**Average (out of 5)**	**SD**	**Score range**
1. To give me an idea of whether I am interested in studying overseas	68	3.88	1.1	1–5
2. Increased the likelihood that you would work in another country	68	3.97	1.0	2–5
3. Because experiential learning with peers is a more effective way to learn for me	57	4.19	1.0	2–5
4. I would be motivated to attend the next series of I-PELICAN sessions with another university	72	4.33	0.9	2–5
5. I would encourage other public health university students to participate in I-PELICAN tutorials in the future	70	4.34	0.8	1–5
6. I would prefer to attend more of I-PELICAN like sessions in place of regular global health classes	60	4.37	0.7	3–5
7. Facilitate an intercultural dimension in your volunteer activities	69	4.38	0.7	2–5
8. Contributed to your level of self-confidence to engage with cross-cultural peer learning	70	4.40	0.8	2–5
9. Enhanced your interaction with people from other cultures	69	4.40	0.7	2–5
Grand Mean for Personal Development		4.25	0.90	1–5
Intellectual Development: To what extent has your I-PELICAN learning experience as a student	**Responses (n = 85)**	**Average (out of 5)**	**SD**	**Score range**
1. Inspired you to read further on cross-cultural influences on global health topics	69	4.25	0.8	2–5
2. Inspired me to question assumptions when discussing cultural issues in global health	71	4.25	0.7	2–5
Grand Mean for Intellectual Development		4.25	0.80	2–5
International Perspectives: To what extent has your I PELICAN learning experience as a student.	**Responses (n = 85)**	**Average (out of 5)**	**SD**	**Score range**
1. Enhanced your understanding of Australian culture	72	3.96	1	1–5
2. Enhanced your understanding of Indian culture	70	4.50	0.8	2–5
3. Facilitated an international or intercultural dimension in your work or activities	70	4.27	0.8	2–5
4. Influenced your understanding of global health issues in other countries	73	4.29	0.8	1–5
5. Influenced your discussion with other people about international and transcultural issues	69	4.30	0.8	2–5
Grand Mean for International Perspectives		4.30	1.30	1–5

the opportunity to apply the SDH framework to identify and develop a new health promotion strategy using the E-poster template. Successful poster creation and in-session presentation were reflective of successful engagement and cross-cultural knowledge development across the I-PELICAN sessions. In the final session, all (ten) groups completed the E-poster which also validated its usability in a cross-cultural and mixed student setting. As outlined, the IPELICAN sessions foci were to encourage new knowledge and ways of thinking about health promotion activities, and this aspect was observed *via* the quality of the E-posters produced and student engagement in the sessions that were jointly observed by the study authors. As an illustration, a co-produced E-poster from one group is provided in Figure 3. Student engagement showed that structured prompts were meaningful to drive the discussion while providing flexibility in addressing the questions. Separately student's Padlet feedback as seen below showed an appreciation for a supportive online environment that fostered engagement by linking cultural immersion through sharing photographs and cultural stories as evidenced *via* the completed E-posters.

> I really liked this way of learning through pictures, we got to learn a lot about each other and our ways of thinking. Not only do we just share our photos, the discussion after is interactive. Each photo shows the students' effort to bring different aspects of life to the class. It keeps us motivated to do better by next class. (IIPH-G, India student respondent).

While the E-poster activity was mainly reviewed in-session, students' experience of participation also came through a separate post-session narrative written reflection using Borton's framework (34), which Australian students completed as part of an in-unit assessment. For non-participating UC students, an alternative reflection was created and compared by study authors, but for the scope of this paper, only key reflections from participating students around themes of peer-to-peer engagement, cultural appreciation, and learning are presented. Students indicated that they appreciated the virtual cross-cultural learning experience.

> the experience of presenting to a global cohort cannot be understated and was a significant learning point for myself.

The deliberate use of cooperative learning groups served to foster social interactions (9) for cross-cultural sharing and learning. Although it is recognized that there are some benefits in mixing up student groups, keeping the groups the same over such a short timeframe and with the intention of building social trust to enhance sharing and contributions proved to be essential.

> …the biggest strength noticed by myself and others in my group was the fact that we remained with the same students throughout our entire global experience. Because of this, we were able to build trust and friendships in order to speak about things that may have been harder to talk about with new students every week.

The student reflections also provided insights into the constructivist learning paradigm that informed much of the I-PELICAN session design. The sessions embedded constructs fostering peer-to-peer learning as a precursor for working in multicultural teams for future health care workers as well as recognizing the importance of understanding culture from a local lens or construct for designing health intervention. Student reflections indicated an appreciation of peer-to-peer engagement in an authentic manner, as shown by comments such as:

> What stood out was the effect of cultural beliefs on healthcare. I was aware that culture has a great influence on health, but just how much, I never realized until these sessions. The interaction with the facilitators and other participants was brilliant. Everyone was rich with experience and happily and respectfully contributed to the discussions. About myself, I realized that I had been until now looking at health clinically, henceforth I need to look at it from a different perspective.

Overall, students indicated that participation in the I-PELICAN was a rewarding experience;

> I was surprised to learn how different we were due mostly to the culture of India having a basis more in spirituality then our Australian culture. I was told that it's not uncommon for families to use faith healers or similar figures to resolve common ailments – this can become problematic as with the case of TB.

5. Discussion on the practical implications, objectives, and lessons learned

5.1. Practical implications

The four I-PELICAN sessions were the first virtual global health series conducted between an Australian and Indian Public Health university, to our knowledge, where constructive learning pedagogy was embedded, utilizing a contemporary global health framework (SDH) to cross-culturally analyze real-world health case studies. The sessions were designed and delivered as a proof of concept, which demonstrated implementation feasibility and a high degree of student satisfaction, as evidenced by the IES survey and student results. The implementation feasibility is important to highlight here as the learning experience and methodology allow potential replication across other public health subjects among partnering universities but also serve as a template for other universities elsewhere. While online learning has transformed tertiary education and enhanced student equity, classical learning theory informs much of current, contemporary online learning approaches (4, 5, 9, 10). Our study adds to existing research and presents a novel method to embed constructivist learning theory and the application of a global health skills-based framework, the SDH, to support culturally and contextually relevant health promotion strategy development among future health workers (8, 11, 17, 18, 23). While the I-PELICAN sessions were first conceptualized as part of a teaching and learning grant awarded by UC to the study authors, it showed that cross-institutional support to explore teaching research is necessary for academics, especially at the early career stage as the first author to develop competencies in this area. Overall, the online module enhanced "global mindedness" for UC and IIPH-G students and

strengthens UC's position as a recognized international knowledge hub in Public Health. The subsequent sections provide an overview of salient themes.

5.2. Implementation insights

While over 100 students jointly participated in the four sessions over 4 weeks during August –September 2022, the sessions took approximately a month of lead-up time for planning, coordination and template design, which included pedagogy-focused workshop sessions jointly attended by UC and IIPH-G academics, where a teaching and learning pedagogy expert provided strategic guidance. Thus, the sessions included an element of capacity building for participating staff who developed virtual cooperative learning group facilitation skills and virtual pedagogy thinking as evidenced by staff feedback in post-session debriefing sessions and in the IES survey findings.

From an implementation perspective, the four sessions were conducted over ten hours in total, with each session scheduled for two hours, having predesigned templates for each session with embedded links for individual Zoom break-out rooms and Padlets, which was important for time management and collaborative access. However, student feedback indicated that more group time would be advantageous for each of the sessions, and therefore, the session plans were adjusted accordingly. The templates were developed by the study authors after the pedagogy workshop and using a facilitative process. UC has a focus on enhancing student equity in university participation, and the I-PELICAN series intrinsically wove student equity in the design to allow greater student participation. In addition to these drivers, one of the underlying principles was being able to demonstrate the proof of concept with minimal financial investment to the participating students and universities involved. As an example, the use of Zoom and Padlet for which institutional licenses were used, allowed technology to be leveraged that was already being used by both institutions and therefore did not require added training time for students. Moreover, by embedding the sessions in the semester as part of an existing global health unit/subject at UC and IIPH-G, attending the sessions was facilitative for students and did not create additional time commitments.

5.3. Foster cross-cultural appreciation through peer-to-peer engagement

An important component of the I-PELICAN session was facilitating intercultural interactions among students early on, using in-session activities such as photograph sharing and observation sharing of health care seeking interviews of family members and others. These activities helped to develop an applied understanding of how cultural perceptions are shaped in respective countries beyond theoretical concepts and actively demonstrated how they influence healthcare-seeking behaviors. By starting the series with a cultural immersion activity where students were encouraged to bring photographs depicting local culture across themes of place, person, and healthcare settings, students showcased to each other the cultural constructs between the two countries and also supported learning in an open and respectful manner.

5.4. Enhancing online social connections

While online sessions have enhanced the delivery of educational content, Greenan et al. (35) noted challenges in online teaching compared to traditional classroom teaching in fostering socialization and student communication (35). Yet studies also note that social connections can still be fostered in online sessions through educators being available, positive, and sympathetic in creating online environments where students have increased opportunities to exhibit social presence or a sense of being together (1, 14–17, 25, 26, 36). The I-PELCIAN sessions sought to encourage social connections among students through individual activities in each session but also structuring safe, student-friendly online spaces in the break-out rooms where students could engage with each other and have greater opportunities for authentic self-disclosure and engagement. A sense of togetherness or social presence was also conveyed through processes of collective reflections and insight generation in separate groups over individual students' ideas in the sessions. Students, for example, used photographs in session one and individual interviews collected from family and friends on COVID-19 experiences in the second session to share insights and co-create new knowledge and understanding of cultural barriers and enablers to health care-seeking behaviors. Photographs that students displayed in individual break-out rooms using the group's Padlet were then voted upon collectively to identify two–three representative photos to bring back to the main room to share with all participants. By structuring each activity through a sequence of transitions between the main room and break-out rooms (for individual group discussions) and back to the main room for presentations and reflections to the whole cohort, students have presented an opportunity to construct their own understanding in smaller groups and engage with peers in an open, supportive non-judgmental virtual space with academic facilitators in the background as support if needed. This created a "safe space" for students to respectfully work together – simulating real-world, virtual, cross-cultural, collaborative PH environments. While also accommodating flexibility in attendance, maintaining the same mixed-group allocation of IIPGH and UC students over the sessions allowed for better cohesion, engagement, and consistency across sessions as validated by student feedback.

In conclusion, the I-PELICAN sessions that were developed as a proof of concept showcased implementation feasibility and provided learnings to allow flexible integration in other core Public Health units and expansion to other universities in the future. The online sessions provide a novel means to enhance the global health unit offerings with a greater focus on cultural awareness and skill development at universities and provide greater equity for students in accessing global mobility-aligned opportunities at no extra cost to a regular unit enrolment fee. It also provides an opportunity to enhance student equity by being available to students regardless of the opportunity to do in-country placements and providing flexibility for students who have competing work, and family caregiving commitments.

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 Human Research Ethics Committee, University of Canberra. The patients/participants provided their written informed consent to participate in this study.

Author contributions

DA, RM, and JS conceptualized, implemented and evaluated the I-PELICAN sessions with support from SS, DS, and DM. DA and RM conceptualized the evaluation framework and analyzed the data for the process and final outcomes. JS provided pedagogy expertise for session design and delivery and contributed to manuscript drafting and editing. DA, RM, JS, DS, SS, and DM engaged in editing the manuscript. All authors contributed to the article and approved the submitted version.

Funding

The I-PELICAN sessions were conducted under the University of Canberra's Faculty of Health Teaching and Education Research Grant (TIGER)2022. No expenses were, however, committed during any stage of the I-PELICAN sessions.

Acknowledgments

The authors thank the students of the University of Canberra, Australia and the Indian Institute of Public Health –IIPH-G, India, who participated in the I-PELICAN sessions and provided insights. We also thank the UC and IIPH-G facilitators who supported the sessions, namely Tapasvi Puwar, Priya Bhavsar, Priyanka Shah, Chiranjivi Adhikari, Nahid Choudhury, Farzana Memon, Tapas Mazumder, Jallavi Panchamia. Lastly, this paper is dedicated to the memory of Professor Shawn Somerset, who cocreated the I-PELICAN grant and sessions but sadly passed away during the final manuscript draft.

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

References

1. Gummeson H, Raj Goel S, Elmusharaf K. Public health practicum: a scoping review of current practice in graduate public health education. *BMJ Open*. (2021) 11:e047512. doi: 10.1136/bmjopen-2020-047512

2. Hamelin AM, Paradis G. Population health intervention research training: the value of public health internships and mentorship. *Public Health Rev*. (2018) 39:6–1. doi: 10.1186/s40985-018-0084-9

3. Department of Economic and Social Affairs, United Nations. *The sustainable development goals report [internet]*. New York: United Nations (2016) Available at: https://unstats.un.org/sdgs/report/2019/The-Sustainable-Development-Goals-Report-2019.pdf.

4. Handler A, Greenleaf R, Bozlak CT, Moerchen V, Pizur-Barnekow K, San Miguel C, et al. Learning from graduate and undergraduate public health virtual internship experiences with state agencies during COVID-19, summer 2020. *Matern Child Health J*. (2021) 26:229–39. doi: 10.1007/s10995-021-03278-1

5. Jackson D, Bridgstock R. Evidencing student success in the contemporary world-of-work: renewing our thinking. *High Educ Res Dev*. (2018) 37:984–98. doi: 10.1080/07294360.2018.1469603

6. Kedia T, Barnett-Vanes A, Jarvis J, Ragins K, Long C, Owaseye O, et al. Equitable access to global health internships: a documentary short. *Lancet Glob Heal*. (2018) 6:e145. doi: 10.1016/S2214-109X(17)30499-0

7. Kosman BA, Etxebarria N, Chipchase LS. The impact of learning abroad programs in developing countries: a scoping review. *Nurse Educ Today*. (2021) 97:104716. doi: 10.1016/j.nedt.2020.104716

8. Kay J, Ferns S. Expanding work integrated learning (WIL) possibilities: enhancing student employability through innovative WIL models. Australian Collaborative Education Network (ACEN) (2018).

9. Brame C.J., Biel R. *Setting up and facilitating group work: using cooperative learning groups effectively*. Tennessee, USA: Vanderbilt University Center for Teaching, (2015). Available at: http://cft.vanderbilt.edu/guides-sub-pages/setting-up-and-facilitating-group-work-using-cooperative-learning-groups-effectively (Retrieved January 2023).

10. Thomas A, Menon A, Boruff J, Rodriguez AM, Ahmed S. Applications of social constructivist learning theories in knowledge translation for healthcare professionals: a scoping review. *Implementation Sci*. (2014) 9:54. doi: 10.1186/1748-5908-9-54

11. Bertelsen NS, DallaPiazza M, Hopkins MA, Ogedegbe G. Teaching global health with simulations and case discussions in a medical student selective. *Glob Health*. (2015) 11:28. doi: 10.1186/s12992-015-0111-2

12. Drain PK, Holmes KK, Skeff DM, Hall TL, Gardner P. Global health training and international clinical rotations during residency: current status, needs, and opportunites. *Acad Med*. (2009) 84:320–5. doi: 10.1097/ACM.0b013e3181970a37

13. Tran LT, Bui H, Nguyen MN. Youth agency in public diplomacy: Australian youth participation in outbound mobility and connection building between Australia and the indo-Pacific region. *Int Stud Sociol Educ*. (2021):1–5. doi: 10.1080/09620214.2021.201778

14. Feldman E. Virtual internships during the COVID-19 pandemic and beyond. *New Horizons Adult Educ Hum Resour Dev*. (2021) 33:46–51. doi: 10.1002/nha3.20314

15. Scherman RM, Snow NE. Defending campus culture against the threat of perennial online instruction in a post-COVID-19 world. *Front Educ*. (2021) 6:1–4. doi: 10.3389/feduc.2021.607655

16. Millar SK, Spencer K, Stewart T, Dong M. Learning curves in COVID-19: student strategies in the 'new normal'? *Front Educ*. (2021) 6:1–7. doi: 10.3389/feduc.2021.641262

17. Nguyen T, Netto CLM, Wilkins JF, Bröker P, Vargas EE, Sealfon CD, et al. Insights into students' experiences and perceptions of remote learning methods: from the COVID-19 pandemic to best practice for the future. *Front Educ*. (2021) 6:1–9. doi: 10.3389/feduc.2021.647986

18. Chan Lin L-J, Hung W-H. Evaluation of an online internship journal system for interns. *Procedia – Soc Behav Sci*. (2015) 191:1024–7. doi: 10.1016/j.sbspro.2015.04.700

19. Oguro S, Mueller B. Learning abroad and graduate employability: challenges articulating international learning outcomes In: E Heinrich and R Bourke, editors. *Research and Development in higher education: Next generation, higher education: Challenges, changes and opportunities*, vol. 42, Australasia: Publisher Higher Education Research and Development Society (2020). 85–93. Available at: https://www.herdsa.org.au/publications/conference-proceedings/research-and-development-higher-education-next-generation-8

20. British Council. Connecting universities: Future models of higher education. (2015). Available at: https://www.britishcouncil.org/sites/default/files/new_university_models_jan2015_print.pdf

21. Trafford J, Haxell A, Lau K, Carlson G, Rebelo da Silva AP, Hart A, et al. Covid-19 (in) a class of its own: student and teacher musings regarding their Learnings and well-being when moving a large blended first year class virtually overnight. *Front Educ*. (2021) 6:1–6. doi: 10.3389/feduc.2021.639466

22. Australian Higher Education Industrial Association, Price Waterhouse Coopers. Australian Higher Education Workforce of the Future. (2016);1–47. Available at: http://www.aheia.edu.au/news/higher-education-workforce-of-the-future-167

23. Case SJ, Collins SL, Wood EA. Global health-based virtual exchange to improve intercultural competency in students: Long-lasting impacts and areas for improvement. *Front Public Health*. (2022) 10:1044487. doi: 10.3389/fpubh.2022.1044487

24. Impact Rankings: Reducing inequalities [Internet]. Times Higher Education (THE). (2022). Available at: https://www.timeshighereducation.com/rankings/impact/2022/reducing-inequalities (Accessed January 14, 2023).

25. Millar C, Carey LB, Hill AE, Fortune T, Mathisen BA. Determining global citizenship capabilities for speech-language pathologists and other health professionals: a study protocol. *Speech Lang Hear*. (2021) 24:193–9. doi: 10.1080/2050571X.2020.1759851

26. Howitt R, Stevens S. Cross-cultural research: ethics, methods and relationships In: I Hay and M Cope, editors. *Qualitative research methods in human geography*. UK: Oxford University Press (2005). 30–50.

27. Social Determinants of Health. World Health Organization (n.d.). Available at: https://www.who.int/health-topics/social-determinants-of-health

28. Duffy TM, Cunningham DJ. Constructivism: implications for the design and delivery of instruction In: DH Jonassen, editor. *Handbook of research for educational communications and technology*. NY: Macmillan Library Reference USA (1996)

29. Bhattacharya S, Singh A. Why tuberculosis control programmes fail? Role of microlevel and macrolevel factors: an analysis from India. *BMJ Case Rep*. (2017) 2017:bcr2017219606. doi: 10.1136/bcr-2017-219606

30. Jiwrajka M, Mahmoud A, Uppal M. A Rohingya refugee's journey in Australia and the barriers to accessing healthcare. *BMJ Case Rep*. (2017) 2017:bcr2017219674. doi: 10.1136/bcr-2017-219674

31. Curtin AJ, Martins DC, Schwartz-Barcott D. A mixed methods evaluation of an international service learning program in the Dominican Republic. *Public Health Nurs*. (2015) 32:58–67. doi: 10.1111/phn.12117

32. Sthapornnanon N, Sakulbumrungsil R, Theeraroungchaisri A, Watcharadamrongkun S. Social constructivist learning environment in an online professional practice course. *Am J Pharm Educ*. (2009) 73:10. doi: 10.5688/aj730110

33. Zorn CR. The long-term impact on nursing students of participating in international education. *J Prof Nurs*. (1996) 12:106. Free design tool: Presentations, video, social media | CANVA [Internet]. [cited 2023 Jan]–10. doi: 10.1016/S8755-7223(96)80056-1

34. Rolfe G. Reach touch and teach: Terry Borton. *Nurse Educ Today*. (2014) 34:488–9. doi: 10.1016/j.nedt.2013.11.003

35. Greenan KA. The influence of virtual education on classroom culture. *Front Commun*. (2021) 6:6. doi: 10.3389/fcomm.2021.641214

36. Van der Weide R, Lakner CM, Daniel G, Narayan A, Ramasubbaiah R. Intergenerational mobility around the world. Policy research working paper; No. 9707. World Bank. Washington, DC. World Bank. (2021). Available at: https://openknowledge.worldbank.org/handle/10986/35827

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 27 April 2023
DOI 10.3389/fpubh.2023.1120922

OPEN ACCESS

EDITED BY
Sharon Brownie,
Swinburne University of Technology,
Australia

REVIEWED BY
Maryse Kok,
Royal Tropical Institute (KIT),
Netherlands
Isaac Amankwaa,
Waikato Institute of Technology,
New Zealand

*CORRESPONDENCE
Ash Rogers
ash@lwalacommunityalliance.org

RECEIVED 10 December 2022
ACCEPTED 03 April 2023
PUBLISHED 27 April 2023

CITATION
Rogers A, Goore LL, Wamae J, Starnes JR, Okong'o SO, Okoth V and Mudhune S (2023) Training and experience outperform literacy and formal education as predictors of community health worker knowledge and performance, results from Rongo sub-county, Kenya.
Front. Public Health 11:1120922.
doi: 10.3389/fpubh.2023.1120922

Training and experience outperform literacy and formal education as predictors of community health worker knowledge and performance, results from Rongo sub-county, Kenya

Ash Rogers[1]*, Lou L. Goore[1], Jane Wamae[1], Joseph R. Starnes[2], Stephen O Okong'o[1], Vincent Okoth[1] and Sandra Mudhune[1]

[1]Lwala Community Alliance, Rongo, Kenya, [2]Department of Pediatrics, Division of Pediatric Cardiology, Vanderbilt University Medical Center, Nashville, TN, United States

Introduction: There is a growing recognition that Community Health Workers are effective at improving health outcomes and expanding health access. However, the design elements that lead to high-quality Community Health Worker programing are relatively understudied. We looked at the predictors of Community Health Worker knowledge of obstetric and early infant danger signs as well as performance in achieving antenatal care and immunization uptake among their clients.

Methods: The study takes place in the context of an intervention implemented jointly by Lwala Community Alliance and the Kenya Ministry of Health which sought to professionalize Community Health Worker cadres through enhanced training, payment, and supervision. There were four cohorts included in the study. Two cohorts started receiving the intervention prior to the baseline, one cohort received the intervention between the baseline and endline, and a final cohort did not receive the intervention. Data on Community Health Worker demographics, knowledge tests, and key performance indicators were collected for 234 Community Health Workers. Regression analyses were used to explore education, literacy, experience, training, and gender as potential predictors of CHW performance.

Results: We found that clients of Community Health Workers trained through the intervention were 15% more likely to be fully immunized and 14% more likely to have completed four or more antenatal care visits. Additionally, recency of training and experience caring for pregnant women were associated with increased Community Health Worker knowledge. Finally, we found no association between gender and CHW competency and tenuous associations between education/literacy and Community Health Worker competency.

Discussion: We conclude that the intervention was predictive of increased Community Health Worker performance and that recency of training and experience were predictive of increased knowledge. Though education and literacy are often used in the selection processes of Community Health Workers globally, the link between these characteristics and Community Health Worker

knowledge and performance are mixed. Thus, we encourage further research into the predictive value of common Community Health Worker screening and selection tools. Further, we encourage policymakers and practitioners to reconsider the use of education and literacy as means of Community Health Worker selection.

KEYWORDS

community health worker (CHW), community health, Kenya, obstetric danger signs, neonatal danger signs, traditional birth attendant (TBA), resource limited setting

1. Introduction

There has been significant progress in the reduction of maternal deaths in Africa. The maternal mortality ratio dropped from 718 maternal deaths per 100,000 in the year 2000 to 417 maternal deaths per 100,000 live births in the year 2017, with the East African region seeing a decrease from 853 to 443 maternal deaths per 100,000 births (1). This reduction in maternal mortality ratio in Africa represents an annual percentage change of −3.0%. In order to reach the United Nations Sustainable Development Goal of less than 70 maternal deaths per 100,000 live births by 2030 (2), this rate would have to be −15.29%. Further, while Kenya has seen a reduction in maternal mortality on par with the region, those gains are not evenly distributed. Just 15 counties (out of 47) contribute to 98% of all maternal deaths in Kenya (3). Further, the neonatal period is significant for child survival with the risk of death during this period being higher than any other period of childhood. The neonatal mortality rate in Kenya is 1.4 times higher than the postneonatal mortality rate and stands at 22 deaths per 1,000 live births. Additionally, neonatal mortality in Kenya declined at the slowest rate compared to all other childhood mortality between 2003 and 2014 (4).

Community Health Workers (CHWs) can play a pivotal role in increasing health access and tackling maternal and neonatal mortality. Substantial evidence shows the potential of CHWs to increase access to health care, maintain continuity of care during pandemic periods, and ultimately improve health outcomes (5–8).

The Kenyan Government has signaled its commitment to a strong CHW system through Kenya's Community Health Strategy 2020–2025, which outlines goals for greater CHW coverage, compensation, training, and supervision (9). Migori County, Kenya, the host of this study, passed a new Community Health Services Act in mid-2022, committing the county to greater investment in community health and laying out key commitments to the CHW workforce.

In order for community health programs to deliver on the goals of policymakers, they must be well-designed. The World Health Organization (WHO) Guideline on Health Policy and System Support to Optimize Community Health Worker Programmes provides important guidance on CHW system design elements including recommendations on payment, supportive supervision, and continuous training (10, 11). This guidance is supported by evidence, including a systematic review showing that these design elements are associated with increased performance (12).

Abbreviations: CHW, Community Health Worker; TBA, Traditional Birth Attendant.

However, in these guidelines the WHO highlights gaps in the "evidentiary certainty" of which CHW selection practices lead to quality care (10). Specifically, the guidelines recommend a "minimum education level that is appropriate to the task(s) under consideration" alongside community acceptance, gender equity, and personal attributes like interpersonal skills, life experience and values. The guideline notes that the certainty of evidence for the recommendation is "very low" and considers the recommendation "conditional." Indeed, research on selection and predictors of CHW performance are limited (13–15).

With this limited direction, selection criteria for CHWs varies widely in the sector, ranging from literacy tests to formal education requirements (16–21). Selection processes are important because they can influence the retention and performance of the community health workforce (22). Additionally, selection can determine the gender balance of these cohorts. Education and literacy tests, for example, risk biasing against women, older populations and other marginalized groups that may be less likely to access formal education (23). Since gender equity is a priority in the best practices laid out by WHO and foundational documents like the CHW AIM Tool, it is important to interrogate practices that may leave women out (11).

Research on the correlation between educational attainment and CHW performance have disparate results with some studies finding associations with education and performance (24–26) and others (27–30) finding no association. Similarly, the literature finds mixed results on the role of gender and years of experience in predicting CHW performance (31). One aspect of CHW selection around which there is wide consensus is the role of community selection. Though the specific methods for community selection lack consistent definition, this general approach is championed by global norm setters and supported in the wider literature (10, 22, 29, 32).

2. Methods

2.1. Study setting

This study takes place in the context of a professionalized CHW program implemented by the Migori County, Kenya Ministry of Health in partnership with Lwala Community Alliance (Lwala). The intervention works with existing cadres of government CHWs and incorporates practicing traditional birth attendants (TBAs) to create a new cadre of professionalized CHWs, who are then trained, paid, supervised, and equipped to complete their work.

This study explores education, literacy, experience, training, and gender as potential predictors of CHW performance. Data were collected in the Rongo sub-county in the northeastern portion of Migori County, Kenya. Rongo sub-county is further divided into wards, which include North Kamagambo (North), East Kamagambo (East), South Kamagambo (South), and Central Kamagambo (Central). Lwala began working in 2007 in North. Since that time, programming has expanded to all of Rongo sub-county (East Kamagambo, South Kamagambo, and Central Kamagambo). For the purpose of this study, implementation took place in North and East prior to the study period. CHW training and program commencement in South took place immediately following the baseline survey, and training in Central had not yet occurred at the end of the study period (Figures 1, 2).

2.2. Intervention

2.2.1. Selection

The existing cadres of government CHWs were originally selected through a participatory process where community members are proposed and endorsed to become CHWs. During the Lwala community entry process in the intervention sites, we selected and worked with all the existing government CHWs and supported a community review process. In addition, TBAs were selected from the community through a community-led mapping process followed by a verification exercise that involved visiting TBAs in their homes. There were no education or literacy requirements imposed, although CHWs in the intervention were required to complete the mandatory training and demonstrate proficiency in the training objectives through written or oral tests (Figure 3). If a CHW did not meet the minimum score they were linked with a strong CHW for mentorship and subjected to another test later.

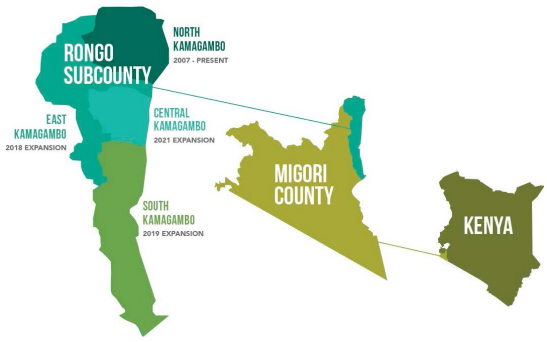


FIGURE 1
Rongo sub-county is located in the northeastern portion of Migori County, Kenya. It is further divided into four wards, which include North Kamagambo and East Kamagambo where programming took place prior to the study, South Kamagambo where programming commenced following the baseline study and Central Kamagambo, where training had not yet occurred at the end of the study period.

2.2.2. Training

The intervention included an initial 7 day training on Kenya's Community Health Volunteer Basic Module, followed by a 5 day training on the Maternal, Newborn, and Child Health Technical Module. As CHWs progressed through the program, they received additional training on technical modules and periodic refresher training as outlined in Figures 2, 3. All training was based on Ministry of Health curriculum and delivered jointly by Migori County Ministry of Health and Lwala. CHWs outside the intervention did not receive training during the study period, with the important exception of training on COVID-19 protocols in April 2020, delivered by Migori County Ministry of Health and Lwala across all cohorts.

2.2.3. Supervision

CHWs in both the intervention and control were supervised by government Community Health Assistants (CHAs). CHAs in the intervention group were trained in the 360 supervision approach. In this approach CHWs participated in weekly review meetings at the village level and monthly review meetings with the link government facility. CHWs also received one-on-one supportive supervision which included CHAs accompanying CHWs on household visits to observe work performance, spot checks of randomly selected households to verify CHW services, and one-on-one meetings with the supervisor to discuss challenges and receive feedback. CHAs outside the intervention did not receive any specific training around CHW supervision, but instead were trained intermittently by government and NGOs on specific public health campaigns.

Cohort	Training: Basic, MNCH, FP	Training: ICCM	Training: COVID-19	Baseline survey	Endline survey
North Kamagambo	Feb 2017	Jan 2018	Apr 2020	Nov 2019 & Jan 2020*	Apr 2021
East Kamagambo	Nov 2018	May 2019	Apr 2020	Nov 2019 & Jan 2020*	Apr 2021
South Kamagambo	Nov 2019 (after baseline survey)	Feb 2020	Apr 2020	Nov 2019	Apr 2021
Central Kamagambo	Not trained	Not trained	Apr 2020	Feb 2020	Apr 2021

*several CHWs were missed in the initial survey & were traced for inclusion in the study

FIGURE 2
Study timeline. *Several CHWs were missed in the initial survey & were traced for inclusion in the study.

Training Topic	Length	Refresher period
Basic CHV Module	7 Days	2 years
Maternal Newborn and Child Health Technical Module	5 Days	Annually
Integrated Community Case Management Technical Module	5 Days	Annually
Family Planning Technical Module	3 Days	Annually

FIGURE 3
Training topics. All training was based on Kenya's national curriculum for CHWs.

2.2.4. Payment

CHWs in the intervention received a monthly payment of between 40–60 USD based on the service package they were delivering. CHWs outside the intervention did not receive payment during the study period.

2.2.5. Role

CHWs across the study were responsible for between 60–80 households. CHWs in the intervention were expected to proactively enroll all households in the community and provide preventative and curative services as well as refer clients to government health facilities for care. Core to their responsibilities was providing support to pregnant women to complete antenatal care visits and delivery with a skilled provider as well as track the health of infants and children ensuring early diagnosis and treatment of illness as well as on-time immunizations.

2.3. Study design

CHWs were surveyed both at the beginning and end of the study period. The sample size was pre-determined based on the number of CHWs working in the geographic area. Previous studies showed rates of knowledge of neonatal danger signs of 50% among control CHWs and approximately 80% among intervention CHWs (33). Using the chi-squared test, power of 0.8, and alpha of 0.05 gives a sample of just 39 in each group needed to detect a similarly sized difference. We estimated there would be 80–100 CHWs working in each ward, which would give a sample that would provide more than adequate power for the primary outcome of CHW knowledge. The entire CHW population was surveyed both to avoid sampling bias and to provide adequate power for secondary outcomes.

The survey tool was created using validated tools. Knowledge questions were derived from Jhpiego' training materials (34) and were used in a previous iteration of this survey (33) Perception of supervision was measured using the Perceived Supervision Scale (PSS), which has been validated specifically with CHWs in multiple countries including Kenya (35). Finally, literacy was assessed using a brief assessment based on Kenya's nationwide literacy exam.

2.4. Data collection and management

Surveys were administered by enumerators trained in informed consent, confidentiality, and appropriate survey administration. In order to maximize response rate, surveys were conducted during regularly scheduled CHW trainings and meetings held for each ward. Mobile tablets were used for data collection, which were synced to a central database. Data were routinely checked for internal consistency and outliers.

Data regarding completion of antenatal care visits and immunizations among patients were obtained from de-identified data sources. For CHWs currently employed by Lwala, these metrics are routinely tracked using a tablet-based tool used by CHWs in the field. For those not currently employed by Lwala, these data were obtained from ledgers kept by facilities with which the CHWs were affiliated.

2.5. Statistical analysis

All analyses were performed using Stata version 14.2 (StataCorp LP, College Station, TX). Categorical variables are presented as percentages, and continuous variables are presented as means with standard deviations. Chi-squared tests were used to compare categorical variables, and two-tailed t tests were used for continuous variables. For regression analyses, multivariable logistic regressions were used for binary outcomes. Similarly, multivariable linear regressions were used for continuous outcomes.

2.6. Ethics statement

The protocol and study design were approved by the Ethics and Scientific Review Committee at AMREF Health Africa (Proposal number: AMREF ESRC P708-2019). Informed consent was obtained from all participants.

3. Results

A total of 234 CHWs across four cohorts in: North, East, South, and Central Kamagambo were included in the study (Table 1). South had the youngest cohort, with an average age of 30 at baseline and 41 at endline, the rest of the cohorts ranged from 41 to 45. The baseline survey included 81% female CHWs and the endline included 78%. The proportion of women ranged from 77 to 91% across all groups. The average years of experience caring for pregnant women ranged from 5.4 years in East to 9.7 years in North.

TABLE 1 CHW demographics.

Variables	North Kamagambo		East Kamagambo		South Kamagambo		Central Kamagambo	
	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
	n =62	*n* =63	*n* =69	*n* =78	*n* =46	*n* =52	*n* =23	*n* =38
Age in years								
Mean (Std. dev.)	41.87 (10.25)	42.95 (9.32)	40.42 (9.02)	41.97 (8.94)	30.22 (15.67)	40.96 (8.59)	44.87 (12.46)	44.84 (9.56)
Gender								
Female	50 (80.6%)	51 (80.95%)	53 (76.8%)	59 (75.64%)	38 (82.6%)	44 (84.62)	21(91.3%)	28 (73.68%)
Male	12 (19.4%)	12 (19.05%)	16 (23.2%)	19 (24.36%)	8 (17.4%)	8 (15.38%)	2 (8.7%)	10 (26.32%)
Education level								
Class 8 or less	32 (51.61%)	31 (49.20%)	24 (34.78%)	29 (37.18%)	18 (39.13%)	19 (36.54%)	10 (43.49%)	8 (21.05%)
Class 9 or higher	30 (48.39%)	32 (50.8%)	45 (65.22%)	49 (62.82%)	28 (60.87%)	33 (63.46%)	13 (56.52%)	30 (78.95%)
Literacy								
Passed test	32 (51.61%)	33 (52.38%)	51 (73.91%)	57 (73.08%)	32 (69.56%)	33 (63.46%)	11 (47.83%)	20 (52.63%)
Did not pass	30 (48.39%)	30 (47.62%)	18 (26.08%)	21 (26.92%)	14 (30.44%)	19 (36.54%)	12 (52.17%)	18 (47.37%)
Years caring for pregnant women								
Mean (Std. dev.)	9.71 (7.45)	9 (3.50)	5.40 (3.997)	7.04 (5.69)	8.17 (6.34)	9.08 (6.07)	7.69(6.2699)	7.05(5.42)

A total of 234 distinct CHWs were interviewed across the baseline and endline.

TABLE 2 CHW training.

Variables	North Kamagambo		East Kamagambo		South Kamagambo		Central Kamagambo	
	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
	n =62	*n* =63	*n* =69	*n* =78	*n* =46	*n* =52	*n* =23	*n* =38
Trained through intervention								
Yes	62 (100%)	63(100%)	69 (100%)	78(100%)	0 (0%)	52 (100%)	0 (0%)	0 (0%)
No	0 (0%)	0 (0%)	0 (0%)	0 (0%)	46 (100%)	0 (0%)	23 (100%)	38 (100%)
Ever trained in obstetric danger signs								
Yes	62 (100%)	63 (100%)	67(97.1%)	75 (96.15%)	32 (69.6%)	51(98.08%)	22 (95.6%)	29 (76.32%)
No	0 (0%)	0 (0%)	2 (2.9%)	3 (3.85%)	11 (23.9%)	1 (1.92%)	1(4.4%)	9 (23.68%)
Missing					3 (6.5%)			
Ever trained in neonatal danger signs								
Yes	62(100%)	63 (100%)	68 (98.6%)	75 (96.15%)	33 (71.7%)	51 (98.08%)	22 (95.6%)	29 (76.32%)
No	0 (0%)	0 (0%)	1 (1.4%)	3 (3.85%)	10 (21.7%)	1 (1.92%)	1(4.4%)	9 (23.68%)
Missing					3 (6.5%)			
Months since last training on obstetric danger signs								
Mean (Std. dev.)	8.85 (6.70)	9.25 (8.226)	5.03 (4.25)	6.78 (9.326)	9.3 (17.04)	5.37 (2.95)	18.39 (15.59)	25.31 (11.72)
Months since last training on neonatal danger signs								
Mean (Std. dev.)	7.64 (5.56)	9.19 (8.30)	4.87 (4.24)	6.68 (9.34)	6.24 (9.91)	5.37 (2.95)	18.8 (15.82)	25.31 (11.72)

A total of 234 distinct CHWs were interviewed across the baseline and endline.

Education level varied by cohort (Table 1). At baseline and endline North had the lowest percentage of CHWs with a Class 9 education or higher (48, 51%). At baseline East had the highest percentage of educated CHWs (65%), while Central had the highest percentage at endline (79%).

We also conducted a literacy test which consisted of 7 questions, one would need to correctly score 6 out of the 7 questions (86%) to pass (Table 1). Across the CHWs surveyed at baseline, 63% passed the literacy test. Across the CHWs included at both baseline and endline, East had the highest literacy rate at (74, 73%) while Central had the lowest (48, 53%), with North performing only slightly higher (52, 52%).

At baseline, all CHWs in North and East had been trained through the intervention, while CHWs in South and Central had not (Table 2). At endline, South CHWs were newly trained and Central CHWs remained untrained by the intervention. At baseline 96–100% of

CHWs in North, East, and Central reported being trained in obstetric and early infant danger signs. In comparison, only 70% of CHWs in South reported receiving training on obstetrics and 72% on early infancy. By the endline, these numbers in South, which had received the intervention between baseline and endline, increased to 96% for obstetrics and 95% for early infancy. In Central, which did not receive the intervention, the number of CHWs reporting that they had been trained in these topics decreased to 77% for obstetrics and 79% for early infancy. The training rates for North and East remained consistent. The average time since the last training on obstetrics and early infancy ranged from ~5 months in East to ~18.5 months in Central at baseline and ~7 months in East to ~18.5 in Central at endline.

We assessed CHWs' knowledge across pregnancy, childbirth, infancy, and the postpartum period, considering a CHW knowledgeable if they were able to correctly identify three or more danger signs (Table 3). Across all cohorts, CHWs were more knowledgeable about danger signs associated with pregnancy and were least knowledgeable about danger signs during childbirth. At baseline, North -the longest-standing intervention site -scored the highest on all 4 knowledge domains with an average 77% of CHWs considered knowledgeable, compared to the other cohorts which ranged from 59–72%. At endline, there were significant increases in knowledge scores across all three cohorts in the intervention: North, East, and South. East, which received the intervention shortly before the baseline, saw its proportion of CHWs passing increase from 62 to 92% with statistically significant change across all 4 knowledge domains. ($p = 0.0001$, $p = 0.0004$, $p = 0.0004$, $p = <0.0001$). South, which joined the intervention between the baseline and endline, saw an increase from 59 to 82% with significant change across all domains ($p = 0.0003$, $p = 0.0124$, $p = 0.0116$, $p = 0.0253$). CHWs in Central, which had not received the intervention, only saw an increase in knowledge of pregnancy from 78.3 to 81.58% ($p = 0.0253$), and actually saw decreases across the other three domains, though those changes were not statistically significant.

Next, we used logistic regression to assess education, literacy, experience, training, and gender as potential predictors of CHW knowledge (Table 4). We found recency of training to be associated with increased knowledge of danger signs in pregnancy (OR = 1.06;

TABLE 3 CHW Knowledge.

	North Kamagambo			East Kamagambo		
% knowledge per category	Baseline	Endline	value of *p*	Baseline	Endline	value of *p*
	n =62	*n* =63		*n* =69	*n* =78	
Pregnancy	52 (83.9%)	63 (100%)	0.0016	53 (76.8%)	77 (98.72%)	0.0001
Childbirth	42 (67.7%)	49 (77.78%)	0.4913	36 (52.2%)	67 (85.9%)	0.0004
Postpartum	45 (72.6%)	57 (90.48%)	0.029	42 (60.9%)	67 (85.9%)	0.0004
Early infancy	52 (83.9%)	55 (87.30%)	0.2059	40 (58%)	75 (96.15%)	0
Average	77.25%	88.75%		62.00%	91.75%	
Mean Score (Std. dev)						
Pregnancy	4.61 (2.15)	5.29 (1.61)		3.41(1.57)	5.24 (1.43)	
Childbirth	3.47 (1.65)	3.48(1.25)		2.67 (1.44)	4.14(1.53)	
Postpartum	3.48 (1.52)	4.11(1.38)		3.03(1.57)	4.41(1.65)	
Early infancy	3.76 (1.25)	3.65(1.3)		2.85 (1.1791)	4.18(1.03)	
	South Kamagambo			Central Kamagambo		
% knowledge per category	Baseline	Endline	value of *p*	Baseline	Endline	value of *p*
	n =46	*n* =52		*n* =23	*n* =38	
Pregnancy	33 (71.7%)	49 (94.23%)	0.0003	18 (78.3%)	31 (81.58%)	0.0253
Childbirth	21 (45.6%)	38 (73.08%)	0.0124	15 (65.2%)	17 (44.74%)	1.000
Postpartum	27 (58.7%)	41 (78.85%)	0.0116	14 (60.9%)	24 (63.16%)	0.0956
Early infancy	26 (56.5%)	42 (80.77%)	0.0253	19 (82.6%)	21 (55.26%)	0.3173
Average	58.50%	81.75%		71.75%	61.25%	
Mean Score (Std. dev)						
Pregnancy	3.46(1.6)	4.46 (1.59)		4.22 (2.09)	4.18 (1.8)	
Childbirth	2.39 (1.31)	3.11(1.28)		2.96 (1.52)	2.95(2.01)	
Postpartum	2.739 (1.32)	3.27(1.05)		3.30 (1.64)	3.5(1.93)	
Early infancy	2.69 (1.19)	3.21(1.07)		3.22 (1.24)	3.13(1.68)	

value of *p* calculated using McNemar's chi2.
A total of 234 distinct CHWs were interviewed across the baseline and endline.

10.3389/fpubh.2023.1120922

TABLE 4 Logistic regressions, knowledge.

	Pregnancy				Neonatal			
	Odds ratio	95% Confidence interval		value of *p*	Odds ratio	95% Confidence interval		value of *p*
Trained in Intervention	1.838	0.866	3.901	0.113	1.79	0.853	3.758	0.124
Educated (> class 8)	1.232	0.595	2.552	0.574	1.103	0.55	2.214	0.782
Literate	1.502	0.715	3.154	0.283	0.413	0.193	0.886	0.023*
Female	0.951	0.383	2.363	0.914	0.815	0.337	1.97	0.649
Recency of training (months)	1.061	1.002	1.124	0.044*	1.046	0.996	1.099	0.07*
Experience (years)	1.083	0.989	1.187	0.086*	1.078	0.987	1.178	0.094*
Constant	0.641	0.163	2.522	0.525	1.279	0.323	5.069	0.727
	Childbirth				Postpartum			
	Odds ratio	95% Confidence interval		value of *p*	Odds ratio	95% Confidence interval		value of *p*
Trained in Intervention	1.535	0.814	2.895	0.185	1.316	0.678	2.552	0.417
Educated (> class 8)	1.117	0.605	2.06	0.724	1.882	0.997	3.553	0.051*
Literate	0.734	0.39	1.38	0.337	0.665	0.34	1.301	0.234
Female	1.008	0.48	2.118	0.982	1.232	0.572	2.654	0.595
Recency of training (months)	1.001	0.976	1.028	0.921	0.985	0.959	1.013	0.299
Experience (years)	1.045	0.981	1.112	0.173	1.048	0.979	1.123	0.177
Constant	0.765	0.248	2.364	0.642	0.927	0.284	3.019	0.899

*means statistically significant.

TABLE 5 Linear regressions, performance.

	Immunization				ANC			
	Coef.	95% Confidence interval		value of *p*	Coef.	95% Confidence interval		value of *p*
Trained in Intervention	15.471	11.415	19.526	0*	13.683	3.837	23.528	0.007*
Educated (> class 8)	0.736	−2.638	4.11	0.667	−3.975	−12.504	4.554	0.358
Literate	3.518	−0.478	7.514	0.084*	4.875	−4.603	14.354	0.311
Female	0.904	−2.908	4.716	0.64	8.177	−4.11	20.464	0.19
Recency of training (months)	0.11	−0.084	0.303	0.264	−0.259	−1.028	0.509	0.506
Experience (years)	0.037	−0.384	0.458	0.863	−0.332	−1.167	0.503	0.433
Constant	77.991	70.004	85.977	0	73.503	54.676	92.329	0

*means statistically significant.

CI = 1.002, 1.124; $p = 0.044$) and early infancy (OR = 1.05; CI = 0.996, 1.099; $p = 0.07$). Experience caring for pregnant women was also associated with increased knowledge of danger signs in pregnancy (OR = 1.08; CI = 0.989, 1.187; $p = 0.086$) and early infancy (OR = 1.08; CI = 0.987, 1.099; $p = 0.094$).

We then used multiple linear regression to assess predictors of CHW performance (Table 5). CHW participation in the intervention training was associated with a 15% increase in the likelihood of a child being fully immunized at 12 months (Coef = 15.47; CI = 11.41, 19.53; $p = 0$) and a 14% increase in the likelihood of a mother completing four or more antenatal care visits (Coef = 13.68; CI = 3.84, 23.53; $p = 0.007$).

Interestingly, there was minimal collinearity between education and literacy, so we included both in the regression models. Having completed schooling beyond Class 8 was associated with increased knowledge of postpartum danger signs (OR = 1.88, CI = 0.997, 3.552; $p = 0.051$) however, education was not predictive of either of the performance measures. Literacy was actually negatively associated

with knowledge of neonatal danger signs (OR = 0.41, CI = 0.193, 0.886, $p = 0.023$) however it was positively associated with immunization rates (Coef = 3.52, CI = −0.478, 7.514, $p = 0.084$). There was no association between gender and knowledge or performance.

4. Discussion

4.1. Knowledge

All three cohorts in the intervention saw increases in knowledge scores from baseline to endline. South, which started the intervention between baseline and endline, saw a significant increase. However, so did East, which started 1 year before the baseline and North, which had started the full intervention more than 2 years prior. These knowledge gains were not seen in the Central, which had not received the intervention, and actually saw a decrease in knowledge over the study period. This provides a helpful comparison and suggests the intervention contributed to increased knowledge among CHWs. Additionally, the literature finds that CHW knowledge often drops after initial training (36, 37). The fact that knowledge for CHWs in the North and East cohorts actually increases overtime may be explained by the connection between recency of training and knowledge found in the regression analysis (Table 4). Further research is required to enumerate the connection between frequency of refresher training and the retention of knowledge among CHWs (31).

4.2. Training

Whether the CHW had been trained through the intervention was a significant predictor of immunization rates and antenatal care completion rates amongst CHW clients. We would expect the intervention to have less impact on CHW performance as compared to CHW knowledge since non-intervention factors may have influenced ANC completion and immunization rates during the study period. Additionally, it is important to note that nearly all CHWs trained by the intervention also received the other program components including consistent payment and frequent supervision. Therefore, it is not possible to associate these results to training independent of these other elements. Rather, training could be viewed as a proxy for CHW professionalization, which includes supervision and payment. Our results are consistent with the wider literature which finds payment, frequent supervision, and continuous training to be associated with increased CHW performance (12). Other research shows training of TBAs to be positively associated with increases in knowledge and antenatal care outcomes (38, 39). We would like to see future studies explore the impact of this intervention on TBAs who have been incorporated into CHW cadres and compare competence of these transformed TBAs with other CHWs.

4.3. Experience

Year of caring for pregnant women is a predictor of increased knowledge of danger signs in pregnancy and early infancy, but was not associated with CHW performance outcomes. Most of the research in this area focuses on experience as a CHW specifically, and the results are mixed. A study in Kenya finds positive association between experience as a CHW and use of job aids, client satisfaction, and client enablement (40), conversely a study in Uganda found that CHWs who had serve for more than 6 years had worse client outcomes than CHWs who had served for less (31). Since our study looked at *any* experience caring for pregnant women it also may be capturing the experience of CHWs who previously acted at TBAs. Further, we call for more research on the link between experience and CHW performance.

4.4. Education and literacy

Our results on the connection between education and literacy and CHW knowledge and performance are mixed. Education was positively associated with one of the four knowledge domains, while literacy was negatively associated with another. Literacy was associated with performance on immunization rates but not antenatal care completion, and the effect size of literacy and immunizations rates (Coef = 3.52, CI = −0.48, 7.51, $p = 0.084$) are less strong than the effect size of training on the same variable (Coef = 15.47; CI = 11.41, 19.53; $p = 0$). Finally, formal education was not associated with either of the performance measures.

This incertitude matches the wider literature (31). A 2016 study of notably low performing CHWs in Northern Uganda found education to be positively correlated with performance (24). Similar results were found in Kenya (25) and Madagascar (26). However, studies in Siaya Kenya, Central Uganda, and South Sudan did not find education to be predictive of good performance (27, 28, 30). Neither did a study of the Living Goods CHW selection process in Kenya which included written tests and one-to-one interviews, but could not find an association between these screens and performance (29). Interestingly, a cross-sectional study in Nigeria which included TBAs in CHW cohorts, argued that properly trained CHWs with lower education levels can be as knowledgeable as CHWs with high education levels (41).

Together with the results of this study we conclude that education and literacy are not reliable factors associated with CHW competency and deficiencies in education might be overcome by other design factors such as frequent training and supervision. Since many CHWs in Kenya and globally are illiterate or semi-literate, and education and literacy requirements are more likely to bias against women, this is an important topic for further inquiry.

4.5. Gender

Across our measures of knowledge and performance we found no significant association with gender. However, studies which used different indicators of performance did find associations. For example, a 2012 study in Busia, Kenya found that male CHWs were more likely to keep satisfactory records, while female CHWs were more likely to counsel clients and influence behavior change

(40) and a 2012 study in Uganda found that female CHWs were less likely to lose clients to follow up (42). We recommend further inquiry, especially including less traditional measures of competency like empathy and trust.

4.6. Study limitations

Limitations include the fact that all four CHW cohorts are geographically adjacent to each other. So even though South CHWs did not receive the intervention at the baseline and Central CHWs did not receive the intervention prior to either survey, there may have been spillover effects. This is especially true as the study period took place in the midst of COVID-19 and both Lwala Community Alliance and the Ministry of Health provided additional training and support, including personal protective equipment, to most CHWs in the study, including many in Central.

Additionally, the study did not randomly select the intervention areas. Instead the CHWs received the intervention according to programmatic and demographic considerations led by the Ministry of Health. Another limitation is that the study does not include other intervention elements that may have influenced knowledge and performance, including payment and supervision, instead training acts as a proxy for all of these elements as they were added as a package. Finally, while 18% of CHWs in study were former TBAs we did not have sufficient numbers across the intervention and non-intervention cohorts in both baseline and endline to include experience as a TBA in our analysis.

5. Conclusion

Our study finds that the intervention's training was significantly associated with performance of CHWs. Further inquiry is recommended to investigate the influence of other program components, including payment, supervision, and refresher training. We also found recency of training and experience caring for pregnant women to be predictive of knowledge of pregnancy and postpartum danger signs. In comparison, the link between education and literacy and CHW performance and knowledge were inconsistent. Further, we postulate that the deficiencies presented by lower education or literacy levels may be recovered by robust training and supervision. Policy makers and practitioners should reconsider the use of education and literacy requirements in the selection process of CHWs, especially if these design choices are intended to influence knowledge or performance. Instead, we encourage selection to focus on community acceptability and experience caregiving and for programs to use competency-based assessments and accreditation following CHW training. We encourage further research into the selection criteria for CHWs and intervention design choices that may influence CHW performance. We think this inquiry would be particularly valuable in the context of a non-NGO setting in which government it working to professionalize CHWs through payment, supportive supervision and training.

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 Ethics and Scientific Review Committee at AMREF Health Africa (Proposal number: AMREF ESRC P708-2019). The patients/participants provided their written informed consent to participate in this study.

Author contributions

JS and AR developed the original study protocol. VO, LG, SO, and JS contributed to the refinement of the study protocol. LG, AR, JS, and JW prepared the initial draft of this manuscript. LG, SM, SO, and AR provided input into initial and final refinements of the full manuscript. All authors contributed to the article and approved the submitted version.

Funding

Costs for this study were paid for by Lwala Community Alliance's unrestricted funds and were not financed by any other donor source.

Acknowledgments

We want to acknowledge the Kenya Ministry of Health and officials in Migori County and Rongo sub-county for their work implementing, overseeing and supporting the named intervention. We want to show special gratitude to Tom Odhong' for championing this research and the community health system in Migori County. We acknowledge the work of the Community Health Impact Coalition, UNICEF, and USAID in their collective effort to advance the use of the CHW AIM Tool, which was foundational to the design of the named intervention. Special thanks to the frontline health workers, CHWs, and survey enumerators who make this study possible.

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

References

1. Onambele L, Ortega-Leon W, Guillen-Aguinaga S, Forjaz MJ, Yoseph A, Guillen-Aguinaga L, et al. Maternal mortality in Africa: regional trends (2000-2017). *Int J Environ Res Public Health*. (2022) 19:13146. doi: 10.3390/ijerph192013146

2. Alkema L, Chou D, Hogan D, Zhang S, Moller AB, Gemmill A, et al. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN maternal mortality estimation inter-agency group. *Lancet*. (2016) 387:462–74. doi: 10.1016/S0140-6736(15)00838-7

3. Delloite. Assessment of UNFPA's advocacy campaign to end preventable maternal and new-born mortality -summary report: UNFPA; (2016) Available at: https://kenya.unfpa.org/en/publications/assessment-unfpa%E2%80%99s-advocacy-campaign-end-preven2.2.2.-maternal-and-new-born-mortality.

4. Kenya National Bureau of Statistics, Ministry of Health/Kenya, National AIDS Control Council/Kenya, Kenya Medical Research Institute, Population NCf, Development/Kenya. *Kenya Demographic and Health Survey 2014*. United States: Rockville, MD (2015).

5. Ballard M, Olsen HE, Millear A, Yang J, Whidden C, Yembrick A, et al. Continuity of community-based healthcare provision during COVID-19: a multicountry interrupted time series analysis. *BMJ Open*. (2022) 12:e052407. doi: 10.1136/bmjopen-2021-052407

6. Lewin S, Munabi-Babigumira S, Glenton C, Daniels K, Bosch-Capblanch X, van Wyk BE, et al. Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane Database Syst Rev*. (2010) 2010:CD004015. doi: 10.1002/14651858.CD004015.pub3

7. Rogers AL, Lee AXT, Joseph JG, Starnes JR, Odhong TO, Okoth V, et al. Predictors of under-five healthcare utilization in Rongo sub-county of Migori County, Kenya: results of a population-based cross-sectional survey. *Pan Afr Med J*. (2022) 41:108. doi: 10.11604/pamj.2022.41.108.31618

8. August F, Pembe AB, Mpembeni R, Axemo P, Darj E. Effectiveness of the home based life saving skills training by community health workers on knowledge of danger signs, birth preparedness, complication readiness and facility delivery, among women in rural Tanzania. *BMC Pregnancy Childbirth*. (2016) 16:129. doi: 10.1186/s12884-016-0916-x

9. World Health Organization. WHO guideline on health policy and system support to optimize community health worker programmes: WHO; (2018) Available at: https://www.who.int/publications/i/item/9789241550369.

10. Cometto G, Ford N, Pfaffman-Zambruni J, Akl EA, Lehmann U, McPake B, et al. Health policy and system support to optimise community health worker programmes: an abridged WHO guideline. *Lancet Glob Health*. (2018) 6:e1397–404. doi: 10.1016/S2214-109X(18)30482-0

11. Ballard M, Bonds M, Burey J-A, Foth J, Jr K, Holeman I, et al. *Community Health Worker Assessment and Improvement Matrix (CHW AIM): Updated Program Functionality Matrix for Optimizing Community Health Programs USAID*. (2018).

12. Scott K, Beckham SW, Gross M, Pariyo G, Rao KD, Cometto G, et al. What do we know about community-based health worker programs? A systematic review of existing reviews on community health workers. *Hum Resour Health*. (2018) 16:39. doi: 10.1186/s12960-018-0304-x

13. Ashraf N, Bandiera O, Lee SS. *Do-gooders and go-getters: Career Incentives, Selection, and Performance in Public Service Delivery*. United States: Harvard Business School (2015).

14. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet*. (2012) 379:2151–61. doi: 10.1016/S0140-6736(12)60560-1

15. Long CRHSFDL-A. The current state of CHW training programs in sub-Saharan Africa and South Asia: What we know, what we Don't know, and what we need to do: MedBox; (2014) Available at: https://www.medbox.org/document/the-current-state-of-chw-training-programs-in-sub-saharan-africa-and-south-asia-what-we-know-what-we-dont-know-and-what-we-need-to-do#GO.

16. Kaseje DC, Spencer HC, Sempebwa EK. Usage of community-based chloroquine treatment for malaria in Saradidi. *Kenya Ann Trop Med Parasitol*. (1987) 81:111–5. doi: 10.1080/00034983.1987.11812196

17. Bentley C. Primary health care in northwestern Somalia: a case study. *Soc Sci Med*. (1989) 28:1019–30. doi: 10.1016/0277-9536(89)90384-5

18. Delacollette C, Van der Stuyft P, Molima K. Using community health workers for malaria control: experience in Zaire. *Bull World Health Organ*. (1996) 74:423–30.

19. Brown A, Malca R, Zumaran A, Miranda JJ. On the front line of primary health care: the profile of community health workers in rural Quechua communities in Peru. *Hum Resour Health*. (2006) 4:11. doi: 10.1186/1478-4491-4-11

20. Newell KWWorld Health Organization. *Health by the People: World Health Organization WHO*. (1975).

21. Johnson BA, Khanna SK. Community health workers and home-based care programs for HIV clients. *J Natl Med Assoc*. (2004) 96:496–502.

22. Sakeah E, Aborigo RA, Debpuur C, Nonterah EA, Oduro AR, Awoonor-Williams JK. Assessing selection procedures and roles of community health volunteers and community health management committees in Ghana's community-based health planning and services program. *PLoS One*. (2021) 16:e0249332. doi: 10.1371/journal.pone.0249332

23. Suda C. Gender disparities in the Kenyan labour market: implications for poverty reduction. *Nord J Afr Stud*. (2002) 11:301–321.

24. Wanduru P, Tetui M, Tuhebwe D, Ediau M, Okuga M, Nalwadda C, et al. The performance of community health workers in the management of multiple childhood infectious diseases in Iira, northern Uganda -a mixed methods cross-sectional study. *Glob Health Action*. (2016) 9:33194. doi: 10.3402/gha.v9.33194

25. Kawakatsu Y, Sugishita T, Tsutsui J, Oruenjo K, Wakhule S, Kibosia K, et al. Individual and contextual factors associated with community health workers' performance in Nyanza Province, Kenya: a multilevel analysis. *BMC Health Serv Res*. (2015) 15:442. doi: 10.1186/s12913-015-1117-4

26. Smith S, Agarwal A, Crigler L, Gallo MF, Finlay A, Homsi FA, et al. *Community Health Volunteer Program Functionality and Performance in Madagascar: A synthesis of Qualitative and Quantitative Assessments. CDC Stacks Public Health Publications*. (2013).

27. Rowe SY, Kelly JM, Olewe MA, Kleinbaum DG, McGowan JE, McFarland DA, et al. Effect of multiple interventions on community health workers' adherence to clinical guidelines in Siaya district, Kenya. *Trans R Soc Trop Med Hyg*. (2007) 101:188–202. doi: 10.1016/j.trstmh.2006.02.023

28. Naoko Kozuki CT, Zhou Annie, Boetzelaer EV. Can Low-Literate Community Health Workers Treat Severe Acute Malnutrition? A study of simplified algorithm and tools in South Sudan (2019) cited South Sudan; (59):30 p. Available at: https://www.ennonline.net/fex/59/samtoolssudan.

29. Taylor CA, Lilford RJ, Wroe E, Griffiths F, Ngechu R. The predictive validity of the living goods selection tools for community health workers in Kenya: cohort study. *BMC Health Serv Res*. (2018) 18:803. doi: 10.1186/s12913-018-3620-x

30. Bagonza J, Rutebemberwa E, Eckmanns T, Ekirapa-Kiracho E. What influences availability of medicines for the community management of childhood illnesses in Central Uganda? Implications for scaling up the integrated community case management programme. *BMC Public Health*. (2015) 15:1180. doi: 10.1186/s12889-015-2525-4

31. Kok MC, Dieleman M, Taegtmeyer M, Broerse JE, Kane SS, Ormel H, et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. *Health Policy Plan*. (2014) 30:1207–27. doi: 10.1093/heapol/czu126

32. Ludwick T, Brenner JL, Kyomuhangi T, Wotton KA, Kabakyenga JK. Poor retention does not have to be the rule: retention of volunteer community health workers in Uganda. *Health Policy Plan*. (2013) 29:388–95. doi: 10.1093/heapol/czt025

33. Heerboth SA, Hennessey C, Omondi B, Wafula M, Mbeya J, Rogers A, et al. Knowledge of obstetric and neonatal danger signs among community health Workers in the Rongo sub-County of Migori County, Kenya: results of a community-based cross-sectional survey. *Afr J Reprod Health*. (2020) 24:121–32. doi: 10.29063/ajrh2020/v24i1.13

34. JHPIEGO. Monitoring birth preparedness and complication readiness: Tools and indicators for maternal and newborn health: Healthy newborn network; (2004) Available at: https://www.healthynewbornnetwork.org/resource/monitoring-birth-preparedness-and-complication-readiness-tools-and-indicators-for-maternal-and-newborn-health/.

35. Vallières F, Hyland P, McAuliffe E, Mahmud I, Tulloch O, Walker P, et al. A new tool to measure approaches to supervision from the perspective of community health workers: a prospective, longitudinal, validation study in seven countries. *BMC Health Serv Res*. (2018) 18:806. doi: 10.1186/s12913-018-3595-7

36. Miyake S, Speakman EM, Currie S, Howard N. Community midwifery initiatives in fragile and conflict-affected countries: a scoping review of approaches from recruitment to retention. *Health Policy Plan*. (2016) 32:21–33. doi: 10.1093/heapol/czw093

37. Reisman J, Arlington L, Jensen L, Louis H, Suarez-Rebling D, Nelson BD. Newborn resuscitation training in resource-limited settings: a systematic literature review. *Pediatrics*. (2016) 138:e20154490. doi: 10.1542/peds.2015-4490

38. Ribeiro SD. Traditional birth attendance (TBA) in a health system: what are the roles, benefits and challenges: a case study of incorporated TBA in Timor-Leste. *Asia Pac Fam Med*. (2014) 13:12. doi: 10.1186/s12930-014-0012-1

39. Sibley LM, Sipe TA, Barry D. Traditional birth attendant training for improving health behaviours and pregnancy outcomes. *Cochrane Database Syst Rev*. (2012) 8:Cd005460. doi: 10.1002/14651858.CD005460.pub3

40. Crispin N, Wamae A, Ndirangu M, Wamalwa D, Wangalwa G, Watako P, et al. Effects of selected socio-demographic characteristics of community health workers on performance of home visits during pregnancy: a cross-sectional study in Busia District. *Kenya Glob J Health Sci*. (2012) 4:78–90. doi: 10.5539/gjhs.v4n5p78

41. Ray AM, Salihu HM. The impact of maternal mortality interventions using traditional birth attendants and village midwives. *J Obstet Gynaecol*. (2004) 24:5–11. doi: 10.1080/01443610310001620206

42. Task-Shifting to Community Health Workers. Evaluation of the performance of a peer-led model in an antiretroviral program in Uganda. *AIDS Patient Care STDs*. (2012) 26:101–7. doi: 10.1089/apc.2011.0279

frontiers | Frontiers in Medicine

TYPE Systematic Review
PUBLISHED 16 June 2023
DOI 10.3389/fmed.2023.1124264

OPEN ACCESS

EDITED BY
Muhammad Shahid Iqbal,
Prince Sattam bin Abdulaziz University,
Saudi Arabia

REVIEWED BY
Muhammad Zahid Iqbal,
AIMST University, Malaysia
Marie-Claire O'Shea,
Griffith University, Australia

*CORRESPONDENCE
Sharon Brownie
✉ sbrownie@swin.edu.au

RECEIVED 19 January 2023
ACCEPTED 25 May 2023
PUBLISHED 16 June 2023

CITATION
Brownie S, Blanchard D, Amankwaa I, Broman P, Haggie M, Logan C, Pearce A, Sampath K, Yan A-R and Andersen P (2023) Tools for faculty assessment of interdisciplinary competencies of healthcare students: an integrative review. *Front. Med.* 10:1124264. doi: 10.3389/fmed.2023.1124264

Tools for faculty assessment of interdisciplinary competencies of healthcare students: an integrative review

Sharon Brownie[1,2,3]*, Denise Blanchard[4,5,6], Isaac Amankwaa[3,7], Patrick Broman[3], Marrin Haggie[3], Carlee Logan[3], Amy Pearce[3], Kesava Sampath[3], Ann-Rong Yan[7] and Patrea Andersen[3,8,9]

[1]School of Health Sciences, Swinburne University, Hawthorn, QLD, Australia, [2]School of Medicine and Dentistry, Griffith University, Gold Coast, QLD, Australia, [3]Centre for Health and Social Practice and Centre for Sports Science and Human Performance, Waikato Institute of Technology – Te Pukenga, Hamilton, New Zealand, [4]School of Nursing, Eastern Institute of Technology – Te Pukenga, Hawkes Bay, New Zealand, [5]School of Nursing, Paramedicine and Healthcare Sciences, Charles Sturt University, Bathurst, NSW, Australia, [6]School of Nursing and Midwifery, The University of Newcastle Central Coast Clinical School, Ourimbah, NSW, Australia, [7]Faculty of Health, University of Canberra, Canberra, NSW, Australia, [8]School of Nursing, Midwifery and Paramedicine, University of the Sunshine Coast, Sippy Downs, QLD, Australia, [9]School of Nursing, Midwifery and Social Science, Central Queensland University, Sippy Downs, QLD, Australia

Increasingly, interprofessional teamwork is required for the effective delivery of public health services in primary healthcare settings. Interprofessional competencies should therefore be incorporated within all health and social service education programs. Educational innovation in the development of student-led clinics (SLC) provides a unique opportunity to assess and develop such competencies. However, a suitable assessment tool is needed to appropriately assess student progression and the successful acquisition of competencies. This study adopts an integrative review methodology to locate and review existing tools utilized by teaching faculty in the assessment of interprofessional competencies in pre-licensure healthcare students. A limited number of suitable assessment tools have been reported in the literature, as highlighted by the small number of studies included. Findings identify use of existing scales such as the Interprofessional Socialization and Valuing Scale (ISVS) and the McMaster Ottawa Scale with Team Observed Structured Clinical Encounter (TOSCE) tools plus a range of other approaches, including qualitative interviews and escape rooms. Further research and consensus are needed for the development of teaching and assessment tools appropriate for healthcare students. This is particularly important in the context of interprofessional, community-partnered public health and primary healthcare SLC learning but will be of relevance to health students in a broad range of clinical learning contexts.

KEYWORDS

interdisciplinary education, interdisciplinary communication, interprofessional relations, public health, primary healthcare, collaboration, assessment, measurement

1. Introduction

Effective interprofessional engagement and collaborative practice are crucial to quality public health and primary healthcare delivery, especially given the growing prevalence of non-communicable illness (1). Therefore, fundamental skills of professional teamwork are essential to the preparation of 21st-century health and social workforces (2–5).

Despite the necessity of pre-licensure healthcare students developing these interprofessional competencies, the educational experience and assessment process is often constrained by profession-specific boundaries and logistical barriers which require specific strategies to address (5–7). There is significant agreement that more work is needed in transforming curricula and effectively assessing the development of interprofessional competencies throughout the educational experience (8). This requires, for educators, the identification of interprofessional competencies required of members of healthcare teams and careful consideration of how these are taught and assessed (9). Prompted by the development of a student-led clinic in Aotearoa New Zealand, this search inquiry was undertaken to identify tools used globally by faculty to evaluate and assess interprofessional competencies in pre-licensure students from two or more healthcare professions. The search sought examples where two or more professions had worked together rather than tools developed or utilized from the activity and perspective of one profession alone.

2. Background

2.1. Student-led clinics

Student-led clinics (SLCs) are an increasingly widely used model of clinical practice education that increases the involvement of pre-licensure students in hands-on practice, particularly within primary healthcare settings, while providing a broad range of benefits to service users and communities (10). Of particular note, SLCs are shown to be a helpful health delivery model in providing public health and primary healthcare services to support underserved and marginalized health communities (1, 11, 12). SLCs may involve a single professional group (10) or may be interprofessional in nature (13, 14). The success of SLCs clinics is enhanced by thoroughly planning clinical activities, student experience and competency assessment. Detailed planning is vital if the clinics are interprofessional. While the benefits of interprofessional practice are well-understood, the IPE dimension adds more complexity to the endeavor of establishing an SLC (5, 6). Evidence-based pedagogical approaches are needed to inform the development of clinical placement rotations and experience.

2.2. Context

The researchers undertaking this review are involved in establishing an interprofessional SLC in the Waikato region of Aotearoa New Zealand. The region's high prevalence of non-communicable diseases such as Type two Diabetes Mellitus (T2DM), cardiovascular disease and respiratory illness calls for greater public health awareness and literacy and enhanced primary healthcare (15). An initial feasibility study canvassed the views of community organizations and members, enabling the proposed development to be community-led and aligned with the specific needs of local communities (16). Following community prioritization of need, it was agreed that the proposed SLC would focus on increasing public health awareness and enhancing primary healthcare access for a broad range of services related to T2DM and related non-communicable diseases. Services are intended to improve health knowledge and care access. Interprofessional delivery helps to address related equity issues (17). This integrative review was designed as part of the planning process for the SLC, to identify competency assessment tool/s currently being used by teaching faculty to inform the development of a teaching and assessment tool common to all pre-licensure students participating in the proposed SLC. Relevant professional groups include nursing, midwifery, physiotherapy, osteopathy, social work, counseling, clinical exercise physiology, dietetics, osteopathy, and sport science students.

2.3. Operational definitions

Ambiguity is not uncommon as various nomenclature is used within the literature to describe concepts of interdisciplinarity and assessment. Thus, definitions were explored as a precursor to this review with the following utilized for the purposes of the review.

2.3.1. Interdisciplinarity

Interprofessional (IP), interdisciplinary and multidisciplinary practices are inconsistently defined in the literature. IP practice is perhaps best defined as multiple health team members from different professional backgrounds working together in clinical practice (18). In contrast, interdisciplinary practice involves "knowledge sharing" (19) from multiple knowledge bases and collaborating to achieve a shared outcome, typically with an educational focus (20, 21). Multidisciplinary practice is differentiated further, as professionals achieve this by working from their own knowledge base, with minimal/no knowledge of each other's knowledge base (19). IP is often also suffixed with education and learning. While IP practice refers to the clinical practice context, IP education and learning "occurs when two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes" (18) and is the process of preparing people for collaborative IP practice (22). Another important distinction to make is collaborative practice, when members of the healthcare teamwork with people from within their profession, people outside their profession, and multiple other stakeholders, such as patients/clients and their families or non-health members of the team (23). In this review, the focus is on assessment of IP practice in a clinical setting and, while this is an interdisciplinary context where collaborative practice will occur, the term IP will be used throughout.

2.3.2. Assessment

This review searched for and appraised appropriate "tools" and "instruments" to inform how to best evaluate or assess IP practice in learners. Assessment "tools" and "instruments" are terms also used interchangeably in the literature (24–26), with contradictory definitions positioning assessment instruments as a component of assessment tools and vice versa (27, 28). For this review, the terms are interchangeable, and both are included as search terms, however, the term assessment tool is reported for consistency.

2.4. Research question

Our interests lie in understanding how competency for interprofessional practice has been measured, by teaching faculty, among pre-licensure healthcare students in practice settings (as opposed to the assessment of profession-specific competencies). Specifically, we sought to identify existing assessment tools used by faculty to assess interprofessional competency attainment of pre-li from two or more professions censure healthcare students in clinical learning contexts and which could be utilized within an interprofessional student-assisted clinic. Thus, this review focused on the following questions:

- What tools have been used by teaching faculty to assess interprofessional competencies of pre-licensure healthcare students experiencing learning in interprofessional contexts (i.e., involving two or more professions)?
- How might identified tools be used to inform development of an assessment instrument for assessing interprofessional competency attainment of healthcare students in clinical learning contexts such as a primary healthcare-focused interprofessional student-led clinic?

3. Method

This review was conducted using an integrative approach as described by Whittemore and Knafl (29). Interprofessional concepts and their associated measurement are complex and context specific (29). One study type or design cannot capture all the dimensions of healthcare students' interprofessional competency assessment and related tools. An integrative review allows for synthesizing methodologically diverse studies to comprehensively understand a particular issue or phenomenon to inform practice or policy (30). Adopting this methodology enables going beyond the narrow focus of traditional systematic reviews to ask broader, practice-based questions that can direct practice-based scientific knowledge (31, 32). The five integrative review methodology stages described by Whittemore and Knafl (31) – (1) problem identification, (2) literature search, (3) data evaluation, (4) data analysis, and (5) presentation – were utilized in this review.

3.1. Inclusion and exclusion criteria

The review's concepts and search terms were based on the PICO/PECO frameworks (**P**—Participants, **I/E**—Interventions/Exposure, C—Comparisons and **O**—Outcomes) (33). The selection criteria are summarized in Table 1. We placed no time restrictions; however, we included only studies published in English. The review includes primary studies only, excluding reviews, books, editorials, letters, and commentaries. Both qualitative, quantitative, and mixed methods studies were included.

TABLE 1 Inclusion and exclusion criteria.

	Inclusion and exclusion criteria	
Inclusion criteria	Population	Pre-licensure healthcare students at any level of study
	Intervention/exposure	interprofessional education and assessment
	Comparison	uni-professional education and assessment
	Outcome	**Primary**- interprofessional competency
Exclusion criteria	1.	Registered health professionals
	2.	Self-assessment of interprofessional competencies

3.2. Databases and search terms

We searched published materials and gray literature using three broad concepts (healthcare student, assessment and interprofessional competence) derived from our research question and refined by MeSH terms in Medline. An initial test string was tested in ERIC for relevance: (Pre-registration OR Pre-licensure) AND (Healthcare student OR Healthcare student) AND (postgraduate OR undergraduate) AND (Evaluate OR Assessment OR assessing OR assess OR outcome OR outcomes OR examin* OR evaluate) OR (measurement OR measure OR measuring) AND (Competenc* OR Competent) AND interprofession*) AND tools). We continued to develop this initial search strategy iteratively and tailor it across these databases: CINAHL, PubMed/Medline, Embase, ERIC and Proquest One Academic. Comprehensiveness in the search scope was achieved through a review of the reference list of relevant primary papers and other sources like Google and Google Scholar search. The search strategy is shown in Table 2.

3.3. Data screening and selection

Identified records from databases and Google searches were imported into Covidence® (34), an online screening and data management software. Automatic removal of duplicates in Covidence was followed by a two-staged screening of unique studies by two sets of independent reviewers including PB, SB, KKS, and IA. The initial screening of the titles and abstracts was followed by a further screening of full-text articles identified. Finally, a third and fourth reviewer (DB and A-RY) consulted together to resolve discrepancies and conflicts between the reviewer judgements in each stage of the review process. The screening and conflict resolution process in Covidence were blinded. The search strategy and data screening procedures, using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) Statements (35), are reported in Table 2 and Figure 1, respectively.

TABLE 2 Search strategy on Proquest ONE Academic, ERIC, Medline and Embase, and search results on 25/05/2022.

Proquest ONE academic		
1	(Pre-registration OR Pre-licensure) AND (Healthcare student OR Healthcare student) AND (postgraduate OR undergraduate) AND stype.exact ("Scholarly Journals") AND (measurement OR measure OR measuring AND tool* OR scale) AND (Evaluate OR Assessment OR assessing OR assess OR outcome OR outcomes OR examin* OR evaluate) AND stype.exact ("Scholarly Journals") AND interprofessional	613
ERIC		
1	(Pre-registration OR Pre-licensure) AND (Healthcare student OR Healthcare student) AND (postgraduate OR undergraduate)) AND ((Evaluate OR Assessment OR assessing OR assess OR outcome OR outcomes OR examin* OR evaluate) OR (measurement OR measure OR measuring) AND (Competenc* OR Competent) AND interprofession*) AND tools) AND stype.exact("Scholarly Journals")	1867
Medline (Via PubMed)		
1	Healthcare Student [MeSH Major Topic]	30,385
2	Pre-registration OR Pre-licensure OR Postgraduate OR undergraduate	158,162
3	#1 OR #2	181,183
4	Assessment [Title/Abstract] OR Evaluate [Title/Abstract] OR Evaluation [Title/Abstract] OR Assessing [Title/Abstract] OR Assess [Title/Abstract] OR Outcome* [Title/Abstract] OR Examin* [Title/Abstract] OR Measurement [Title/Abstract] OR measure [Title/Abstract] OR measuring [Title/Abstract]	8,752,126
5	Competenc* [MeSH Major Topic]	2,670
6	Competenc* [Title/Abstract]	100,068
7	#5 OR #6	101,015
8	Interprofession* [Title/Abstract] OR Inter-profession* [Title/Abstract] OR Health profession* [Title/Abstract] OR healthcare profession* [Title/Abstract] OR Health [Title/Abstract] AND social care profession* [Title/Abstract] OR collaborat* [Title/Abstract]	179,031
9	#7 AND #8	5,199
10	#3 AND #4 AND #9	622
Embase <1947 to present>		
1	health student/	1686
2	(Pre-registration or Pre-licensure or Postgraduate or undergraduate).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	93448
3	1 or 2	94751
4	((assessment or evaluation) and interprofessional).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	5918
5	3 and 4	696
6	Competence/or clinical competence/	92987
7	5 and 6	92

3.4. Data extraction and synthesis

Data were extracted and synthesized following Whittemore and Knafl (31) guidelines. The data extraction process involved reviewing each study's details, research design, aims, ethical considerations, sample population and size, comparative interventions, outcome measures, findings, and limitations. Covidence was used as the primary tool for data extraction. Data were then synthesized by identifying themes and concepts related to the review questions. The synthesis process involved sorting the data into intellectual bins, naming themes, and looking for relationships to guide future studies. The studies' psychometric features, such as internal consistency, inter-item and inter-total correlations, and inter-rater reliability, were examined to assess the quality and reliability of the findings. The key themes and relationships are summarized in Table 5.

3.5. Evaluation of data

Including both primary and theoretical literature in integrative review makes quality appraisal more complex (31). In line with our decision to integrate quantitative, qualitative and mixed methods studies, we adopted the "mixed-methods assessment tool (MMAT), version 2018" (36) for the quality appraisal of eligible studies. Two reviewers (DB and A-RY) independently appraised the quality of included studies and resolved any disagreements by consensus. Each study's quality is presented. In keeping with the integrative

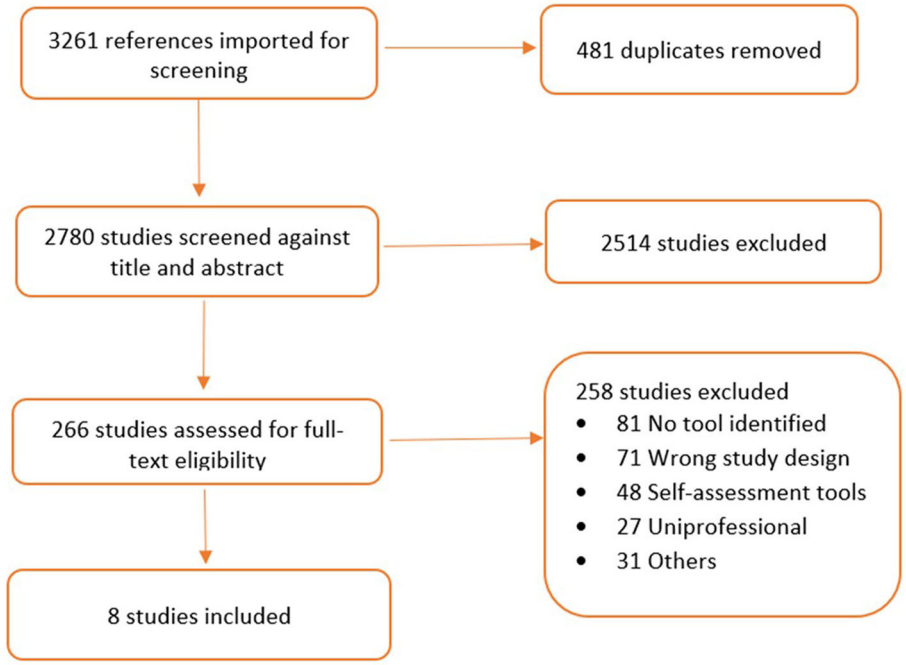


FIGURE 1
PRISMA flow chart of study selection process.

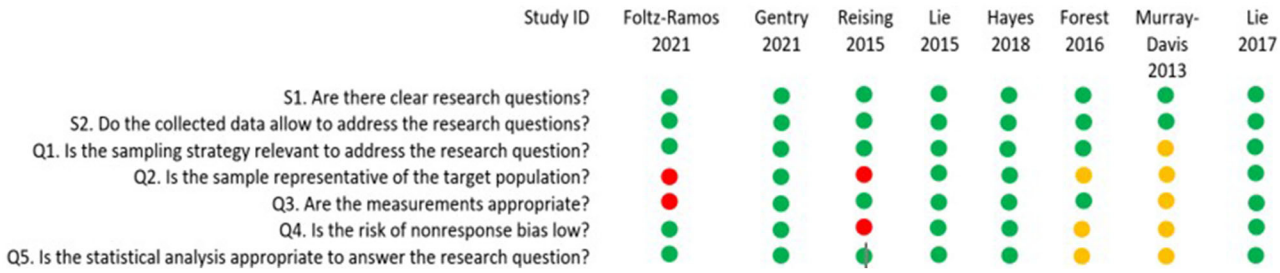


FIGURE 2
Quality appraisal of the included articles.

review methods, no eligible study was excluded based on research quality issues (31, 37).

4. Results

Eight manuscripts were identified for inclusion in the review (38–45), however, two reported activities from the same context. The PRISMA Flow Chart and study selection process (Figure 1) outlines the process of assessment and inclusion.

Application of the the 'MMAT version 2018' (36) provided the quality appraisal results shown in Figure 2.

In terms of study quality, notable issues exist where, sample representativeness is questionable due to the sample size being too small (38–40) or reported inconsistently (41). Selection bias may exist when the participants are recruited on a voluntary basis and if not all the participants are included for analysis (42). Also, the measurements may be inappropriate if only one rater is used in the competency assessment (41), and to assess tool quality. Bias is reduced when two faculty members rate and compare results vs. the assessment of a single faculty member alone.

Six of the eight studies were based in the United States of America, one in Canada and one in an unstated country. Each included diverse aims, as shown in Table 3. The different approaches included emphasis on the development and delivery of the interprofessional education program with the application of assessment tools (40, 41), or alternatively focusing on testing the assessment tools (38, 39, 42).

The interprofessional initiatives assessed in the eight studies were equally diverse and included ongoing interprofessional activities; interprofessional collaboration with community partners; an interprofessional escape room; an interprofessional

TABLE 3 Characteristics of the included studies.

Study ID	Country	Aim of study	Limitations	Study design	Total number of students/assessors
Foltz-Ramos et al. (41)	USA	To create and test the use of an interprofessional escape room to improve teamwork before interprofessional simulation	Previous experience of escape rooms was not considered; simulations rather than true life cases were used.	Quantitative descriptive studies	233/1
Gentry et al. (40)	USA	To describe a longitudinal, collaborative interinstitutional IPE project that engages community partners (CP) while delivering core IPE competencies.	Small sample size without medical students' participation; missing sociodemographic faculty data; not linking the student team to faculty assessment data; community-based IPE may be difficult to scale.	Quantitative descriptive studies	27/9
Reising et al. (42)	USA	To establish psychometric testing of the Indiana University Simulation Integration Rubric (IUSIR), a tool for measuring interprofessional communication in simulations	Agreement on how to score with the tool is needed when more than one behavior is involved; the sample consisted of nursing and medical student only from a single midwestern university; the tool is specific to individual and team communication; Simulation was used	Quantitative descriptive studies	295/NA
Lie et al. (35)	USA	To test the feasibility of using a retooled scale to rate performance in a standardized patient encounter and to assess faculty's ability to accurately rate both individual students and teams	Participants were trained students and one-third were lowest performing, which is not seen in real world; small sample size	Quantitative descriptive studies	16/16
Hayes et al. (43)	USA	To describe the IPE experiences and the development of Interprofessional Team-based Care Rubric (ITCR) and report its reliability and validity	A small size of sample from one regional university; the documentation was not graded; participants were at different academic levels; a nominal scale of zero to five rather than a more continuous scale was used	Quantitative descriptive studies	78/6
Forest et al. (44)	NA	to develop and implement a tool for rating teams and individuals	One institutional project; too few faculty trained to assess interobserver reliability statistically; the effect of giving feedback to the team was not investigated	Quantitative descriptive studies	NA/NA
Murray-Davis et al. (45)	Canada	To report on the development of a TOSCE for learners from three health professions from family physicians, midwives, and obstetricians	Next steps including assessor training and learner involved TOSCE are required	Quantitative descriptive studies	NA/NA
Lie et al. (39)	USA	To improve scale usability for clinical settings by reducing item numbers while maintaining generalizability; and to explore the minimum number of observed cases required to achieve modest generalizability for giving feedback.	A standard patient setting was used; only four health professions (Physician Assistant, Pharmacy, Occupational Therapy, and Nursing) were participated	Quantitative descriptive studies	63/16

10.3389/fmed.2023.1124264

TABLE 4 Characteristics of the interprofessional education delivered in the included studies.

Study ID	Name of IPP/IPE	Duration of IPP/IPE	Venue	Cases/patients	Participants	Raters
Foltz-Ramos et al. (41)	Interprofessional escape room	NA	In a simulation center located in an eastern U.S. university	High-fidelity patient simulators	Third-year pharmacy and senior nursing students scheduled for an existing required session during the fall 2018 semester. An interprofessional simulation experience was part of mandatory coursework in their respective programs. Teams of four students: two pharmacy students and two nursing students	One observer
Gentry et al. (40)	MVA IPE collaborating with CP	six months 30 hours over two semesters	In a community setting	Na	Twenty-seven students from five universities representing ten healthcare academic programs were divided into five teams.	Nine faculty leaders
Reising et al. (42)	Ongoing interprofessional activities	At least one team simulation activity was planned per semester, with a minimum of four simulation activities for each student team throughout the curriculum	Na	Simulation scenarios	Two hundred and twenty nine pre-licensure bachelor of science in nursing students and 66 pre-licensures first- and second-year medical students. Teams consisted of one medical student and one to two nursing students	The lead nursing school faculty member and lead medical school faculty member
Lie et al. (35)	TOSCE station	35 minutes for one TOSCE station (stroke)	At the health science campus of a single institution (the University of Southern California) located in urban Los Angeles, California	Four sps were recruited from a database of experienced SP actors to perform at TOSCE stations with the selected case of stroke	Sixteen students from four professions were trained a priori to perform in teams of four at three different levels as individuals and groups	Sixteen volunteer faculty members, representing dentistry, medicine, occupational therapy, pharmacy, and physician assistant professions with experience teaching and assessing students and no prior experience with IPE assessment. Faculty members had a 60-minute pre-TOSCE training and were blinded to the study's purpose and student and IPE team performance levels
Hayes et al. (43)	NA	Phase I (Fall 2012 and 2013) began as one 3-hour experience with nursing and physical therapy students and faculty. Phase II started in Fall2014 and included two experiences during the semester and the addition of social work students and faculty.	At a regional comprehensive university in the southeast United States	The simulation scenario was based on an unfolding case study that followed one client from an acute care hospital admission through transitional care planning. Documentation assignments during the IPE experiences	Twenty five nursing students, 32 physical therapy students, 21 social work students. Students from the three programs were randomly assigned to ten teams of 7–8 students. Each team consisted of 2–3 nursing, 2–3 physical therapy, and 1–2 social work students.	Three raters and three additional raters

(Continued)

10.3389/fmed.2023.1124264

TABLE 4 (Continued)

Study ID	Name of IPP/IPE	Duration of IPP/IPE	Venue	Cases/patients	Participants	Raters
Forest et al. (44)	Training session	45 min	Na	Actor patient	Actors	40 faculty members
Murray-Davis et al. (45)	TOSCE stations	20 min	At an Ontario University who are involved in primary care obstetrics	A written description of a patient case, or a standardized patient, or a video monolog from a patient	Three professions	Two evaluators
Lie et al. (39)	A two-station TOSCE	Each station lasted 25 minutes	At the University of Southern California	Two standardized patients in succession	Sixty three volunteer students from the four health professions programs (Physician Assistant, Pharmacy, Occupational Therapy, and Nursing) no inclusion/exclusion criteria.	Sixteen volunteer faculty raters from the same four professions. The criterion was previous experience evaluating students in clinical settings. Review a standardized training video and complete the rating on the actor students, and a one-hour of in-person group training.

team-based care rubric, and a Team Observed Structured Clinical Encounter (TOSCE) station focused on stroke (see Table 4).

A single study (40) reported a multi-site inquiry of five sites; other studies involved single-site initiatives and evaluations. One study included four participating professions, namely, occupational therapy, pharmacy, dentistry and medicine (45) with the remaining studies involving fewer professions, for example, nursing and medicine (42) or nursing and pharmacy (41).

Each research team described their interprofessional assessment tool in detail and evaluated the performance in their specific study context (see Table 5) Five assessment tools were used across the 8 studies, none of which are the same, though four of them are modified from the McMaster-Ottawa scale in different ways (38–40, 52) Two studies evaluated internal consistency of the assessment tools (Observed Interprofessional Collaboration [OIPC] and Indiana University Simulation Integration Rubric [IUSIR], respectively) and reported the Cronbach's alphas, which ranged from 0.79 to 0.91 indicating a high reliability (38). Two studies analyzed interrater reliability of the assessment tools (IUSIR and TOSCE) between two and sixteen assessors, respectively (38, 42): Reising et al. reported high accuracy for both individual (92%) and team (94%) assessment by IUSIR from two assessors, while Lie et al. found a lower accuracy in individual (38–81%) than team (50–100%) assessment by TOSCE from sixteen faculty raters. These two studies also validated the assessment tools. The assessment tool IUSIR was found to have significant discriminatory capacity to differentiate junior-/senior-level performance (42); however, with the assessment tool TOSCE individual but not team performance may be over-rated (38).

5. Discussion

The authoring team closely followed Whittemore and Knafl (31) five integration stages in conducting this review: (1) problem identification, (2) literature search, (3) data evaluation, (4) data analysis, and (5) presentation. During the first stage of the review the team clarified the need to seek, locate and review existing tools utilized by teaching faculty in the assessment of interprofessional competencies of relevance to pre-licensure healthcare students. The second through fourth stages of literature search, evaluation and analysis are reported in Sections 2.2 to 2.5 with results presented in Tables 3, 4. The final presentation of results is aided by the analysis in Table 5 and the ensuing discussion.

Results yielded a paucity of published work in the field. The search focused on identifying examples where faculty had worked together in the development and evaluation of IPE competency assessment tools for pre-licensure students from two or more healthcare professions. The identified tools included the OIPC, a five-item modified TOSCE Scale, the IUSIR, TOSCE modified from the McMaster-Ottawa scale, the Interprofessional Team-based Care Rubric (ITCR), the modified McMaster-Ottawa scale, and others.

The reported consequences of deficits in interprofessional communication and teamwork include increases in medical errors, poor patient outcomes and persistence of embedded health inequalities (17, 41). As early as the 1970's, entities such as the World Health Organization (WHO) and the Institute of Medicine (IOM) highlighted the need for an increased

TABLE 5 Characteristics and performance of the assessment tools applied in the included studies.

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Foltz-Ramos et al. (41)	Observed Interprofessional Collaboration (OIPC)	Interprofessional collaboration	The first ten items relate to the adequacy of how the team builds a shared vision of the situation and the remaining ten items relate to the team's ability to develop a joint action plan.	For each item, teams are rated using a 3-point Likert-type scale (1 = inadequate, 2 = more or less adequate, 3 = adequate).	The Cronbach alpha was: 0.84 for the first ten items on the OPIC; 0.82 for the remaining ten items on the OIPIC; and 0.91 for the overall score indicating high reliability for each	NA	NA	Total score: control group 53 (43, 44, 46–51) vs. intervention group 55 (43, 49–51), $p < 0.01$ Items 1–10 Subtotal score: control group 26 (24–28) vs intervention group 27 (26–28), $p < 0.01$ Items 11-20 Subtotal score: control group 27 (25–28) vs. intervention group 27 (26–28), $p < 0.01$	Enhanced teamwork	Participating in escape rooms improved teamwork and performance during simulation, as measured by the OIPC and ISVS-21 instruments. The intervention group, which participated in the escape room activity, had higher median scores in team building, common action plan development, and overall total score compared to the control group. The control group, on the other hand, had more students who were able to escape the escape room, and those who did not escape needed more suggestions than those who did. While the escape room activity does not increase individual problem-solving skills, it does improve teamwork and collaboration among students in an interprofessional education context

(Continued)

10.3389/fmed.2023.1124264

TABLE 5 (Continued)

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Gentry et al. (40)	five-item modified TOSCE Scale	Interprofessional team competency	1. Collaboration 2. roles and responsibilities 3. community partner centered approach 4. conflict management and resolution 5. values and ethics	per item: 3 (minimum)—9 (maximum) points total score: maximum 45 points	NA	NA	NA	Average total score: 43.11 (+/- 3.26) Average scores per item: collaboration 8.67 (+/- 0.71), roles and responsibilities 8.56 (+/- 1.01), community partner centered approach 8.67 (+/- 0.71), conflict management and resolution 8.67 (+/- 0.71), values and ethics 8.56 (+/- 1.01)	Interprofessional Education (IPE) and Enhanced Teamwork	Most students expressed interest in Interprofessional Education (IPE) and collaboration for future collaborations. A follow-up assessment with 21 students showed significant changes in attitudes, behaviors, and beliefs about interprofessional collaboration and socializing. ISVS total scores also significantly improved, with collaboration, communication, and comfort with other professions being recurrent themes. Faculty leaders assessed program student teams using a modified Team Objective Structured Clinical Examination (TOSCE) Scale, which resulted in high scores in collaboration, responsibilities, tasks, community partner-centered approach, conflict management and resolution, values, and ethics

(Continued)

10.3389/fmed.2023.1124264

TABLE 5 (Continued)

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Reising et al. (42)	Indiana University Simulation Integration Rubric (IUSIR)	interprofessional communications	Individual Body language, Eye contact, (Physical) Appearance; Use of closed-loop communication, Use of terminology, Introduction to the patient; Incorporating feedback, Asking for clarifications and questions, Addressing errors; Seeking out input from the team, Referring to written resources; Identifying critical patient care issues, Implementing treatment; Patient reassurance, Addressing patient questions. Team Teams' energy and communication; Using closed-loop communication; Using input, Patients' care; Clinical impression; Education of patient about treatment; Reassessing patient after treatment.	For each item, the lowest performing score is 1, the mid-score is 3, and the high score is 5. The maximum score for an individual and a team is 30.	The Cronbach's alphas for individual items: nursing students 0.82 medical students 0.86 The Cronbach's alphas for team items: nursing students 0.79 medical students 0.90	The average individual inter-item correlation was 0.434; the average team inter-item correlation was 0.3906 The average individual inter-total correlation was 0.517; the average team inter-total correlation was 0.479	for individual scores 92% for team scores 94%	For nursing scores on individual items, senior-level students performed significantly better than junior-level students, $p < 0.000$. Senior-level team scores on team items were significantly higher than junior-level team scores, $p < 0.001$	Communication Skills Assessment	IUSIR is a reliable and valid tool for measuring individual and team communication skills in simulated environments; Senior-level students outperformed junior-level students on individual and team items; Overall, the IUSIR is a useful tool for measuring interprofessional communication skills in simulated environmen

(Continued)

10.3389/fmed.2023.1124264

TABLE 5 (Continued)

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Lie et al. (35)	TOSCE modified from the McMaster-Ottawa scale	Interprofessional individual and team competencies	Rating individual students: 1. Communication Assertive communication Respectful communication Effective communication 2. Collaboration Establishes collaborative relationships Integration of perspectives Ensures shared information 3. Roles and responsibilities Describe roles and responsibilities Shares knowledge with others; accepts accountability 4. Collaborative patient-family-centered approach Seeks input from patients and family Shares with patients and family Advocates for patient and family 5. Conflict management/ resolution Demonstrates active listening Respectful of different perspectives Works with others to prevent conflict 6. Team functioning Evaluates team function and dynamics Contributes effectively Demonstrates shared leadership	1 or 2 or 3 point for each item	NA	NA	Accuracy of faculty raters: 38-81% of individuals, 50-100% teams.	with errors in the direction of over-rating individual, but not team performance	Faculty evaluation	Faculty demonstrated a leniency error in rating students, even with prior training using behavioral anchors; Two trained faculty raters per station are recommended to improve consistency; G-study shows most of the variance in student scores was attributable to systematic differences between students; Faculty expressed a need for more training and a simpler rating form

(Continued)

10.3389/fmed.2023.1124264

TABLE 5 (Continued)

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Hayes et al. (43)	Interprofessional Team-based Care Rubric (ITCR)	student team learning	ITCR tool is comprised of five major items, each of which contains five key criteria for a total of 25 key criteria. The Interprofessional Collaborative Practice Competency Domains from IPEC were used to inform the criteria standards, which are (1) values/ethics for interprofessional practice, (2) roles/responsibilities, (3) interprofessional communication, and (4) teams and teamwork	1 not relevant, 2 somewhat relevant, 3 quite relevant, 4 highly relevant The total team scores were reported as an average of 5 instead of a total of 25	NA	NA	The ITCR was found to have good reliability in testing (0.842) by 3 raters who used the rubric to evaluate student performance on a sample of 30 team documentation assignments during the development process, and (0.825) for all rubrics by three additional raters	For the five major items of the ITCR, both the item-level and scale-level content validity index (CVIs) were 1.00, indicating the scale was determined to have excellent content validity. For the25 key criteria, the item-level CVI has a range of 0.67e1.00. Three criteria did not achieve universal agreement among the raters. The scale-level CVI was 0.96, which is above 0.90 and considered acceptable	Rubric Development and Assessment	The rubric building process revealed that the three professions have different vocabulary and professional boundaries. The Interprofessional Team Communication Rubric (ITCR) data demonstrated statistical variations in team performance between labs, with lab 1 having the highest performance and lab 3 the lowest. However, teams performed similarly across the three labs and the rubric was found to be useful in detecting performance discrepancies and guiding team development. The tiny sample size limits the study, but it emphasizes the difficulty of creating a uniform interprofessional assessment tool and highlights the need for continual evaluation of interprofessional education experiences

(Continued)

10.3389/fmed.2023.1124264

TABLE 5 (Continued)

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Forest et al. (44)	modified McMaster-Ottawa Scale	student and interprofessional team performance	Six competencies are communication, collaboration, roles and responsibilities, collaborative patient-family centered approach, conflict management and resolution, teamwork/team functioning, and global score.	3 points scale: 1 below expected 2 at expected 3 above expected	NA	NA	NA	NA	Online and Hybrid Learning	There are three major themes that emerged: (1) the impact of technology on education, (2) the importance of student engagement and participation, and (3) the challenges and opportunities presented by online and hybrid learning. Within these themes, several patterns and relationships were identified, including the increased use of online learning tools, the need for personalized and interactive learning experiences, and the importance of effective communication and support for students in online and hybrid environments.

(Continued)

10.3389/fmed.2023.1124264

TABLE 5 (Continued)

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Murray-Davis et al. (45)	McMaster-Ottawa observer score based on the Canadian Interprofessional Health Collaborative's National Competency Framework	Collaborative Competency	communication, collaboration, roles/responsibilities, collaborative patient-family centered approach, conflict management/ resolution, and team function	NA	NA	NA	NA	NA	Communication Skills Assessment.	Internal consistency was supported for all individual and team items, and inter-item and inter-total correlations were positively correlated. Interrater reliability was also high. The tool was found to be a reliable and valid measure for interprofessional communication, with sensitivity to changes in communication skills over time. Senior-level students outperformed junior-level students on individual and team items. Overall, the IUSIR is a useful tool for measuring interprofessional communication skills in simulated environments.

(Continued)

10.3389/fmed.2023.1124264

TABLE 5 (Continued)

Study ID	Name of the tool	Outcome measured	Items	Scales	Internal consistency	Inter-item & inter-total correlations	Interrater reliability	Scores/validity	Themes	Summary
Lie et al. (39)	Modified McMaster-Ottawa scale	interprofessional team competencies	Seven items: Collaboration, Roles, Patient/Family-centeredness, Conflict Management, Communication, Teamwork, and Global. Four items: Collaboration, Roles, Patient/Family-centeredness, and Conflict Management	3 points with descriptive behavioral anchors	NA	NA	NA	Team scores from a two-station TOSCE demonstrate low generalizability whether the scale consisted of four (0.53) or seven items (0.55) Individual scores from a two-station TOSCE demonstrate modest generalizability whether the scale consisted of four (0.73) or seven items (0.75)	Individual Performance Assessment	Observation of students in teams interacting with two different patients provides reasonably reliable ratings for giving feedback; Team scores from a two-station TOSCE demonstrate low generalizability whether the scale consisted of four or seven items

focus on public health and primary healthcare supported by increased collaboration between the professions (53, 54). The IOM Conference of 1972 focused specifically on the transformation of health professional curricula to address the increasingly important need for interprofessional education (53). The ensuing decades have seen continuing calls for curriculum transformation and emphasis on interprofessional education (3, 18, 46, 55, 56) and yet significant work remains to be done. A clear finding of this review is that while progress has been made, major gaps persist in various aspects of curriculum transformation, IPE pedagogy and assessment processes. Additional development and research are needed in respect to the education and assessment of interprofessional competencies among health professionals including pre-licensure healthcare students (5, 47).

Despite the small volume of work identified in this search, valuable insights were gained regarding assessment tools that could be utilized with pre-licensure healthcare students in an IP SLC service or other clinical learning context. Lie et al. (38) adopted an existing scale, specifically, the 9-point McMaster-Ottawa Scale and associated TOSCE tool (44, 48) and converted this to a 3-point scale with behavioral anchors. Participating faculty indicated comfort in assessing up to four students within the TOSCE period of 35 minutes. However, a leniency error was noted among faculty even after comprehensive training. It is recommended that two trained faculty raters are included in each TOSCE station (38). The McMaster-Ottawa Scale was also adapted by Forest et al. (44) to develop a three-point scale, with Lie et al. (39) building on their earlier developments – Forest and Lie both reported the usefulness and validity of the McMaster- Ottawa Scale as a basis for development and implementation (39, 43).

In the ITCR approach utilized by Hayes et al. (43), interprofessional practice competency domains were used to inform the criteria standards within the tool. Testing occurred in respect to both the level and content of the scale with results showing excellent content validity (49). Reising et al. (42) undertook psychometric testing using the IUSIR which is a tool that has been developed to measure interprofessional communication during clinical simulation (42). While useful, the tool is somewhat narrow in focus in that it assesses the interprofessional communication domain only rather than a broader set of interprofessional competencies. A further limitation is that design and testing using the IUSIR tool has occurred in simulated contexts only, with utility in practice contexts yet to be determined.

The use of an interprofessional escape room is reported by Foltz-Ramos et al. (41) to improve and test interprofessional collaboration in pre-license nursing and pharmacy students (41). Escape rooms are a relatively recent teaching innovation that integrates gaming technology with learning – an attractive approach among 21st-century learners (50). Escape room technology requires students to cooperate to effectively escape a particular scenario and achieve a good outcome. Escape rooms help build teamwork skills. The tool was shown to be effective, however, escape room development requires high levels of technical expertise and resource (41) and while fruitful they are essentially a simulated learning activity and further innovation is

required to implement within the context of clinical rotations such as SLCs (41).

Transforming curricula to strengthen the focus on public health and primary healthcare priorities and reduce healthcare inequalities must take the student out of the classroom and into the community (51). However, studies reporting IPE assessment in the community and SLC settings are not commonly reported (40). Uniquely, Gentry et al. (40) collaborated with community partners over six months to deliver and assess interprofessional competencies of pre-licensure students in practice settings within primary care settings. Teams were drawn from ten professional groupings across five universities with a mixed-method approach taken to education and assessment. Participating community partners were not-for-profit entities delivering services to specific underserved and vulnerable populations. Faculty undertook continuous assessment and provided feedback to students throughout the six-month placement. Faculty assessments included qualitative assessment of IP domains; feedback on student presentation to community partners; utilization of existing tools specifically, the Interprofessional Socialization and Valuing Scale (ISVS) (57) completed prior to and after the placement; use of the McMaster-Ottawa Scale and TOSCE assessments, and analysis and feedback on student reflections.

The ISVS is a 24-point self-reporting measure focused on attitudes, behaviors and beliefs that underpin interprofessional socialization. The scale is used before and after the educational/clinical placement experience with a view to measuring the impact of the placement experience (57). The McMaster Ottawa Scale with TOSCE was explicitly developed for assessments of interprofessional competencies in primary care with the view to enable public health and primary healthcare teams to assess and then improve their team collaboration competencies – patient safety and better outcomes being a major aim (44, 48). In the Gentry et al. (40) study faculty utilized each of these assessment and feedback tools. Students reported a major benefit of the experience as getting to know the perspectives of others and working with like-mind people who also brought entirely different skill sets (40). Faculty and students also reported a greater understanding and comfort with team-based roles, improved competence in shared decision-making and problem-solving, and a greater understanding and empathy for community needs (40). The mixed method, community-based approach detailed by Gentry and team aligns well with a community-based, student-led interprofessional health service, the development of which formed the impetus of this search.

The identified tools provide valuable insight into the development of an assessment instrument for evaluating interprofessional competency attainment of healthcare students in clinical learning contexts, such as a primary healthcare focused interprofessional student-led clinic. While unvalidated, the McMaster-Ottawa Scale with TOSCE and the ISVS seem to show the greatest promise as tools for this purpose. The McMaster-Ottawa Scale with TOSCE is designed for assessing interprofessional competencies in primary care settings, enabling teams to evaluate and improve their collaborative skills, ultimately aiming for better patient safety and outcomes (38). The ISVS is a 24-point self-reporting measure that focuses on attitudes, behaviors, and beliefs underpinning interprofessional socialization (40, 51), which can be used before and after educational or placement experiences to gauge the impact of these experiences on students' interprofessional competency development.

When developing an assessment instrument for a primary healthcare focused interprofessional student-led clinic, it may be beneficial to incorporate elements from these existing tools while adapting them to the specific context and learning objectives of the clinic. Combining a mixed-method approach that includes continuous assessment, feedback loops, and strong community engagement, as demonstrated in the Gentry et al. (40) study, can further enhance competency development and assessment. Utilizing a variety of assessment methods such as self-reporting, qualitative assessments, and observed clinical encounters will provide a comprehensive evaluation of interprofessional competency development among students. Ultimately, ongoing research and evaluation are essential to refine any assessment instrument and ensuring its effectiveness in fostering interprofessional competencies in future healthcare professionals.

5.1. Limitations

It is appropriate to note some limitations of this review. Perhaps most obvious is the possibility that the search did not capture all relevant literature, especially given the heterogenous nature of terminology used to describe practice involving representatives from more than one health profession; and an assessment or measurement instrument. Determining what was a tool used by teaching faculty to assess (as opposed to self-assessment) was also difficult. Including only published articles in the English language may have excluded examples of international examples or tools in the gray literature, especially as teaching and learning tools are often informal and evolving and not always well-documented. Educators working to promote interprofessional collaboration among health profession students, and formally assessing the results, should be encouraged to share the tools or applications they have built or explored to do so. Additionally, each of the identified works was very different. The majority were based in the USA and one in Canada, where there is a strong emphasis on interprofessional practice collaboration across all health professional accrediting bodies (47). The lack of global representation in the identified studies is noted as a limitation within the findings of this review.

6. Conclusion

Effective interprofessional teamwork is a cornerstone to improved health outcomes and reductions in healthcare inequalities. Purposefully designed placement experiences and assessment activities are required to better develop interprofessional competencies among pre-licensure healthcare students and prepare them for practice. The mixed method assessment approach with continuous feedback loops and strong community engagement aligns well with the planning and delivery of a student-led clinic engaged delivering of public health and primary healthcare services. Existing assessment tools, such as the ISVS and the McMaster Ottawa Scale with TOSCE can further guide assessment processes and form the basis of future tool validation studies. Ongoing research and validation studies are

needed to inform education and practice developments in this field of interprofessional competency assessment tools for faculty assessing students.

Data availability statement

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

Author contributions

SB, PA, and PB conceived the evaluative design of the study. SB, DB, A-RY, and IA developed the search strategy. All authors provided substantial contributions to this work and accept accountability for the finished product, participated in the collection of data, contributed to data analysis including COVIDENCE screening and writing of the manuscript, and reviewed and approved final drafts.

Funding

This project was supported by a Trust Waikato Community Impact Grant.

Acknowledgments

The authors acknowledge Ema Tokolahi and Cassie Cook for contributions during the early phase of the review process, and Jia Rong Yap for assistance in editing and preparation of the manuscript.

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

References

1. Fröberg M, Leanderson C, Fläckman B, Hedman-Lagerlöf E, Björklund K, Nilsson GH, et al. Experiences of a student-run clinic in primary care: a mixed-method study with students, patients and supervisors. *Scand J Prim Health Care.* (2018) 36:36–46. doi: 10.1080/02813432.2018.1426143

2. Cust F. Interprofessional education is an essential component of health professional education. Available online at: https://www.nursingtimes.net/opinion/interprofessional-educationis-an-essential-component-of-health-professional-education-27-04-2021/ (accessed February 15, 2023).

3. Bhutta ZA, Chen L, Cohen J, Crisp N, Evans T, Fineberg H, et al. Education of health professionals for the 21st century: a global independent Commission. *Lancet.* (2010) 375:1137–8. doi: 10.1016/S0140-6736(10)60450-3

4. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet.* (2010) 376:1923–58. doi: 10.1016/S0140-6736(10)61854-5

5. Samarasekera DD, Nyoni CN, Amaral E, Grant J. Challenges and opportunities in interprofessional education and practice. *Lancet.* (2022) 400:1495–7. doi: 10.1016/S0140-6736(22)02086-4

6. Brewer ML, Flavell HL, Jordon J. Interprofessional team-based placements: the importance of space, place, and facilitation. *J Interprof Care.* (2017) 31:429–37. doi: 10.1080/13561820.2017.1308318

7. Mladenovic J, Tilden VP. Strategies for overcoming barriers to IPE at a health sciences university. *J Interprof Educ Pract.* (2017) 8:10–3. doi: 10.1016/j.xjep.2017.05.002

8. Batteson T, Garber SS. Assessing constructs underlying interprofessional competencies through the design of a new measure of interprofessional education. *J Interprof Educ Pract.* (2019) 16:100195. doi: 10.1016/j.xjep.2018.08.004

9. Frost J, Chipchase L, Kecskes Z, D'Cunha NM, Fitzgerald R. Research in brief: exploring perceptions of needs for the same patient across disciplines using mixed reality: a pilot study. *Clin Simul Nurs.* (2020) 43:21–5. doi: 10.1016/j.ecns.2020.02.005

10. Kavannagh J, Kearns A, McGarry T. The benefits and challenges of student-led clinics within an Irish context. *J Pract Teaching Learn.* (2015) 13:58–72. doi: 10.1921/jpts.v13i2-3.858

11. Stuhlmiller CM, Tolchard B. Developing a student-led health and wellbeing clinic in an underserved community: collaborative learning, health outcomes and cost savings. *BMC Nurs.* (2015) 14:32. doi: 10.1186/s12912-015-0083-9

12. Tokolahi E, Broman P, Longhurst G, Pearce A, Cook C, Andersen P, et al. Student-led clinics in Aotearoa New Zealand: a scoping review with stakeholder consultation. *J Multidiscip Healthc.* (2021) 14:2053–66. doi: 10.2147/JMDH.S308032

13. Frakes KA, Brownie S, Davies L, Thomas J, Miller ME, Tyack Z. Experiences from an interprofessional student-assisted chronic disease clinic. *J Interprof Care.* (2014) 28:573–5. doi: 10.3109/13561820.2014.917404

14. Frakes KA, Brownie S, Davies L, Thomas JB, Miller ME, Tyack Z. Capricornia allied health partnership (CAHP): a case study of an innovative model of care addressing chronic disease through a regional student-assisted clinic. *Aust Health Rev.* (2014) 38:483–6. doi: 10.1071/AH13177

15. Chepulis L, Morison B, Keenan R, Paul R, Lao C, Lawrenson R. The epidemiology of diabetes in the Waikato region: an analysis of primary care data. *J Prim Health Care.* (2021) 13:44. doi: 10.1071/HC20067

16. Brownie S, Smith G, Broman P, et al. *He Kaupapa Oranga Tahi: Working in Partnership to Grow the Health Workforce Through Tauira-Assisted Health Services. Report No.: ISBN 978-1-877510-21–2, 2021.* Hamilton: Wintec – Te Pukenga.

17. National Academies of Practice. *National Academies of Practice Position Paper: Interprofessional Collaboration.* Lexington, KY: National Academis of Practice (2022).

18. World Health Organization (ed). *Framework for Action on Interprofessional Education and Collaborative Practice.* Geneva, Switzerland: World Health Organization (2010).

19. Hero L-M, Lindfors E. Students' learning experience in a multidisciplinary innovation project. *Educ Train.* (2019) 61:500–22. doi: 10.1108/ET-06-2018-0138

20. Choi BC, Pak AW. Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: definitions, objectives, and evidence of effectiveness. *Clin Invest Med.* (2006) 29:351–64.

21. Columbia University. *Team Healthcare Models.* Columbia University) [n.d.]. Available online at: https://ccnmtl.columbia.edu/projects/sl2/pdf/glossary.pdf (accessed November 2, 2022).

22. Canadian Interprofessional Health Collaborative. *A national interprofessional competency framework.* Canadian Interprofessional Health Collaborative. (2010). Available online at: https://phabc.org/wp-content/uploads/2015/07/CIHC-National-Interprofessional-Competency-Framework.pdf (accessed November 2, 2022).

23. Services AH. Collaborative practice [n.d.]. Available online at: https://www.albertahealthservices.ca/assets/careers/ahs-careers-stu-supporting-interprofessional-placements.pdf (accessed November 2, 2022).

24. Dennis V, Craft M, Bratzler D, Yozzo M, Bender D, Barbee C, et al. Evaluation of student perceptions with 2 interprofessional assessment tools-the collaborative healthcare interdisciplinary relationship planning instrument and the interprofessional attitudes scale-following didactic and clinical learning experiences in the United States. *J Educ Eval Health Prof.* (2019) 16:35. doi: 10.3352/jeehp.2019.16.35

25. Iverson L, Todd M, Haddad AR, Packard K, Begley K, Doll J, et al. The development of an instrument to evaluate interprofessional student team competency. *J Interprof Care.* (2018) 32:531–8. doi: 10.1080/13561820.2018.1447552

26. Peltonen J, Leino-Kilpi H, Heikkilä H, Rautava P, Tuomela K, Siekkinen M, et al. Instruments measuring interprofessional collaboration in healthcare—A scoping review. *J Interprof Care.* (2020) 34:147–61. doi: 10.1080/13561820.2019.1637336

27. Australian Skills Quality Authority. *What is the Difference Between An Assessment Tool and an Assessment Instrument? (Clause 1.8)*) [n.d.]. Available online at: https://www.asqa.gov.au/faqs/what-difference-between-assessment-tool-and-assessment-instrument-clause-18 (accessed November 7, 2022).

28. Industry Network Training & Assessment Resources. *Difference between 'tools' and 'instruments' - Chapter 3*) [n.d.]. Available online at: https://www.intar.com.au/resources/training_and_assessing/section_3/chapter3_developing_assessment_tools/lesson2_tools_and_instruments.htm (accessed November 7, 2022).

29. Wang Z, Song G. Towards an assessment of students' interdisciplinary competence in middle school science. *Int J Sci Educ.* (2021) 43:693–716. doi: 10.1080/09500693.2021.1877849

30. Broome M. Integrative literature reviews for the development of concepts. In: Rodgers BL and Knafl KA (eds) *Concept Development in Nursing: Foundations, Techniques and Applications*. Philadelphia: WB Saunders Company (2000), pp.231-250.

31. Whittemore R, Knafl K. The integrative review: updated methodology. *J Adv Nurs.* (2005) 52:546–53. doi: 10.1111/j.1365-2648.2005.03621.x

32. Soares CB, Hoga LAK, Peduzzi M, Sangaleti C, Yonekura T, Silva DRAD. Integrative review: concepts and methods used in nursing. *Revista da Escola de Enfermagem da USP.* (2014) 48:335–45. doi: 10.1590/S0080-623420140000020000

33. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med.* (2009) 6:e1000100. doi: 10.1371/journal.pmed.1000100

34. Babineau J. Product review: covidence (systematic review software). *J Can Health Libr Assoc/Journal de l'Association des bibliothèques de la santé du Canada.* (2014) 35:68–71. doi: 10.5596/c14-016

35. McCluskey J, Gallagher AL, Murphy CA. Reflective practice across speech and language therapy and education: a protocol for an integrative review. *HRB Open Res.* (2021) 4:29. doi: 10.12688/hrbopenres.13234.1

36. Hong QN, Fàbregues S, Bartlett G. The mixed methods appraisal tool (MMAT) version 2018 for information professionals and researchers. *Educ Inf.* (2018) 34:285–91. doi: 10.3233/EFI-180221

37. Ganong LH. Integrative reviews of nursing research. *Res Nurs Health.* (1987) 10:1–11. doi: 10.1002/nur.4770100103

38. Lie D, May W, Richter-Lagha R, Forest C, Banzali Y, Lohenry K. Adapting the McMaster-Ottawa scale and developing behavioral anchors for assessing performance in an interprofessional team observed structured clinical encounter. *Med Educ Online.* (2015) 20:26691. doi: 10.3402/meo.v20.26691

39. Lie DA, Richter-Lagha R, Forest CP, Walsh A, Lohenry K. When less is more: validating a brief scale to rate interprofessional team competencies. *Med Educ Online.* (2017) 22:1314751. doi: 10.1080/10872981.2017.1314751

40. Gentry C, Espiritu E, Schorn MN, Hallmark B, Bryan M, Prather P, et al. Engaging the community through a longitudinal, interprofessional, interinstitutional experiential learning collaboration. *Curr Pharm Teach Learn.* (2021) 13:169–76. doi: 10.1016/j.cptl.2020.09.012

41. Foltz-Ramos K, Fusco NM, Paige JB. Saving patient X: a quasi-experimental study of teamwork and performance in simulation following an interprofessional escape room. *J Interprof Care.* (2021) 3:1–8. doi: 10.1080/13561820.2021.1874316

42. Reising DL, Carr DE, Tieman S, Feather R, Ozdogan Z. Psychometric testing of a simulation rubric for measuring interprofessional communication. *Nurs Educ Perspect.* (2015) 36:311–6. doi: 10.5480/15-1659

43. Hayes CA, Carzoli JA, Robinson JL. Development and implementation of an interprofessional team-based care rubric to measure student learning in interprofessional education experiences: a pilot study. *J Interprof Educ Prac.* (2018) 11:26–31. doi: 10.1016/j.xjep.2018.02.003

44. Forest Chrisptopher P, Lie Désirée A, Ma Sae B. Evaluating interprofessional team performance: a faculty rater tool. *MedEdPORTAL.* (2016) 12:10447. doi: 10.15766/mep_2374-8265.10447

45. Murray-Davis B, Marshall D, Mueller V. A Team Observed Structured Clinical Encounter (TOSCE) for pre-licensure learners in maternity care: a short report on the development of an assessment tool for collaboration. *J Res Interprof Pract Edu.* (2013) 3:122–8. doi: 10.22230/jripe.2013v3n1a89

46. Zorek J, Raehl C. Interprofessional education accreditation standards in the USA: a comparative analysis. *J Interprof Care.* (2013) 27:123–30. doi: 10.3109/13561820.2012.718295

47. McMaster-Ottawa Team. *The McMaster-Ottawa Team Observed Structured Clinical Encounter (TOSCE).* (2010). Available online at: https://fhs.mcmaster.ca/tosce/documents/tosce_checklist_user_instructions.pdf (accessed December 1, 2022).

48. McMaster-Ottawa Team. *McMaster/Ottawa TOSCE (Team Observed Structured Clinical Encounter) Toolkit: An Innovative Tool for Building and Assessing Interprofessional Competencies*. Hamilton, ON: McMaster University (2022).

49. Zhang XC, Lee H, Rodriguez C, Rudner J, Chan TM, Papanagnou D. Trapped as a group, escape as a team: applying gamification to incorporate team-building skills through an 'escape room' experience. *Cureus.* (2018) 10:e2256. doi: 10.7759/cureus.2256

50. Yuan M, Lin H, Wu H, Yu M, Tu J, Lü Y. Community engagement in public health: a bibliometric mapping of global research. *Arch Public Health.* (2021) 79:6. doi: 10.1186/s13690-021-00525-3

51. King G, Shaw L, Orchard CA, Miller S. The interprofessional socialization and valuing scale: a tool for evaluating the shift toward collaborative care approaches in health care settings. *Work.* (2010) 35:77–85. doi: 10.3233/WOR-2010-0959

52. Institute of Medicine (ed). *Educating for the Health Team. Conference on the Interrelationships of Educational Programs for Health Professionals 1972 October 2–3*. Washington, D.C.: Institute of Medicine. (1972).

53. World Health Organization (ed). *Alma-Mata: Primary Healthcare. International Conference on Primary Healthcare (PHC)*) 1978 September 6-12) Alma-Mata, Kazakhstan, USSR: World Health Organization and United Nation Children's Fund.

54. Rifkin SB. Alma Ata after 40 years: primary health care and health for all-from consensus to complexity. *BMJ Glob Health.* (2018) 3:e001188. doi: 10.1136/bmjgh-2018-001188

55. World Health Organization. *Transforming and Scaling Up Health Professionals' Education and Training: World Health Organization Guidelines*. Geneva, Switzerland: World Health Organization (2013).

56. Rogers GD, Thistlethwaite JE, Anderson ES, Dahlgren MA, Grymonpre RE, Moran M, et al. International consensus statement on the assessment of interprofessional learning outcomes. *Med Teach.* (2017) 39:347–59. doi: 10.1080/0142159X.2017.1270441

frontiers | Frontiers in Public Health

TYPE Review
PUBLISHED 18 July 2023
DOI 10.3389/fpubh.2023.1128617

OPEN ACCESS

EDITED BY
Christiane Stock,
Charité – Universitätsmedizin Berlin, Germany

REVIEWED BY
Ranjit Kumar Dehury,
University of Hyderabad, India
Simon Robert Stones,
Envision Pharma Group, United Kingdom

*CORRESPONDENCE
Kesava Kovanur Sampath
✉ kesava.sampath@wintec.ac.nz

RECEIVED 20 December 2022
ACCEPTED 27 June 2023
PUBLISHED 18 July 2023

CITATION
Kovanur Sampath K, Ann-Rong Y, Haggie M, Tapara T and Brownie S (2023) Exploring the option of student-run free health clinics to support people living with type 2 diabetes mellitus: a scoping review.
Front. Public Health 11:1128617.
doi: 10.3389/fpubh.2023.1128617

Exploring the option of student-run free health clinics to support people living with type 2 diabetes mellitus: a scoping review

Kesava Kovanur Sampath[1,2]*, Yan Ann-Rong[2], Marrin Haggie[1], Timi Tapara[3] and Sharon Brownie[2,4,5]

[1]Waikato Institute of Technology – Te Pukenga, Hamilton, New Zealand, [2]University of Canberra, Canberra, ACT, Australia, [3]Tu Tonu Rehabilitation Ltd., Hamilton, New Zealand, [4]Swinburne University, Melbourne, VIC, Australia, [5]Griffith University, Gold Coast, QLD, Australia

Diabetes is a major cause of morbidity and premature mortality worldwide and now identified as a 'public health emergency' and a 'modern and preventable pandemic'. Indigenous populations are disproportionately affected by type 2 diabetes mellitus (T2DM) and associated complications. Student run free clinics (SRFCs) may play an important role in the prevention and management of T2DM. The primary objective of this scoping review was to investigate the opportunity for curriculum enhancement through the role and effectiveness of SRFCs in managing T2DM. Electronic databases such as PubMed, CINAHL, Science Direct and Cochrane Library were searched from inception to October 2022. Identified records from database literature searches were imported into Covidence®. Two independent reviewers screened and extracted the data. The research team collectively created a data charting table/form to standardize data collection. A narrative synthesis was used to summarize the evidence. Six studies (total of 319 participants) that met our eligibility criteria were included in this scoping review. SRFCs can provide high-quality diabetic care, especially for uninsured and economically weaker population. Preliminary evidence further indicate that shared medical appointments and telehealth may facilitate diabetic care especially during times where access to care may be difficult (e.g., COVID lockdown). However, no study included in the review explored or discussed family centred/culturally sensitive interventions. Hence, such interventions should be made part of the curriculum in the future with students in SRFCs exposed to such an approach.

KEYWORDS

type II diabetes, T2DM, student clinics, student run free clinics, cultural sensitivity, scoping review

Introduction

Diabetes is a major cause of morbidity and premature mortality worldwide and now identified as a 'public health emergency' and a 'modern and preventable pandemic' with a predicted 642 million people to be affected by the year 2040 (1, 2). Unlike type 1 diabetes, which is caused by insulin deficiency due to autoimmune- mediated pancreatic beta- cell failure, type 2 diabetes is characterised by insulin resistance and a degree of beta- cell dysfunction (3). The

aetiology of Type Two Diabetes Mellitus (T2DM) comprises of a complex mix of genetic, social, cultural, psychological, political, and economic factors (4, 5). Prevalence rates of type 2 diabetes and obesity have increased in recent decades due to factors such as globalisation and urbanisation, which are accompanied by sedentary behaviour and energy-dense diets (6, 7). Indigenous populations are disproportionately affected by type 2 diabetes and associated complications (4, 8). In Aotearoa/New Zealand for example, 7.2% of Māori (indigenous people) have diabetes compared to 5.1% of Pākehā (New Zealand European). Racism along social determinants of health are root causes of these inequities (8).

Traditionally, the focus of diabetic intervention has been on doctor led primary health strategies. This western medicine-based approach has led to a tendency to measure what can easily be measured (e.g., HbA1c) without much evaluation of team work and transitions of care (9). Also, the current approach does not account much for cultural factors that may act as a barrier for many people (especially indigenous) from accessing care when required (10). The lack of cultural integration means that indigenous and/or socioeconomically disadvantaged people are mere passengers through the system (9–11). Furthermore, for people living in remote/rural places, accessing/commuting to these services may be impractical or may put undue pressure on the family (12–14). Hence, to be effective in terms of prevention and intervention, the current approach may not be sufficient and can be complemented by other approaches including delivery of additional support via relevant curricula innovations and transformation. Placement experience for pre-licensure healthcare student-led clinics or student run free clinics (SRFC) may represent one such strategy whereby pre-licensure healthcare students may make contributions to existing health services, help address service gaps and gain greater insights and hands-on experience in providing services to individuals and families challenge by T2DM.

SRFC's typically involve pre-licensure students such as student doctors, nurses, physiotherapists, etc. in hands-on practice, particularly within primary health-care settings 1. SRFC's may involve a single professional group or may be interprofessional in nature. SRFC's provide an opportunity within the curriculum for teaching population-based medicine, chronic disease assessment and management to medical students (e.g., doctors, nursing, physiotherapy) (1, 15). Further, SRFC's may also enable students to develop their skills and own practice under close faculty supervision. In turn, this provides an opportunity for the faculty and the student to identify things that are working well and areas that need improvement (4). SRFCs also enable increased access to services, more time for assessments and treatments and more holistic and integrated care for patients.

SRFC's has been shown to be a useful health delivery model in providing/delivering public health program. A recent systematic review has been shown that SRFCs interventions demonstrated positive impact on patients at risk of developing cardiovascular disease (16, 17). SRFCs have been used to deliver efficient preventive medicine services including HIV testing (9) and falls prevention (18). SRFC may play an important role in providing humanistic care and support to underserved/uninsured and marginalized health communities (12); and those who have difficulty accessing services (19). Although patients have a primary health care provider that oversees and coordinate the quality of care; patients expect more than just a single pointed service or in-coordinated referral. In this context, SRFCs may play an important role in providing this coordinated care to patients with T2DM. Nonetheless, literature about the efficacy of SRFCs specifically addressed in the prevention and management of T2DM to require further development.

Scoping reviews enable to incorporate a range of study designs to comprehensively summarize and synthesize evidence with the aim of informing practice (16). A scoping review was considered appropriate for this review as little is known about the effectiveness of SRFCs in the prevention and management of T2DM.

The aims of this scoping review are to:

- Investigate the opportunity for curriculum enhancement through the role and effectiveness of SRFCs in managing T2DM.
- Establish the barriers and enablers for SRFCs for the management of T2DM diabetes in indigenous population.
- Explore whether a culturally appropriate/sensitive care can be provided through SRFCs in the management of T2DM.

Methods

This review has been reported in accordance with the preferred reporting items for systematic reviews and meta-analysis extension for scoping review (PRISMA-ScR) checklist (20).

Eligibility criteria

Inclusion criteria

Participants: Indigenous Kaumatua (Older adult) with T2DM.

Intervention: Any studies (quantitative, qualitative and mixed methods) that investigated mobile health clinic/interventions for people with T2DM will be included in the review.

Comparison: Studies will be included with or without a comparison group.

Outcomes: Studies will be included if they report any quantifiable outcome and/or qualitative outcome/feedback.

Setting: Studies should have taken place only in health care (medicine, nursing, physiotherapy, etc.) setting.

Limiters: English language.

Exclusion criteria

Studies will be excluded if: (1) they were not conducted in a primary health care setting; (2) the study design is one of the following: secondary research, pilot study, expert opinion, practice guidelines, editorial, letter to the editor, and commentary; (3) non-peer reviewed studies, and (4) non-English studies.

Information source

The following electronic databases were searched since inception to October 2022: PubMed, CINAHL, Cochrane Library and SCOPUS. Additional search will also be undertaken on protocol registries such as PROSPERO. Furthermore, two reviewers (KK and AY) independently screened the reference list and citations of the included full-text articles for any additional citations.

Search strategy

The lead investigator developed the initial search strategy which was refined in discussion with an experienced subject librarian. The search strategy was developed to locate studies relevant to three key components of our research question: diabetes mellitus, healthcare inequities and student led clinics. A combination of keywords and MeSH terms such as diabetes OR (Health Services, Indigenous) OR (Healthcare Disparities) OR (Medically Underserved Area) OR (Student Run Clinic) were used. The search strategy was developed and adapted for various databases. An example of this process has been provided in Appendix 1.

Study records

Data management

Identified records from database literature searches were imported into Covidence® (17), an online data management software. Automatic removal of duplicates in Covidence was followed by a two-stage screening of unique studies by two sets of independent reviewers (KK and AY).

Study selection

Titles and abstracts of the retrieved articles were screened independently by two reviewers (KK and AY) for relevance after removing the duplicates. Full-text articles that did not meet the inclusion criteria were excluded. Any disagreements that arose between reviewers at any stage of the selection process were resolved through discussion; if no agreement could be reached, a third reviewer (SB) was available to be consulted.

Data collection process

The research team collectively created a data charting table/form to standardise data collection. Two independent reviewers (KK and AY) appraised the extracted data, with the opportunity to consult a third reviewer (MH) in case of disagreement. Data that extracted from each study include in whole or combination study's aim; study design; participant demographics, service provided, outcome measures, and findings.

Summarising the data

A narrative synthesis was used to summarise the data. The data were summarised under the following key concepts which were considered important: (1) intervention/care provided; (2) role of students; (3) outcome measures used; (4) Quality of care of diabetes in SRFC; (5) patient satisfaction; and (6) type of consultation.

Quality assessment (including risk of bias)

This was not undertaken as this was not considered mandatory for a scoping review.

Results

The electronic search yielded a total of 7,427 articles. Following the removal of duplicates, 4,601 articles were retained for further screening. After title, abstract, and full-text screening, only 6 studies (21–26) met our criteria and were included in our review (refer Figure 1).

Characteristics of included studies

Characteristics of the 6 included studies are presented in Table 1. The number of participants with T2DM ranged between 8 to 182 and included a total of 319 patients. All studies included both male and female participants. The ethnicity of participants varied including African, Asian, Latino, Hispanic, Pacific Islanders and White. All the six studies were undertaken in the United States of America.

Intervention/care provided

The nature of intervention/care provided varied across the studies and included screening tests (including ophthalmology exam), immunizations, medical care, medications, laboratory services, social services, disease management, exercise and patient education. The duration of care also varied among studies and ranged between 7 weeks to 2 years.

Role of students

Although all studies had students on placement and/or providing care, only two studies reported on the role of students and the nature

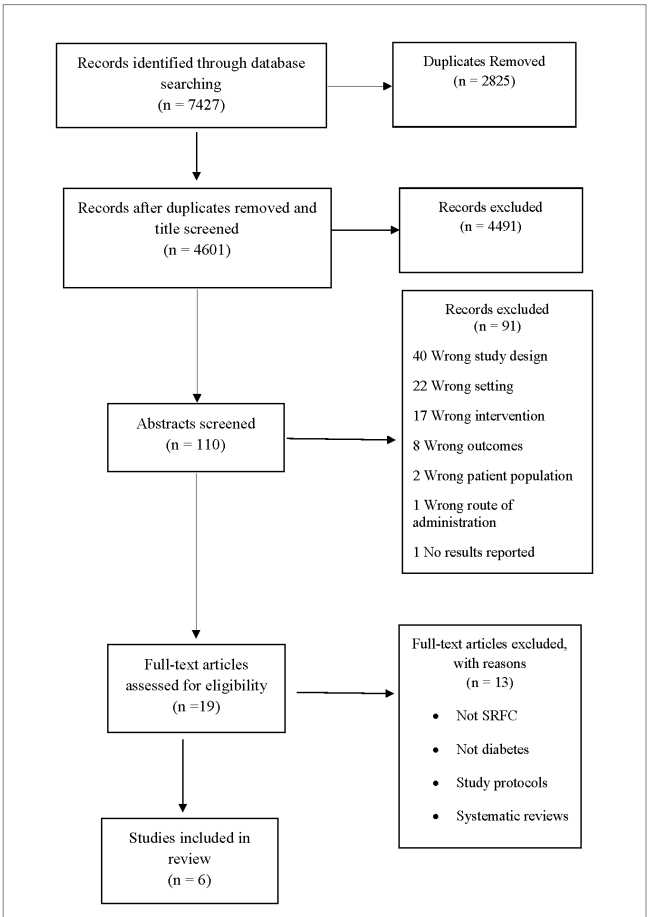


FIGURE 1
PRISMA flow diagram of included studies.

TABLE 1 Characteristics of included studies.

Study ID/ Country/ Name of program	Study objectives	Study design	Participant demographics	Service provided/ duration	Outcome measures/ duration	Main findings
Gorrindo 2014; United States of America; Shade Tree Clinic Patient Health Education (PHE) program.	To examine the clinical impact of a medical student health educator program for diabetic patients	Retrospective study design	Total: 45 Ethnicity: Hispanic 15/45 (33.3%) Non-Hispanic white 13/45 (28.9%) Non-Hispanic black 16/45 (35.6%) Non-Hispanic other 1/45 (2.2%) Age: 48.7 (10.3) Gender: Male (37.8%) Female (62.2%)	Free medical care, medications, laboratory services, immunizations, social services, and disease management. Educational activities include student-led preclinic â€œchalk talksâ€ (small-group discussions of clinical topics relevant to patients scheduled in the clinic), faculty-led postclinic â€œwrap-upâ€ discussions that afford students an opportunity to share interesting or particularly educational cases they saw in the clinic that day, weekly laboratory review sessions, quarterly case presentation series, and annual clinical skills workshops. Duration: 1 year	Mean A1c 9.6	A medical student health educator program at an SRFC can provide high-quality diabetes care and facilitate clinical improvement 1 year after enrolment, despite inherent difficulties in caring for underserved patients.
Felder-Heim 2020; United States of America; DAWN (Dedicated to Auroraâ€™s Wellness and Needs).	To understand DAWNâ€™s ability to achieve quality-of-care performance standards for diabetes and hypertension similar to other safety-net providers, and to identify quality improvement targets that may lead to improved chronic disease management.	Retrospective chart review	Total: 30 Ethnicity: NA Indigenous 6 (75%) Non-Hispanic White 2 (25%) Age: 19–44 7/30 (23.3%) 45–64 16/30 (53.3%) 65–74 5/30 (16.7%) 75–84 2/30 (6.7%) Gender: Male (60%) Female (40%)	HbA1c screen, nephropathy screen (or ACE-inhibitor prescription), retinopathy screen, lipid panel, and prescription.	HbA1c, neuropathic symptoms, retinopathy screen and lipid levels.	SRFC may have a role in safety net health care system.

(Continued)

TABLE 1 (Continued)

Study ID/ Country/ Name of program	Study objectives	Study design	Participant demographics	Service provided/ duration	Outcome measures/ duration	Main findings
Kahkoska 2018; United States of America; Student Run Free Clinics (SRFC).	The objective was to increase patient engagement and improve health outcomes in this underserved patient population by transitioning from the traditional clinical model to the patient-driven SMA model	Prospective evaluation study	Total: 8 Ethnicity: Indigenous 6 (75%) Non-Hispanic White 2 (25%) Gender: Male (75%) Female (25%)	Teams of transdisciplinary trainees work together to perform triage, medication reconciliation, brief history, and physical exam, after which patients participate in the shared medical appointments (SMA). The endocrinologist evaluates SMA patients individually during and after the visit Duration: 2 years	HbA1c	SMA may help address health disparities and increase the quality of free diabetes care.
Schroeder 2020; United States of America; Community Care Free Medical Clinic (CCFMC)	The primary objective of this quality improvement study was to assess patient satisfaction with diabetes care at an SRFC. In addition to satisfaction of overall diabetes care, the study focused on satisfaction of self-management of diabetes, nutrition, and exercise. Secondary objectives included evaluating satisfaction between ages, sex, length of diabetes diagnosis, and time attending the CCFMC.	Survey study design	Total: 25 Ethnicity: White (17); Hispanic (3) Black African/ American (3); Native American (1); Asian/ pacific Islander (1) Age: 56 (Range: 25–67) Gender: Male (15) Female (10)	Duration: 7 weeks.	The Shade Tree Patient Satisfaction Survey, Diabetes Treatment Satisfaction Questionnaire, and Diabetes Self-Management Questionnaire	The survey helped identify key areas in which the diabetes care provided at the SRFC could be improved. These areas included education about diabetes in general, as well as in understanding treatment, self-monitoring, and healthy eating and exercise options.
Simon 2022; United States of America; Student Run Free Clinics (SRFC).	The aim of this study is to evaluate the impact of the pandemic on the management of chronic disease, specifically diabetes.	Retrospective study design	Total: 29 Ethnicity: Hispanic Non-Hispanic Other Age: Hispanic Non-Hispanic Other Gender: Male (16) Female (13)	Eye exam, chronic kidney disease monitoring, Hb A1c Value, BP, influenza vaccination and prescribed statin therapy.	Eye exam, chronic kidney disease monitoring, Hb A1c Value, BP, influenza vaccination and prescribed statin therapy.	Diabetes care using telehealth in a SRFC may be an acceptable alternative model when face-to-face visits are not feasible.

(Continued)

TABLE 1 (Continued)

Study ID/ Country/ Name of program	Study objectives	Study design	Participant demographics	Service provided/ duration	Outcome measures/ duration	Main findings
Smith 2014; United States of America; University of California San Diego (UCSD) Student Run Free Clinic (SRFC).	To determine if the quality of care of diabetic patients at a Student-Run Free Clinic Project (SRFCP) meets the standard of care, is comparable with other published outcomes, and whether pertinent diabetic clinical indicators improve over time	Retrospective chart review	Total: 182 Ethnicity: Latino (75%) Caucasian (15%) Asian (4%) African American (3%) Other (3%) Age: 53 (11.5) Gender: Male (41%) Female (59%)	Screening tests (process measures) was blood pressure (BP) 100%, HbA1c 99.5%, creatinine 99.5%, LDL 93%, HDL and triglycerides 88%, microalbumin/creatinine ratio 80%, and ophthalmology exam 32%. Duration: 1 year	Blood pressure (BP) HbA1c Creatinine LDL HDL Triglycerides 88%, Microalbumin/ creatinine ratio Ophthalmology exam 32%.	Diabetic patients at UCSD SRFCP reached goals for both process measures and intermediate outcomes at rates that meet or exceed published outcomes of insured and uninsured diabetics on nearly all measures, with the exception of ophthalmology screening.

of the placements. In the study by Gorrindo et al. (22), pre-clinical and clinical students had a twice-weekly clinic sessions under the supervision of faculty providers. Other educational activities included student-led preclinic "chalk talks" and faculty-led postclinic "wrap-up" discussions. In the study by Kahkoska et al. (23), teams of transdisciplinary trainees work together to perform triage, medication reconciliation, brief history, and physical exam.

Outcome measures

The most common outcome measures used across the studies included physiological measures such as BP, HbA1c, lipid levels, eye exam, retinopathy, and neuropathic screen. Few studies also used outcome measures such as American Diabetes Association (ADA) process and outcome measure benchmarks to track success of the care provided by SRFC. Patient satisfaction was also measured (24) using tools such as The Shade Tree Patient Satisfaction Survey, Diabetes Treatment Satisfaction Questionnaire, and Diabetes Self-Management Questionnaire.

Quality of care of diabetes in SRFC

Three included studies investigated the quality of care of diabetic patients at a SRFCs and whether the quality of care at SRFCs are comparable with other published outcomes. Gorrindo et al. (22) examined the clinical impact of a medical student health educator program for diabetic patients at an SRFC. This involved retrospectively reviewing the electronic medical records of diabetic patients for 3 years. They compared clinical outcomes at initial presentation to the clinic and 12 months later and analyzed the relationship between the number of patient–student interactions (touchpoints) and change in haemoglobin A1c values. Further, the quality of care provided was compared to best-practice benchmarks (process and outcomes measures). The mean haemoglobin A1c values improved significantly. The authors concluded that a SRFC can provide high quality diabetes care and facilitate clinical improvement 1 year after enrolment. Smith et al. (26) conducted a retrospective review of diabetic patients at three SRFCs ($n = 182$) and compared the quality of care with published outcomes. The study reported that diabetic patients at these SRFCs reached goals for both process measures and intermediate outcomes at rates that meet or exceed published outcomes of insured and uninsured diabetics on nearly all measures. Felder-Heim and Mader (21) investigated DAWN (Dedicated to Aurora's Wellness and Needs) SRFC's ability to achieve quality-of-care performance standards for diabetes and hypertension similar to other safety-net providers. A mixed-methods evaluation of diabetes and hypertension management was conducted for patients. Retrospective chart review assessed whether patients received recommended screening tests (process outcomes) and achieved disease control (short-term outcomes). In-depth case studies of randomly selected individuals with good and poor disease control identified targets for quality improvement through nominal group technique. The outcomes were compared to local health centres. SRFC may have a role in safety net health care system.

Patient satisfaction

Schroeder and Hickey (24) used survey methodology to assess patient satisfaction with diabetes care at a SRFC in order to assist in identifying areas of improvement. Established patients who were aged 18 years or older and diagnosed with diabetes, were invited to complete the survey. The majority of patients (88%) were satisfied with their diabetes care at the SRFC. Sub analyses demonstrated significant differences when comparing sex, age, and length of diabetes diagnosis. Areas of improvement were identified including education about diabetes in general, as well as in understanding treatment, self-monitoring, and healthy eating and exercise options.

Type of consultation

Two studies investigated the effects of type of consultation (face to face vs. telehealth and shared medical appointment) on quality of care of diabetes in SRFCs. Simon et al. (25) evaluated the impact of the pandemic on the management of chronic disease, specifically diabetes. Patients with diabetes who received care continuously throughout the pre-pandemic (face-to-face) and pandemic (telehealth) study periods at a SRFC were evaluated. The progress was evaluated on six quality measures including annual eye exams, blood pressure, hemoglobin A1c, chronic kidney disease monitoring, fu vaccination, and statin therapy. The study demonstrated that diabetes care using telehealth in a SRFC may be an acceptable alternative model when face-to-face visits are not feasible. Kahkoska et al. (23) explored whether shared medical appointments (SMA) improve outcomes in type 2 diabetes. SMA groups comprised of transdisciplinary trainees working together to perform triage, medication reconciliation, brief history, and physical exam, after which patients participate in the SMA. The endocrinologist evaluated SMA patients individually during and after the visit. The study reported that SMA increased clinic efficiency and offered an opportunity to integrate transdisciplinary trainees.

Discussion

Summary of findings

This scoping review aimed to investigate the role and effectiveness of student led clinics in managing T2DM. A key finding of our review was that SRFCs can provide high-quality diabetic care, especially for uninsured and economically weaker population. These improvements are observed in both physiological outcome measures and logistical processes. Preliminary evidence further indicate that shared medical appointments and telehealth may facilitate diabetic care especially during times where access to care may be difficult (e.g., COVID-19 lockdown).

Our review found strong evidence that SRFCs are effective in the management of T2DM (21–23). This is not only consistent with published literature on the management of DM but also other chronic medical conditions, such as hypertension and smoking cessation (18, 27–29). Hence it can be argued that SRFCs can be used as conduits for effective DM care. Interestingly, the outcomes from these SRFCs (where students are supervised by clinicians) compared well with that of normal medical care provided by health professionals (26). Taken together, our findings and the existing literature, it is evident that medical students can design and implement good management plans that may meet the standards of care for patients with T2DM.

The quality of care provided at SRFCs has been a matter of debate. However, our review found that patients were satisfied with the care provided by students (24). This is in agreement with previous findings that showed that the quality of care provided at SRFCs are comparable or better than other providers. Further, shared medical appointments that involved transdisciplinary teams not only provided quality of care but also expedited patient intake (23). Interestingly, the SRFC care provided via telehealth during the COVID pandemic was also found to be effective and resulted in patient satisfaction (25). Collectively, these findings point to a bigger role of SRFCs in the management of T2DM.

On the other hand, however, our review identified a number of aspects of SRFC that can be improved including consistent patient education, monitoring and tracking of patient's diet and physical activity (24). A key strategy that may need to be incorporated as part of SRFC would be 'goal setting' with patients where healthy eating and counselling are part of goal setting (30). In this context, a SRFC that promotes inter-professional education may be important to expose students to a multi-dimensional approach to DM. Such an approach may not only benefit the students from variety of clinical experiences but also would facilitate students' experience in addressing this major public health issues and in understanding of other professions and prepare them for future practice (for example, SMA) (23, 31). Hence, it seems timely strengthen the public health focus for undergraduate healthcare students and strengthening inter-professional knowledge and insights as part of undergraduate health curriculum.

All studies in the current review included patients from disadvantaged communities, especially of Hispanic and African ethnicities. While all studies reported improvements in metabolic measures, it is unclear whether any culturally appropriate/safe interventions were provided. Traditionally, the focus of diabetic intervention has been on doctor and nurse-led primary health strategies involving physical activity and nutrition components that are effective at preventing diabetes and cardiovascular disease along with reducing weight (9, 32). However, evidence-based interventions may not be effective in indigenous communities without adapting the intervention to fit the target community (9, 19, 33). Family-centred interventions may play an important role in this context (34). This may include supporting healthy family behaviours; promoting community connectedness; improving access and culturally supportive care. For example, many indigenous older adult live in family home (11) with their families and do not necessarily cook for themselves alone and may not east nutritious and/or the right type of food for T2DM. Hence, it may be important for SRFCs to understand the kind of foods people from minority ethnic groups are accustomed to and prepare educational resources based on that information. Preliminary evidence suggests that such an approach may improve diet quality, hypertension and BMI (35). Further, promoting a cultural, spiritual and community connectedness is also an important strategy to facilitate a holistic management for T2DM (11, 34). This includes identifying, training and employing an indigenous health care workforce and providing health care delivery information in native languages (33, 34). However, no study included in the review explored or discussed family centred interventions. Hence, family-centred interventions should be made part of the curriculum with students in SRFCs exposed to such an approach.

Limitations

The review is not without its limitations. Only a small number (six) studies met our inclusion criteria. Further, the included studies were heterogeneous which may limit the confidence in our findings. However, we carried out an exhaustive search and maximised opportunity to include studies. Hence, the small number of studies may point to an emerging field and/or need for more research in this area. All the studies included in the review were done in the

United States of America. Therefore, the generalizability of the findings to other countries, setting and health systems can be limited. Secondly, the nature of training and the role of students was varied and heterogeneous across studies. For example, only one study had reported the educational activities provided to students. This may seriously limit our ability to make any recommendations about the educational content for students in the SRFC. All studies included people from disadvantaged communities who were mainly of Hispanic or African ethnicity. Future studies should investigate the effectiveness of SRFC in the management of T2DM in other indigenous communities. Family centred and community centred health care models may be timely in preventing the pandemic of T2DM for which SRFCs may play a crucial role. Hence, future programs should consider incorporating such health care models as part of their curriculum.

Recommendations

Based on our scoping review findings, the following recommendations are made:

- SRFC have an important role in managing and preventing the T2DM pandemic. Hence, the curriculum for health care professionals must be reviewed to include greater focus of this major public health crisis.
- The curriculum for health care professionals must include holistic management strategy of T2DM and not just metabolic outcome measures.
- Cultural aspects/understanding has been shown to be a barrier for managing T2DM. Hence students must be exposed to family/community centred health care models that promote cultural understanding, particularly for indigenous and vulnerable population.

Conclusion

The findings from the current review suggests that SRFC may play an important role in complimenting core services and expanding support to patients with T2DM. Our review further found that patients were satisfied with the care provided by students. However, the cultural aspects of SRFC are an area of future research.

Author contributions

KK, YA-R, MH, TT, and SB provided substantial contributions to this work and accept accountability for the finished product. KK conceived the scoping review. YA-R developed the search strategy. KK, YA-R, and SB participated in the collection of data and analysis including COVIDENCE screening. MH and TT provided critical inputs. All authors contributed to the article and approved the submitted version.

Funding

This project is supported by a Health Research Council (NZ) Grant ref: 21–1070.

Conflict of interest

TT was employed by Tu Tonu Rehabilitation Ltd.

The remaining 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

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1128617/full#supplementary-material

References

1. Al-Lawati JA. Diabetes mellitus: a local and global public health emergency! *Oman Med J*. (2017) 32:177–9. doi: 10.5001/omj.2017.34

2. Singer ME, Dorrance KA, Oxenreiter MM, Yan KR, Close KL. The type 2 diabetes 'modern preventable pandemic' and replicable lessons from the COVID-19 crisis. *Prev Med Rep*. (2022) 25:101636. doi: 10.1016/j.pmedr.2021.101636

3. Galicia-Garcia U, Benito-Vicente A, Jebari S, Larrea-Sebal A, Siddiqi H, Uribe KB, et al. Pathophysiology of type 2 diabetes mellitus. *Int J Mol Sci*. (2020) 21:6275. doi: 10.3390/ijms21176275

4. Anderson I, Robson B, Connolly M, Al-Yaman F, Bjertness E, King A, et al. Indigenous and tribal peoples' health (the lancet-Lowitja Institute global collaboration): a population study. *Lancet*. (2016) 388:131–57. doi: 10.1016/S0140-6736(16)00345-7

5. Lynch J, Helmrich SP, Lakka TA, Kaplan GA, Cohen RD, Salonen R, et al. Moderately intense physical activities and high levels of cardiorespiratory fitness reduce the risk of non-insulin-dependent diabetes mellitus in middle-aged men. *Arch Intern Med*. (1996) 156:1307–14. doi: 10.1001/archinte.1996.00440110073010

6. Gassasse Z, Smith D, Finer S, Gallo V. Association between urbanisation and type 2 diabetes: an ecological study. *BMJ Glob Health*. (2017) 2:e000473. doi: 10.1136/bmjgh-2017-000473

7. Weinstein AR, Sesso HD, Lee IM, Cook NR, Manson JE, Buring JE, et al. Relationship of physical activity vs body mass index with type 2 diabetes in women. *JAMA*. (2004) 292:1188–94. doi: 10.1001/jama.292.10.1188

8. Harris R, Tobias M, Jeffreys M, Waldegrave K, Karlsen S, Nazroo J. Effects of self-reported racial discrimination and deprivation on Māori health and inequalities in New Zealand: cross-sectional study. *Lancet*. (2006) 367:2005–9. doi: 10.1016/S0140-6736(06)68890-9

9. Beaton A, Manuel C, Tapsell J, Foote J, Oetzel JG, Hudson M. He Pikinga Waiora: supporting Māori health organisations to respond to pre-diabetes. *Int J Equity Health*. (2019) 18:3. doi: 10.1186/s12939-018-0904-z

10. Aguayo-Mazzucato C, Diaque P, Hernandez S, Rosas S, Kostic A, Caballero AE. Understanding the growing epidemic of type 2 diabetes in the Hispanic population living in the United States. *Diabetes Metab Res Rev*. (2019) 35:e3097. doi: 10.1002/dmrr.3097

11. Hokowhitu B, Oetzel JG, Simpson ML, Nock S, Reddy R, Meha P, et al. Kaumātua Mana Motuhake Pōi: a study protocol for enhancing wellbeing, social connectedness and cultural identity for Māori elders. *BMC Geriatr*. (2020) 20:377. doi: 10.1186/s12877-020-01740-3

12. Caballero AE. The A to Z of managing type 2 diabetes in culturally diverse populations. *Front Endocrinol*. (2018) 9:479–9. doi: 10.3389/fendo.2018.00479

13. Eer AS, Hearn T, Atkinson-Briggs S, Drake S, Singh S, Neoh S, et al. Improved metabolic parameters of people with diabetes attending an aboriginal health service in regional Victoria. *Intern Med J*. (2022) 53:787–97. doi: 10.1111/imj.15856

14. Massey CN, Appel SJ, Buchanan KL, Cherrington AL. Improving diabetes care in rural communities: an overview of current initiatives and a call for renewed efforts. *Clin Diabetes*. (2010) 28:20–7. doi: 10.2337/diaclin.28.1.20

15. An ML, Laks KM, Long NA. Uninsured with diabetes: how student-run free medical clinics are filling the gap. *Clin Diabetes*. (2019) 37:282–3. doi: 10.2337/cd18-0111

16. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. (2005) 8:19–32. doi: 10.1080/1364557032000119616

17. Babineau J. Product review: covidence (systematic review software). *J Can Health Libraries Assoc/J Assoc Canada*. (2014) 35:68–71. doi: 10.5596/c14-016

18. Berman R, Powe C, Carnevale J, Chao A, Knudsen J, Nguyen A, et al. The crimson care collaborative: a student-faculty initiative to increase medical students' early exposure to primary care. *Acad Med*. (2012) 87:651–5. doi: 10.1097/ACM.0b013e31824d5269

19. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement Sci*. (2009) 4:50. doi: 10.1186/1748-5908-4-50

20. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. (2018) 169:467–73. doi: 10.7326/M18-0850

21. Felder-Heim C, Mader K. Quality of diabetes and hypertension management at the DAWN (dedicated to Aurora's wellness and needs) student-run free clinic. *Cureus*. (2020) 12:e9539. doi: 10.7759/cureus.9539

22. Gorrindo P, Peltz A, Ladner TR, Reddy I, Miller BM, Miller RF, et al. Medical students as health educators at a student-run free clinic: improving the clinical outcomes of diabetic patients. *Acad Med*. (2014) 89:625–31. doi: 10.1097/ACM.0000000000000164

23. Kahkoska AR, Brazeau NF, Lynch KA, Kirkman MS, Largay J, Young LA, et al. Implementation and evaluation of shared medical appointments for type 2 diabetes at a free, student-run Clinic in Alamance County, North Carolina. *J Med Educ Train*. (2018) 2:1–10.

24. Schroeder MN, Hickey MO. Patient satisfaction with diabetes care in a student-run free medical clinic: a quality improvement study. *J Pharm Technol*. (2020) 36:61–7. doi: 10.1177/8755122519899084

25. Simon ME, Reuter ZC, Fabricius MM, Hitchcock NM, Pierce RP. Diabetes control in a student-run free clinic during the COVID-19 pandemic. *J Community Health*. (2022) 47:835–40. doi: 10.1007/s10900-022-01117-0

26. Smith SD, Marrone L, Gomez A, Johnson ML, Edland SD, Beck E. Clinical outcomes of diabetic patients at a student-run free clinic project. *Fam Med*. (2014) 46:198–203.

27. Liang En W, Koh GC, Lim VK. Caring for underserved patients through neighborhood health screening: outcomes of a longitudinal, interprofessional, student-run home visit program in Singapore. *Acad Med*. (2011) 86:829–39. doi: 10.1097/ACM.0b013e31821d841d

28. Lough LE, Ebbert JO, McLeod TG. Evaluation of a student-run smoking cessation clinic for a medically underserved population. *BMC Res Notes*. (2011) 4:55. doi: 10.1186/1756-0500-4-55

29. Zucker J, Gillen J, Ackrivo J, Schroeder R, Keller S. Hypertension management in a student-run free clinic: meeting national standards? *Acad Med*. (2011) 86:239–45. doi: 10.1097/ACM.0b013e31820465e0

30. Fredrix M, McSharry J, Flannery C, Dinneen S, Byrne M. Goal-setting in diabetes self-management: a systematic review and meta-analysis examining content and effectiveness of goal-setting interventions. *Psychol Health*. (2018) 33:955–77. doi: 10.1080/08870446.2018.1432760

31. van Diggele C, Roberts C, Burgess A, Mellis C. Interprofessional education: tips for design and implementation. *BMC Med Educ*. (2020) 20:455. doi: 10.1186/s12909-020-02286-z

32. Tan HQM, Chin YH, Ng CH, Liow Y, Devi MK, Khoo CM, et al. Multidisciplinary team approach to diabetes. An outlook on providers' and patients' perspectives. *Prim Care Diabetes*. (2020) 14:545–51. doi: 10.1016/j.pcd.2020.05.012

33. Oetzel J, Rarere M, Wihapi R, Manuel C, Tapsell J. A case study of using the he Pikinga Waiora implementation framework: challenges and successes in implementing a twelve-week lifestyle intervention to reduce weight in Māori men at risk of diabetes, cardiovascular disease and obesity. *Int J Equity Health*. (2020) 19:103. doi: 10.1186/s12939-020-01222-3

34. McCalman J, Heyeres M, Campbell S, Bainbridge R, Chamberlain C, Strobel N, et al. Family-centred interventions by primary healthcare services for indigenous early childhood wellbeing in Australia, Canada, New Zealand and the United States: a systematic scoping review. *BMC Pregnancy Childbirth*. (2017) 17:71. doi: 10.1186/s12884-017-1247-2

35. Marpadga S, Fernandez A, Leung J, Tang A, Seligman H, Murphy EJ. Challenges and successes with food resource referrals for food-insecure patients with diabetes. *Perm J*. (2019) 23:23. doi: 10.7812/TPP/18-097

frontiers | Frontiers in Public Health

TYPE Community Case Study
PUBLISHED 28 July 2023
DOI 10.3389/fpubh.2023.1105559

OPEN ACCESS

EDITED BY
Sunjoo Kang,
Yonsei University, Republic of Korea

REVIEWED BY
Mohsin Sidat,
Eduardo Mondlane University, Mozambique
Berjo Dongmo Takoutsing,
Association of Future African Neurosurgeons (AFAN), Cameroon

*CORRESPONDENCE
Judith Auma
✉ aumjudit@gmail.com

RECEIVED 22 November 2022
ACCEPTED 28 June 2023
PUBLISHED 28 July 2023

CITATION
Auma J, Ndawula A, Ackers-Johnson J, Horder C, Seekles M, Kaul V and Ackers L (2023) Task-shifting for point-of-care cervical cancer prevention in low- and middle-income countries: a case study from Uganda. *Front. Public Health* 11:1105559. doi: 10.3389/fpubh.2023.1105559

Task-shifting for point-of-care cervical cancer prevention in low- and middle-income countries: a case study from Uganda

Judith Auma[1]*, Allan Ndawula[2], James Ackers-Johnson[3], Claire Horder[4], Maaike Seekles[5], Veena Kaul[6] and Louise Ackers[3]

[1]Hampshire Hospitals NHS Foundation Trust, Basingstoke, United Kingdom, [2]Kataraka Health Centre, Knowledge for Change (K4C), Fort Portal, Uganda, [3]Knowledge for Change, University of Salford, Salford, United Kingdom, [4]School of Health and Society, University of Salford, Salford, United Kingdom, [5]Liverpool School of Tropical Medicine, Liverpool, United Kingdom, [6]Mid Yorkshire Hospitals NHS Trust, Wakefield, United Kingdom

Cervical cancer remains the leading cause of female cancer deaths in sub-Saharan Africa. This is despite cervical cancer being both preventable and curable if detected early and treated adequately. This paper reports on a series of action-research 'cycles' designed to progressively integrate a comprehensive, task-shifted, point-of-care, prevention program in a community-based public health facility in Uganda. The work has been undertaken through a UK-Ugandan Health Partnership coordinated by Knowledge for Change, a UK-registered Charity. The intervention demonstrates the effectiveness of task-shifting responsibility to Community Health Workers combined with the use of Geographic Information Systems to strategically guide health awareness-raising and the deployment of medical devices supporting respectful and sustainable point-of-care screen-and-treat services. The integration of this with public human immunodeficiency virus services demonstrates the ability to engage hard-to-reach 'key populations' at greatest risk of cervical cancer. The findings also demonstrate the impact of external influences including the Results Based Financing approach, adopted by many foreign Non-Governmental Organizations. The model presents opportunities for policy transfer to other areas of health promotion and prevention with important lessons for international Health partnership engagement. The paper concludes by outlining plans for a subsequent action-research cycle embracing and evaluating the potential of Artificial Intelligence to enhance service efficacy.

KEYWORDS

cervical cancer, prevention, task-shifting, frugal innovation, geographic information systems, results based finance

1. Introduction. Cervical cancer: a case of neglect

In Uganda, cervical cancer is the most common cause of both cancer-related incidence (54.8 per 100,000) and cancer-related deaths (40.5 per 100,000) (1). Eighty percent of patients present late with advanced stage (often terminal) disease (2). Late patient presentations are attributed to low levels of knowledge among health care providers and the public about cervical cancer and prevention strategies and minimal access to available (and free) public screening services (2, 3).

The 2010 National Strategic Plan for Cervical Cancer Prevention and Control prioritized 3 areas (3). The first 2 of these include an emphasis on health education and awareness-raising:

1. Human Papillomavirus (HPV) vaccination of 10–14-year-old girls
2. Low-cost screening using Visual Inspection with Acetic Acid (VIA)
3. Treatment of early dysplasia (cervical intraepithelial neoplasia) using cryotherapy

While HPV vaccination has become the primary preventive intervention in high income settings, Uganda's HPV vaccination program, targeting girls aged 10–14 in primary schools, has achieved only about 20% uptake (4). Progress has been substantially impacted by the immediate and long-term effects of extended school closures during the COVID-19 pandemic and subsequent Ebola outbreaks. For the foreseeable future, this implies continued emphasis on screen-and-treat programs working in parallel with HPV vaccination. A key goal of Priorities 2 and 3 was to have 80% of eligible women screened and treated for precancerous lesions (3). Despite these intentions, Uganda's national screening program faces considerable implementation gaps. In practice, screening in Uganda is erratic and absent in many regions (5). Unfortunately, there is very limited (or no) public funding for such programs which suffer from acute donor-dependency (6, 7). Uptake of screening services that do exist are negatively impacted by limited access to facilities, compounded by the costs associated with services, travel, and wait times (8, 9). There is also a shortage of trained screening providers (10). This explains the low lifetime screening rate of between 4.8 and 30% (11), and the continued prevalence of advanced disease and mortality (2).

Cervical screening guidelines in Uganda are based on a 'see-and-treat' approach targeting women aged 25 to 49 years. VIA is the main screening procedure used. In theory, women diagnosed with positive mild–moderate precancerous lesions (diagnosed through VIA) should then be treated, in the community, using cryotherapy. In practice, even Non-Governmental Organizations (NGOs) that constitute the private 'not-for-profit', sector levy significant charges for such treatment. National Guidelines (until recently) stipulated that women who test positive for Human Immunodeficiency Virus (HIV) should be screened annually while HIV-negative women should undergo cervical screening every 3 years. Midwives and nurses are the primary providers of cervical cancer screening as well as treatment (3).

Knowledge for Change (K4C) is a UK and Ugandan registered NGO focused on health systems change.[1] At the time of the commencement of the Knowledge for Change (K4C) screen-and-treat service in Fort Portal (Uganda), the city had no public facility offering free cervical screening services. This paper presents a Community Case Study documenting a complex intervention (defined through a series of action-research cycles) drawing out the potential for scale-out of see-and-treat cervical cancer prevention in Low- and Middle-Income Countries (LMICs).

2. The K4C screen and treat intervention and action-research methodology

It is customary in research papers to outline the specific methods used for a time-limited study with a clearly specified objective. The overall long-term objective in this work was to address the lack of preventive cervical cancer screening services and, in so doing, find ways to sustainably reduce the mortality associated with this preventable disease. In practice, K4C has learnt that health systems change is rarely a paradigm-shifting process but happens through closely contextualized and carefully evaluated progressive incremental change (6). External influences beyond the control of individual projects in Aid-driven health systems have considerable potential to disrupt and even undermine planned interventions. The authors share complex positionalities as health workers, charity actors and trustees, volunteers, and academic researchers. Our approach to research is best described as action or implementation research. We have described the challenging and unpredictable nature of this approach elsewhere (6) and alluded to the necessity of process continuity. Action-research does not have simple start and end-dates and objectives inevitably need to change over time in response to changing contexts and opportunities. The publication of results in this paper marks a stage in an unpredictable journey, characterized by a series of action-research cycles each bringing new knowledge and expertise to the wider intervention. The intervention commenced some years ago with measures to promote respectful care in service delivery at Kagote Health Centre, Uganda (12). Respectful care provides the essential foundation for any intervention to improve access to public services. The decision to develop a preventive clinic in Kagote in 2017 kick-started a sequence of evolving action-research cycles starting with device procurement then moving onto staff training, public awareness-raising and service integration with HIV clinics. As staff trained under our program were routinely rotated by the District Health Office into other facilities, screen-and-treat services were extended to these public health centres. In practice, this took place in a more sporadic fashion and in the absence of a systematic health awareness intervention. The paper documents the development of K4C's Model for community-based cervical screening with interventions and the results associated with them reported sequentially.

3. The action-research cycles

Section 3 documents a series of 4 action-research cycles. They are distinguished here to allow discussion of the specific programmatic elements they concern (device procurement, capability-enhancement, the use of Geographic Information Systems to guide awareness-raising and service integration with HIV care). The distinction also maps the

1 www.knowledge4change.org

Abbreviations: AI, Artificial Intelligence; EVA, Enhanced Visual Assessment; GIS, Geographic Information Systems; HIV, Human Immunodeficiency Virus; HPV, Human Papillomavirus; LMIC, Low- and Middle-Income Countries; NGO, Non-Governmental Organizations; PAP, Smear Papanicolaou Smear test; RBF, Results Based Finance; VHT, Village Health Team; VIA, Visual Inspection with Acetic Acid.

chronology of intervention. In reality, action-research is necessarily a 'messy' process (13, 14) and cycles overlap and interface with each other.

3.1. Cycle 1: point-of-care device procurement

Cycle 1 focused on the selection of appropriate devices to support sustainable task-shifting in Community-based facilities. In 2017, K4C established the first screen-and-treat cervical cancer prevention service in a Ugandan community-based public health facility (Kagote Health Centre). K4C grew increasingly concerned at the 'outreach' or 'health camp' model to partnership working. This approach, delivering services at remote locations and often through organizations operating in parallel to public services, has been explicitly fostered by the private (ostensibly) 'not-for-profit' sector. This approach is immediately attractive to foreign 'donors' driven by numerical 'outcome' measures and to hosting organizations that operate a 'vending-machine' approach to income generation. K4C had found itself caught up in this approach as local organizations encouraged us to fund screening out-reaches. We soon stopped this activity as we were concerned about the ethics of offering free screening to women in the absence of free preventive treatment of eligible precancerous lesions. The first action-research cycle then focused on the procurement of a suitable point-of-care device. Biomedical engineering expertise lies at the heart of K4C's work and we were very aware of the risks associated with the procurement of equipment (such as the popularly used cryotherapy devices) reliant on on-going supplies of consumables or reagents. In practice, much of this equipment lies unused in health facilities waiting for donor funding for consumables (15). With advice from its specialist biomedical engineer and informed by recent research on the relative merits of thermocoagulation – also known as 'cold coagulation' or thermal ablation (16, 17), K4C procured a rechargeable thermocoagulation device. This device is hand-held, rechargeable and no bigger than a standard hairdryer.

Existing screening programmes in Uganda were using the naked-eye approach. Visual Inspection with Acetic Acid (VIA) is generally used in public and not-for-profit sectors in Sub-Saharan Africa where PAP Smear tests or testing for the presence of Human Papillomavirus (HPV)[2] is regarded by national authorities and the World Health Organization to be inefficient (20–22). The VIA approach has been effectively task-shifted to midwives and nurses in Uganda, many of whom will have received varying levels of training (again almost exclusively by NGOs). Concerned about the efficacy of this random approach to training, K4C embarked on a comprehensive training program including training in the use of a new device, developed by a company in Israel to enhance and quality assure the VIA process. The Enhanced Visual Assessment (EVA) device is effectively a colposcope mounted on a Samsung phone that captures a high-quality image of the cervix and uploads that, along with key patient data, onto a secure database.[3] The password-protected database is then accessible in real time from anywhere in the world. This rapid point-of-care diagnostic technology gives a better view of the cervix and provides opportunities for remote review and audit of clinical decision-making. Critically, in the K4C Model, it has supported capacity-building through a virtual volunteering (or telemedicine) approach. Beery (23) co-founder of Mobile ODT, the company manufacturing the EVA device, describes the role that it can play in supporting training and quality assurance mechanisms in cervical screening programs in developing countries. This approach connects to a fast-emerging knowledge base around digital health more generally and point of care diagnostics particularly in resource-poor and geographically remote environments (24). It also responds to concerns about potential 'diagnostic drift' associated with one-time, poorly integrated, fly-in fly-out, NGO-led training. The limited impact of such approaches on health worker behavior have been reported in areas such as neo-natal resuscitation training and emergency obstetric care (6, 25). A systematic review of interventions to improve health worker performance in LMICs found that 'one time training interventions result in very low to no learning outcomes (26).

3.2. Cycle 2: capability-enhancement for effective task-shifting

The introduction of new devices and services demands attention to staff capability and training. Cycle 2 focused specifically on knowledge transfer and training. Task-shifting is defined by the World Health Organization (WHO) as 'the rational re-distribution of tasks (…) from highly qualified health workers to health workers who have fewer qualifications in order to make more efficient use of the available human resource' (27). We have argued elsewhere (25) that the concept of task-shifting is often best characterised as task-dumping (dumping tasks on less well-paid staff, without the necessary training and often falling out with their role specification exposing them to risk of professional malpractice). To avoid the risks associated with delegating tasks to staff who were not trained in their initial education or through continuing professional development in such tasks, the planned program required an initial phase of health worker training. The multi-disciplinary knowledge mobilization team included K4C volunteers (midwives, nurses and doctors), Ugandan midwives and a doctor employed directly by K4C, and the midwives, nurses and Village Health Workers employed at the local health facilities. The training included 2 two-week blocks of intensive on-site training (of a total of 40 health workers) followed by long term, continuous, mentoring supported by the EVA-device's database function. In practice, this involved fortnightly reporting of cases to the UK experts which could be checked against the database. As expertise developed in-country, the UK team now responds only to cases referred to them.

2 Testing for the presence of HPV is now commonly used as a triage process reducing the need for more invasive PAP smear testing (18, 19).

3 Further information and guidance on the practical use of both thermocoagulation and the EVA device is available on the Mobile ODT website 9 with free demonstrations available: https://www.mobileodt.com/products/eva-pro/.

Evaluation of the initial training (using pre- and post-training tests) demonstrated familiarity with the VIA technique. However, as the EVA system was new, further training was required on data input, how to take high quality colposcopic photographs and interpret them in real time. Overall, the trainees were quick to learn how to use the EVA, and the images provided opportunities for patient education, peer-peer learning, targeted treatment and later, clinician to clinician support. We soon learnt that screening required two healthcare professionals when using the EVA (one to perform the procedure and one to take the images) as it was difficult to take high quality images while maintaining infection prevention control measures and keeping the cervix in view. This had the advantage though of implementing K4C's principle of co-working and co-presence (6) ensuring the trainee received peer support and a second opinion while learning to use the EVA. Interviews with health workers reported high satisfaction among patients who were pleased to receive immediate feedback on their examination using the images, which in turn helped the trainees to explain the findings and offer treatment. We found that women were very interested in the images and did not feel embarrassed by the strategy. In Ghana, nurses training in VIA using a smartphone colposcope and their patients had a similar positive experience using this approach (28). Training extended to the use of the thermocoagulation device, as very few Ugandan health workers in public settings had received training in treatment methods. The WHO recommends that trained nurses and midwives perform thermal ablation in addition to physicians (17). For women who were VIA positive, with lesions eligible for ablative treatment (according to WHO guidelines), it proved to be easy for the midwives to use and acceptable to the patients. As there was a low VIA positive rate during training, it was not possible for all trainees to practice but they were later supported by their colleagues who had had the opportunity and together confidence was gained in the thermal ablation technique. The Commonwealth Professional Fellowship Scheme enabled further enrichment through the training of 6 colleagues in the UK[4].

Fit-for-Purpose, contextualized, training materials were developed which gave a comprehensive overview of the basic histology of the cervix, through to cervical screening methods, investigation and management of cervical cancer; these have provided a continuous resource to follow-up training.[5] The course included opportunities for midwives to practice counseling and consenting women for screening with feedback from trainers. It also included simulating thermal ablation using models of the cervix made from shoeboxes and raw meat. Prior to training, participants were asked to complete a multiple-choice questionnaire assessing their knowledge of local screening eligibility criteria, cervical anatomy and types, identification of benign and precancerous cervical lesions and screen and treat methods using VIA. Generally, at baseline, the healthcare providers' knowledge about cervical screening was fairly good. The majority correctly identified HPV as the causal agent and acknowledged the significance of cervical screening toward early detection and prevention of cervical cancer. They also had good knowledge of the screening target age group and the screening intervals. However, most participants found it challenging to identify the transformation zone of the cervix, distinguish benign lesions from abnormal changes, and deciding when to treat. The majority also did not know the appropriate time to view the cervix for any changes after application of acetic acid. This raised a significant area to focus on while conducting training and/or refresher courses. The post-test assessment questionnaire showed significant improvement in overall knowledge of cervical screening using VIA and treatment of minor lesions. This is congruent with previous studies identifying training as an effective intervention in cervical cancer prevention (29, 30). Participants' confidence was also assessed on a 5-point Likert scale; Figure 1 illustrates overall improvements in confidence. Slightly lower confidence was seen in understanding which lesions to treat compared to the other components. Previous studies have reported the subjective nature of VIA which makes it challenging to accurately identify abnormal changes (31). This is because the demarcated acetowhite staining on VIA positive women can be suggestive of HPV infection, inflammation, metaplasia, or dysplastic changes (32, 33). This underlines the need for continual experiential practice, regular refresher courses and mentoring to improve confidence and maintain necessary skill sets.

K4C recognizes the limitations of formal one-off training interventions and always combines these with continuous mentoring and support. This has taken the form of co-working (where volunteers and K4C staff work in co-present relationships with local staff) and telemedicine support. The EVA device is uniquely positioned as images can be shared in real time through the system's encrypted online image-sharing database, supporting on-going discussion over diagnoses. A fortnightly case reporting system has also enabled the team to flag cases of interest or concern through this virtual mentoring process. As expertise and confidence has developed, we have found that more cases can be resolved through in-country discussion. It is important to note that K4C had been actively involved in the development of 'respectful care' in Kagote Health Centre and this laid the essential foundations of trust and mutual respect (34).

Once the screening facility was established and staff positioned to provide services, we were initially (naively) disappointed at the uptake. Support from the UK's Small Charities Challenge Fund (SCCF)[6] provided the opportunity to develop an ambitious awareness-raising program.

3.3. Cycle 3: systematizing health awareness raising using geographic information systems (GIS)

Cycle 3 responded to the need to raise awareness among eligible women about cervical cancer, the importance of preventive action and the screen-and-treat process. The WHO identifies community awareness-raising and health education as critical components of

4 The 3-month fellowships coincided with the start of the COVID-19 pandemic so in practice this training also took place on a virtual basis.

5 K4C has a portfolio of resources that is regularly updated and would be happy to share.

6 Funded by the UK Department for International Development [now the UK Foreign, Commonwealth & Development Office (FCDO)].

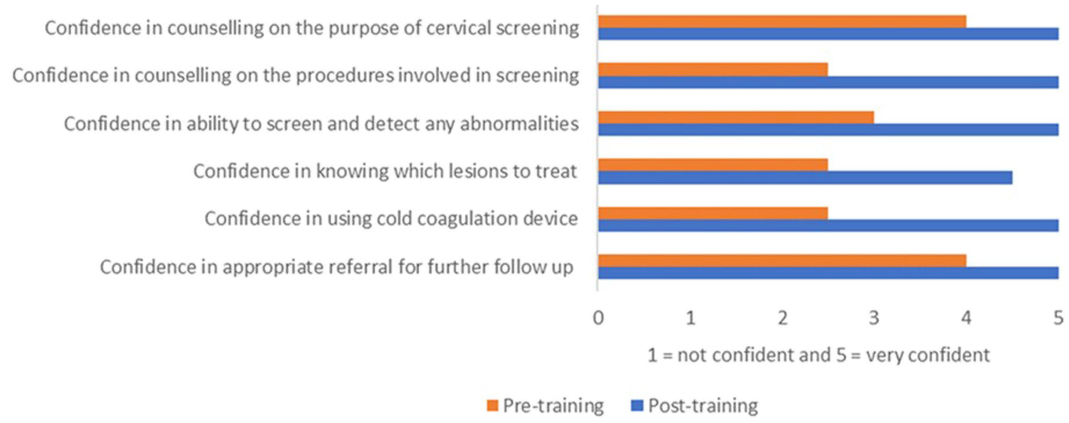


FIGURE 1
Confidence of the healthcare providers pre- and post-training (K4C).

preventive screening to ensure optimal geographical coverage, treatment adherence and challenge common taboos (35). To achieve this, the Ugandan Ministry of Health proposed a target of 90% of women aged 15–49 years to be reached through Information, Education, and Communication (IEC) materials about cervical cancer (MOH, 2010). Under this system, Uganda's Village Health Teams (VHTs) are the primary vehicle for public health engagement primarily through outreach activities. Nominally, VHTs are unpaid volunteers embedded in local communities. In practice, these 'volunteers' are typically remunerated by Ministry and NGO actors on specific missions (including childhood immunization, family planning and HIV awareness).

Concerned to optimize demand for the new screening service, K4C took the decision to mobilize the local VHTs working alongside midwives and nurses in an ambitious community outreach program. As noted above, this included an initial phase of multi-disciplinary training to ensure that VHTs understood cervical cancer and the role that early prevention can play and anticipate some of the barriers to screening among local women.

The interviews with health workers conducted as part of the evaluation emphasize both the importance of using VHTs (given their rapport with local communities) and more informal relationships but also the importance of ensuring that health education messages are evidence-based:

> The community health workers/VHTs (…) could be a better option cause they are familiar with the clients and the clients are okay with them. If they are the ones to pass on the message to the clients, then there would be no cause for alarm (HCP 7 - Records personnel).

> Most times I say cooperation is good. The VHTs have been very helpful. If they are seated [with the other health workers] and the VHTs give the talk to the women, it is very good. Then if the health worker also tops up the voice? I think this thing would sound more beautiful than if only left to the VHT. Others may think the VHTs don't have much information, but if they cooperate I think the voice would be heard so good (HCP 5 – Midwife).

We were also aware that VHT mobilizations are typically quite random. Although they are selected to represent their local communities as a rule health education programs, whether organized through the government or by NGOS, typically provide limited direction (or monitoring) of geographical coverage. In early trials we found that VHTs tended to focus, for example, on the very local market area. Perhaps because of the volume of people present but also for pragmatic reasons; less far to walk and convenient to combine with shopping. We wanted the intervention to take a more strategic approach to public awareness-raising supported by fine grained, geo-health data. The decision was taken to pilot the use of Geographical Information Systems (GIS) to guide outreach work combining health education with a community survey. The GIS approach was informed by a model used in rural Nigeria to determine the prevalence of hypertension and its comorbidities leading to mortality (36).

The community survey was designed to function on a tablet device using Epicollect, an Open Data Source capable of capturing location data (37). The survey acted as a census to determine women's previous cervical screening experiences, capture key demographic characteristics and inform our approach to cervical cancer awareness. It was conducted by trained VHT/midwife pairs. Once the team established the presence of an eligible respondent (a woman aged 18–60) a short interview was conducted, and the responses saved on a tablet or mobile phone. The survey was followed by a short health education talk on the process and effectiveness of cervical screening and guidance on how to access the free public service. Women were also provided with an information leaflet translated into local languages. The community survey and mapping activities were planned to take place twice-weekly, prior to the twice-weekly clinics to reduce any delays and facilitate immediate responses. In practice, the awareness raising was so successful in terms of generating demand, we had to tailor the frequency of the outreach work to ensure that we could deliver a high-quality service and minimize waiting times which we knew were a deterrent to women. The outreach intervention involved 48 days (usually 2 days/week prior to clinics) over a 6-month

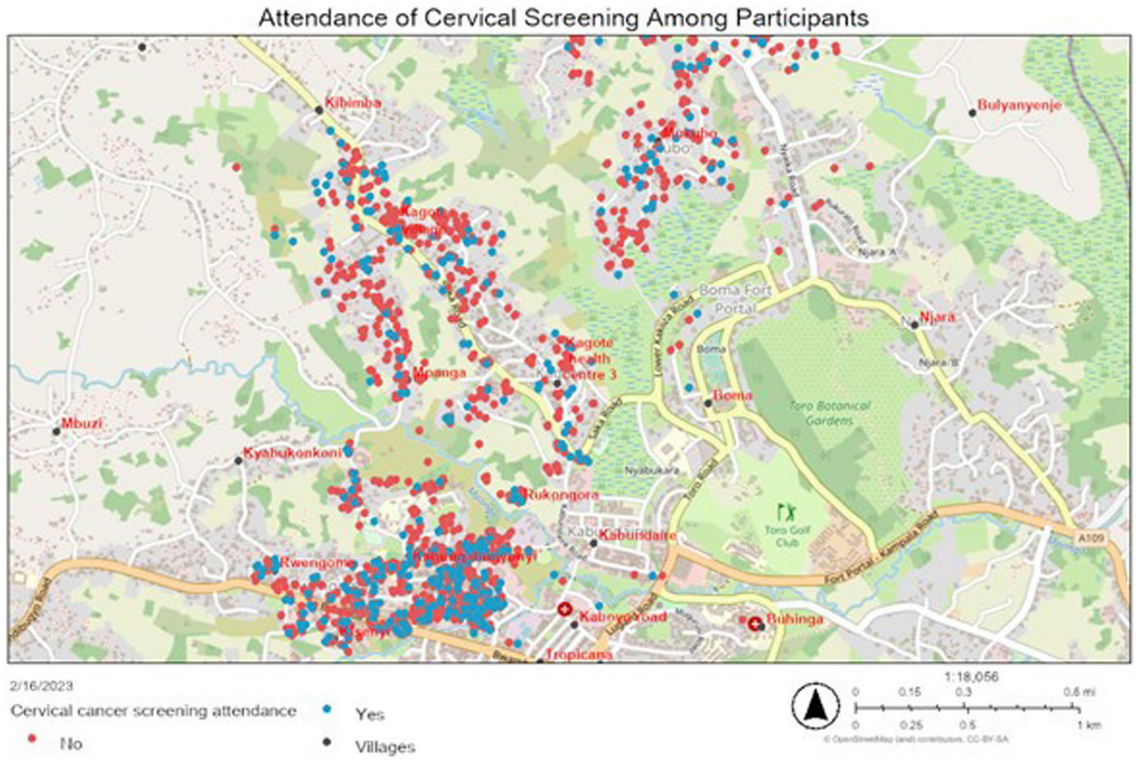


FIGURE 2
Geographical distribution of women by previous screening attendance (37).

period from April 2019. A total of 2014 participants were interviewed during the door-to-door visits.[7] The average age of participants was 30 years, ranging from 18 to 86 years.

3.3.1. Survey and GIS mapping results

The GIS approach supported a dynamic analysis integrating location data with a range of other data collected from the survey to produce interactive visual maps describing participants' experiences in association with their location. By way of example, Figure 2 shows the distribution of participants that reported having previously attended cervical screening:

It is surprising that participants who attended screening (the blue dots) lived in the same communities as those who never attended, suggesting either limited peer-to-peer influence or perhaps that they have gained awareness but do not feel the need to access screening at this point. The problem with this in the case of cervical cancer is that this is a largely symptom-free condition until the cancer is advanced. This raises the need to further explore (and challenge) factors leading to low uptake such as cultural myths and beliefs, costs of screening, and lack of time (11, 38). In addition to this substantive data (on screening experience), Figure 2 demonstrates the power of the GIS approach in terms of strategically guiding health awareness work. The area most densely populated with cases (to the south of Kagote Health Centre) is the area traditionally frequented by VHTS in outreach work. Continuous mapping of results enabled the project manager to guide, and, where necessary, provide transport to extend the geography of the intervention. The approach could also be scaled-out to support the planning of future cervical cancer prevention and control interventions. In practice, we have seen patient journeys increase as the reputation and awareness of the service has grown over time; this includes cases of women traveling from outside the health district to access services at Kagote. Women have a right, under MOH protocols, to access any public service and the widening catchment area can be seen as an indicator of service availability and acceptability. The necessity of travel does raise issues about the need to extend the service to other, more distributed, community health centres.

Respondents who said they had previously been screened were asked to name the facility they accessed. The purpose of this question was to identify the kinds of facilities women had been attending. As noted above the survey took place a short time after screening was introduced at Kagote. Of the 399 respondents who had previously attended screening the largest group had attended public facilities with 131 (33%) identifying public hospitals. A total of 81 cases (20.3%) involved screening in community health facilities as envisaged in the MOH Strategy. This latter group is dominated by Kagote residents (61 of the 81 cases). A further 38.6% named private facilities (including both for and not-for-profit centres). Most of this group (100 out of 154) named key NGO providers (Reproductive Health Uganda, Marie Stopes and Mildmay). An additional 31 women said they had been screened in outreach camps in the past.

7 Ethical Approval for this work was obtained HSR1819-061 (for interviews with health workers) and HSR1819-061 (for the GIS work).

TABLE 1 Main sources of health education by age group.

Age group	Radio % (*n*)	Word-of-mouth % (*n*)	VHTs % (*n*)	TV % (*n*)	Newspaper % (*n*)	Other (%)
18–24 (*n* = 571)	62.2 (355)	35.0 (200)	25.4 (145)	26.6 (152)	4.0 (23)	14.4 (82)
25–34 (*n* = 918)	60.5 (555)	40.0 (367)	30.9 (284)	23.4 (215)	3.4 (31)	20.5 (188)
35–44 (*n* = 353)	58.6 (207)	36.8 (130)	31.7 (112)	27.2 (96)	5.7 (20)	20.1 (71)
45+ (*n* = 172)	75.0 (129)	34.3 (59)	29.7 (51)	33.1 (57)	7.6 (13)	11.0 (19)
Total	61.9 (1246)	37.5 (756)	29.4 (592)	25.8 (520)	4.3 (87)	17.9 (360)

3.3.2. Sources of information on cervical cancer and screening

One of the questions the survey sought to assess concerned the sources of information women relied upon when making decisions about reproductive health and/or cancer screening. Participants were presented with a range of options and invited to identify which they relied upon for health information. Table 1 confirms the findings of Uganda's National Media Access Statistics that confirm reliance on radio as the main source of public information rated at 65% (39). This finding encouraged us to use local radio stations to inform women about the need for and access to free cervical screening.

After word of mouth, Village Health Workers formed the next most cited source of health information supporting our decision to actively train and deploy these cadres. The survey did not specifically ask about social media and we would anticipate this becoming a significant source of information and misinformation in the future. Table 1 shows that, for now, even younger age groups are very reliant on radio and VHTs.

The survey also asked whether respondents had attended cervical screening before. Table 2 summarizes the results cross tabulated by age group, educational level and information source.

Prior to the health education program, only 20% (402) respondents had attended cervical screening at the time of the survey. Some significant differences in percentages screened across age groups, with (perhaps inevitably) those in the youngest age group (18–24) least likely to have received cervical screening. No significant differences were seen in the likelihood of screening by the educational levels attained. Interestingly, for those women who have received screening in the past the sources of information were much more balanced.

TABLE 2 Previous screening attendance by age group, education level and information source.

	Reported previous screening % (*n*)
Total (*n* = 2014)	20.0 (402)
Total 25+ (*n* = 1443)	24.2 (349)
Age group	
18–24	9.3 (53)
25–34	20.4 (187)
35–44	30.3 (107)
45+	32.0 (55)
Education level completed	
None	22.1 (25)
Primary	19.9 (108)
Secondary	18.4 (167)
University	22.6 (102)
Information source	
TV	24.0 (125)
VHT	23.6 (140)
Newspaper	23.0 (20)
Radio	19.9 (248)
Word-of-mouth	18.1 (137)
Other	19.4 (70)

3.4. Cycle 4: integrating cervical screening and HIV clinics

Cycle 4 responded to the specific risks that women who are HIV positive are exposed to and the opportunities to capture those women accessing regular Anti-retroviral medications. Action-Research cycle 4 extended the previous literature review to focus specifically on the relationship between cervical cancer and HIV prevalence. A previous study evaluating cervical screening techniques in Uganda, found that HIV positive women had a higher prevalence of precancerous lesions than HIV negative women; 12.9% vs. 1.7%, respectively (40). HIV positive women have also been shown to have a higher rate of persistent multiple high-risk HPV infections (41) and higher incidence of both precancerous and invasive cervical cancer lesions (42). Cobucci et al. (43) attributes this to the long-term effects of increased access to antiretroviral therapy that has lengthened life expectancy for HIV positive women, and thus exposing them to the risk of developing other AIDS-defining cancers. HIV also weakens the natural cell-mediated immune responses that are required to clear HPV infection increasing the likelihood of an HIV positive woman's cervical cells developing into premalignant lesions and advancing to invasive cancer (44–46). UNAIDS/WHO (17) estimates that about 17.3 million women form almost half of the total number of HIV positive individuals worldwide and of these, 13.2 live in sub-Saharan Africa. Uganda is only second to South Africa where 2,363 individuals get

infected with HIV every week. Currently in Uganda, as regards to UNAIDS (47) data, 1.4 million people were HIV positive in 2022, and about 17 000 AIDS-related deaths were reported, with an estimated HIV prevalence among adults (aged 15–49) standing at 5.1%. Women are more affected by HIV than men, with 6.5% of adult women aged 15–49 being HIV positive compared to 3.6% of men. Additionally, HIV prevalence is almost four times higher among females aged 15 to 24 than males of the same age (48). Sia et al. (49) attribute this gender inequality in HIV/AIDS prevalence in Uganda to the gender differences in the distributions of observable HIV/AIDS risk factors (i.e., sociodemographic characteristics, sexual behaviors, and HIV/AIDS awareness) between women and men. For instance, the lower socioeconomic status of women predisposes them to transactional and intergenerational unprotected sexual relations that may increase their vulnerability to HIV (50–53). Additionally, poorer and less-educated women may lack the knowledge needed to adopt HIV risk-reducing behavior (54).

We have noted the importance of respectful care in ensuring optimal access for these 'hard-to-reach' patients. As the screening work was developing one of K4C's Ugandan doctors identified the lack of integration between the HIV-clinic at the local health centre and the cervical screening clinic (about 10 meters apart). This stimulated a further action-research intervention aimed at improving screening coverage of women attending the HIV clinics and, in turn, encouraging those women presenting for screening to check their HIV status. When this study, supported by a Royal Society of Tropical Medicine and Hygiene (RSTMH) small grant[8] commenced in August 2019, only 31.3% eligible women utilizing the HIV clinic had accessed cervical screening (55). One of the advantages of integrating the clinics arose from the fact that HIV positive women are required to visit the HIV care clinics (1–6 monthly) for reviews and drug refills. This creates a valuable 'window' to encourage women to access cervical screening. The evaluation of this cycle involved qualitative interviews with 16 of the health professionals engaged in the screening process at Kagote Health Centre to gauge their perceptions and experiences of service integration. The interventions (based on the findings of the interviews) consisted of sensitizing women about cervical cancer prevention and creating a system of 'call and recall' of women due for screening. The latter involved use of an appointment book and cervical screening cards, similar to the cards being used in HIV care to monitor patients' viral loads. The cards were attached to each of the women's records to prompt clinicians to discuss and update women on their screening appointments. VHTs and other health professionals in the HIV clinic were mentored to sensitize and refer eligible women for screening.

The intervention to integrate the 2 clinics involved sensitizing HIV positive women about cervical screening and other women attending screening about the need for HIV testing (a bi-lateral process). The word 'cancer' is avoided at this stage as the association of cancer with major costs and mortality often means that women in Uganda would prefer not to know. A cancer diagnosis in an LMIC setting such as Uganda where treatment options are very limited can cause severe anxiety and distress. To avoid overwhelming women on first diagnosis of HIV sensitisation commenced after their second visit. Evaluation of this action-research cycle included analysis of patient data and interviews with health workers to assess their perspective of service integration and the impact of this on their workload and on patient outcomes.

All the health worker respondents spoke positively about the integration of cervical screening services with the HIV clinic. The midwife below highlights how it would support follow-up, minimize transport costs and increase access for cervical screening services:

> It is good because when it's an ART clinic day, you get more clients - this is a gathering centre where they come to pick their treatment, it is very good for this client to have all services at once and she goes back rather than giving her a return date. In Africa, people have many challenges on transportation, so she may not come back if you give a different date. But if you put services together, both ART and cervical screening, it reduces on the transport costs for the client (HCP 10 – midwife).

Another respondent acknowledges the value of using this 'gathering' of women as a health education 'moment' and suggests that women respond very well to this:

> The turn up of the women after the health talks in the ART and the immunization clinics is good. The women are responsive (HCP 3 – nurse).

Integrating services is time saving, as the women can access all the required services from one facility instead of looking for services that are scattered in different locations or even visiting the same facility on different days for different services offered. Another perceived benefit of integration is the provision of a better means of record keeping – having all the patient's details in one facility. This helps clinicians to have a better picture of each of the patients when presenting with any concerns:

> If it's connected to the ART clinic, anyway, then everything is in one case and you even have it in one folder you can treat the person as one (HCP 1 – midwife).

One of the most frequent perceived benefits by almost all the participants is the improved targeting of the women at high-risk for cervical cancer:

> It's a good thing to make cervical screening a routine in ART because their immunity is suppressed; their bodies have some cells that don't function as well as in those without the virus. So, they have a higher chance of getting the cancer. It is therefore good specially to tell them to be screened every year (HCP 4 – VHT).

The service integration approach proved highly successful yielding an exponential increase in timely screening of HIV positive women: from 31% to nearly 80% (recommended target for any screening programme) over a period of 10 ten months (55).

As with any implementation research the context does not stand still and wait for tidy results. In the last 2 years, the Ugandan Ministry of Health, through international 'implementing' partners (including

8 Funded by the National Institute for Health and Care Research (NIHR).

TABLE 3 Number of women screened by HIV status and screening outcomes by health facility (April 2019 to date).

	Overall % (*n*)	Kagote % (*n*)	Bukuuku % (*n*)	Kasusu % (*n*)	Kira % (*n*)	Kasangati % (*n*)
Total *n*	3,690	1,499	1,088	163	294	173
HIV + ve	74 (2728.6)	52.9 (793.5)	83.1 (904)	84 (136.9)	91.2 (267.6)	92.5 (160)
Ca + ve	6 (221.4)	5.6 (83.9)	16.7 (181.7)	1.8 (2.9)	3.1 (9.1)	4 (6.9)

US-financed NGO (Baylor), PEPFAR and Mildmay) introduced a scheme to target HIV positive women. This was later supported by a (short-lived) Results-Based-Finance (RBF) scheme providing financial incentives to health facilities for screening of HIV positive women. K4C has serious concerns about RBF and its impact on service planning and health worker behavior. In practice RBF tends to stimulate a very narrow focus on the outcomes for which remuneration is available often to the exclusion of other needs or patients. At the present time in Uganda cervical cancer screening is driven by *pro rata* payments for women who are HIV positive leading to the almost total neglect of other women.

Table 3 presents the totals for K4C-supported screening and treat services across all facilities. Since 2019 a total of 3,690 women have accessed cervical screening. Of these an average of 6% had positive results and treatment. Seventy-four percent of those screened were HIV positive. Table 3 also enables us to look at screening profiles by health facility and gives some indication of the impact of K4Cs health awareness intervention, predominantly in Kagote; at least in terms of encouraging those women who are not HIV positive (and therefore not already connected with health facilities) to attend screening.

The outreach health education program described above has only taken place in Kagote. While Auma's work to integrate HIV and screening services has also only taken place at Kagote the outcome data suggest that the RBF intervention has overwhelmed approaches to screening in the past 2 years. A serious unintended consequence of this has been the almost total neglect of women who are not HIV positive (over 90% of women screened in some facilities are HIV positive compared to a rate of 52.9% in Kagote). This provides a very powerful critique of RBF-driven interventions. As is common with interventions driven by external (foreign) partners, this time-limited nature of financial support will inevitably simply put a halt to any screening in future. K4C is currently trying to rebalance this with a focus on awareness-raising post-natal and immunization clinics. In some facilities where the screening takes place within the HIV clinics, we are concerned both that staff will fail to screen HIV negative women but also such women may want to avoid the stigma of visiting the HIV clinics. In one health facility where this has emerged as a key concern, K4C has established a new screening clinic adjacent to maternity open to any women.

4. Conclusion

This paper reports on the evolution of a cervical screening program that has developed and become embedded in public health services in one health district in Uganda over the past 5 years. As we noted, earlier effective and sustainable implementation research is a continuous process typically involving a range of evidence-based interventions informed by consecutive 'cycles'. The decision to report, at this juncture, was informed by the launch of a new EVA device supported by Artificial Intelligence. The telemedicine aspect of the EVA system, where expert clinical advice and support with clinical decision making supported through virtual image sharing and consultation in real time, has proved effective in preventing diagnostic drift and ensuring women receive appropriate treatment. Respectful care lies at the heart of all services and plays a major role in promoting access, particularly in such sensitive areas as cervical cancer and HIV. A foundation of respectful care coupled with comprehensively trained multi-disciplinary teams and strategically planned public awareness programs (guided by GIS) has been shown capable of delivering high quality point-of-care preventive services. The integration of cervical screening with HIV clinics took this to another level ensuring that those women most at risk access these services. Service integration is also an important component of our sustainability commitment. K4C's commitment to co-working in public services has ensured a model that can be sustained with minimal external resourcing beyond the management of the EVA device. The effectiveness of the thermocoagulation approach has been picked up by the Ministry of health who now provide these devices. The updated next-generation EVA device enhances this telemedicine support through an Artificial Intelligence (AI) automated clinical decision support tool embedded within the system. AI presents unique opportunities to extend the task-shifted model and increase the efficacy, availability and quality of screening. The next phase of the work will involve the planned introduction of the AI approach in 2 carefully monitored sites to evaluate the contribution that this can make to cervical screening in Uganda. We also plan to assess the potential for frugal innovation returns to the UK's National Health Service through this innovation.

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 approval was obtained from the University of Salford. Written informed consent was obtained from the individuals involved, for the publication of any potentially identifiable images or data included in this article.

Author contributions

LA, JAJ, JA, and AN conceived the project. LA, JA, and AN wrote the manuscript. MS supported data analysis. VK led the training. All authors reviewed drafts and approved the final manuscript.

Acknowledgments

The authors would like to acknowledge support for this project from the University of Salford, Knowledge For Change, the Small Charities Challenge Fund, the Royal Society of Tropical Medicine and Hygiene and the Commonwealth Professional Fellowships Program. Special thanks to Rachel Namiiro, Stella Bonabaana and Dorothy Gashuga for their pivotal role in data collection and service delivery. We are also grateful to Alice Aganyira and Cathy Howell for their active involvement in the project development and training.

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

References

1. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. *Global cancer observatory: Uganda fact sheet*. Lyon, France: International Agency for Research on Cancer (2018b).

2. Nakisige C, Schwartz M, Ndira A. Cervical cancer screening and treatment in Uganda. *Gynecol Oncol Rep*. (2017) 20:37–40. doi: 10.1016/j.gore.2017.01.009

3. Ministry of Health. *Strategic plan for cervical Cancer prevention and control in Uganda 2010–2014*. (2010) Available at: http://www.rho.org/files/PATH_Uganda_cxca_strat_plan_2010-2014.pdf

4. Isabirye A, Mbonye M, Asiimwe J, Kwagala B. Factors associated with HPV vaccination uptake in Uganda: a multi-level analysis. *BMC Womens Health*. (2020) 20:1–11. doi: 10.1186/s12905-020-01014-5

5. Obol J, Lin S, Obwolo M, Harrison R, Richmond R. Knowledge, attitudes, and practice of cervical cancer prevention among health workers in rural health centres of northern Uganda. *BMC Cancer*. (2021) 21:110. doi: 10.1186/s12885-021-07847-z

6. Ackers H, Ackers-Johnson J. *Mobile professional voluntarism and international development: killing me softly?* New York: Palgrave Macmillan (2017).

7. Tsu V, Njama-Meya D, Lim J, Murray M, de Sanjose S. Opportunities and challenges for introducing HPV testing for cervical cancer screening in sub-Saharan Africa. *Prev Med*. (2018) 114:205–8. doi: 10.1016/j.ypmed.2018.07.012

8. Bukirwa A, Mutyoba J, Mukasa B, Karamagi Y, Odiit M, Kawuma E, et al. Motivations and barriers to cervical cancer screening among HIV 76 infected women in HIV care: a qualitative study. *BMC Womens Health*. (2015) 15:82. doi: 10.1186/s12905-015-0243-9

9. Kumakech E, Andersson S, Wabinga H, Berggren V. Integration of HIV and cervical cancer screening perceptions of healthcare providers and policy makers in Uganda. *BMC Public Health*. (2014) 14:810. doi: 10.1186/1471-2458-14-810

10. PATH *Cervical cancer screening and treatment in low-resource settings*. (2013). Available at: https://www.iccp-portal.org/system/files/resources/PATH_HPV-screen-treat_2013.pdf

11. Ndejjo R, Mukama T, Musabyimana A, Musoke D. Uptake of cervical cancer screening and associated factors among women in rural Uganda: a cross sectional study. *PLoS One*. (2016) 11:e0149696. doi: 10.1371/journal.pone.0149696

12. Ackers L, Webster H, Mugahi R, Namiiro R. What price a welcome? Understanding structure agency in the delivery of respectful midwifery care in Uganda. *Int J Health Govern*. (2018) 23:46–59. doi: 10.1108/IJHG-11-2017-0061

13. Hantrais L. *International Comparative Research: Theory, Methods and Practice*. Basingstoke: Palgrave Macmillan (2009).

14. Cook T. The purpose of mess in action research: building rigour though a messy turn. *Educ. Action Res*. (2009) 17:277–291. doi: 10.1080/09650790902914241

15. Ssekitoleko R, Arinda B, Oshabahebwa S, Namuli LK, Mugaga J, Namayega C, et al. The status of medical devices and their utilization in 9 tertiary hospitals and 5 research institutions in Uganda. *Glob Clin Eng J*. (2022) 4:5–15. doi: 10.31354/globalce.v4i3.127

16. Castle P, Murokora D, Perez C, Alvarez M, Quek S, Campbell C. Treatment of cervical intraepithelial lesions. *Int J Gynecol Obstet*. (2017) 13:20–5. doi: 10.1002/ijgo.12191

17. WHO. *WHO guidelines for the use of thermal ablation for cervical pre-cancer lesions*. Geneva: World Health Organization (2019).

18. Black E, Richmond R. Prevention of cervical cancer in sub-Saharan Africa: the advantages and challenges of HPV vaccination. *Vaccine*. (2018) 6:p61. doi: 10.3390/vaccines6030061

19. Peirson L, Fitzpatrick-Lewis D, Ciliska D, Warren R. Screening for cervical cancer: a systematic review and meta-analysis. *Syst Rev*. (2013) 2:1–14.

20. Catarino R, Petignat P, Dongui G, Vassilakos P. Cervical cancer screening in developing countries at a crossroad: emerging technologies and policy choices. *World J Clin Oncol*. (2015) 6:281–90. doi: 10.5306/wjco.v6.i6.281

21. Sauvaget C, Fayette J, Muwonge R, Wesley R, Sankaranarayanan R. Accuracy of visual inspection with acetic acid for cervical cancer screening. *Int J Gynaecol Obstet*. (2011) 113:14–24. doi: 10.1016/j.ijgo.2010.10.012

22. WHO. *Guidelines for screening and treatment of precancerous lesions for cervical cancer prevention*. Geneva: World Health Organization (2013).

23. Beery A.. MobileODT's goal: making cervical cancer screening available to every woman, everywhere – at a profit. Interviewed by Kyle Poplin for the Next Billion, 23 January. (2017). Available at: https://nextbillion.net/mobileodts-goal-making-cervical-cancer-screening-available-to-every-woman-everywhere-at-a-profit/

24. Nayak S, Blumenfeld N, Laksanasopin T, Sia S. Point-of-care diagnostics: recent developments in a connected age. *Anal Chem*. (2017) 89:102–23. doi: 10.1021/acs.analchem.6b04630

25. Ackers H, Ackers-Johnson G, Welsh J, Kibombo D, Opio S. *AMR in global perspective*. London: Palgrave (2020).

26. Rowe SY, Peters DH, Holloway KA, Chalker J, Ross-Degnan D, Rowe AK. A systematic review of the effectiveness of strategies to improve health care provider performance in low- and middle-income countries: Methods and descriptive results. *PLoS ONE*. (2019) 14:e0217617.

27. WHO, PEPFAR, and UNAIDS. *Task shifting: Rational redistribution of tasks among health workforce teams: Global recommendations and guidelines*. (2007). Available at: https://apps.who.int/iris/handle/10665/43821

28. Asgary R, Cole H, Adongo P, Nwameme A, Maya E, Adu-Amankwah A, et al. Acceptability and implementation challenges of smartphone-based training of community health nurses for visual inspection with acetic acid in Ghana: mHealth and cervical cancer screening. *BMJ Open*. (2019) 9:e030528. doi: 10.1136/bmjopen-2019-030528

29. Frund C, Kenfack B, Sormani J, Wisniak A, Fouogue J, Tincho E, et al. Training, supervision, and competence assessment of cameroonian health care providers using HPV self-sampling, triage by visual inspection, and treatment by thermal ablation in a single visit. *Front Public Health*. (2022) 10:875177. doi: 10.3389/fpubh.2022.875177

30. Umuago I, Obiebi I, Eze G, Moeteke N. Improving primary health care workers' knowledge of cervical cancer and visual inspection screening techniques through competency-based training: prospects for expanding coverage in developing countries. *Int J Commun Med Public Health*. (2020) 7:1637. doi: 10.18203/2394-6040.ijcmph20201960

31. Cubie H, Campbell C. Cervical cancer screening – the challenges of complete pathways of care in low-income countries: focus on Malawi. *Womens Health*. (2020) 16:1745506520914804. doi: 10.1177/1745506520914804

32. Ghosh P, Gandhi G, Kochhar P, Zutshi V, Batra S. Visual inspection of cervix with Lugol's iodine for early detection of premalignant & malignant lesions of cervix. *Indian J Med Res*. (2012) 136:265–71.

33. Petignat P, Kenfack B, Wisniak A, Saiji E, Tille J, Tsuala Fouogue J, et al. ABCD criteria to improve visual inspection with acetic acid (VIA) triage in HPV-positive women: a prospective study of diagnostic accuracy. *BMJ Open*. (2022) 12:e052504. doi: 10.1136/bmjopen-2021-052504

34. Ackers HL, Ackers-Johnson J. *Mobile Professional Voluntarism and International Development: Killing me softly?*. New York: Palgrave Macmillan (2017).

35. WHO. *Comprehensive cervical cancer control: a guide to essential practice*. *2nd* ed. Geneva: World Health Organization (2014).

36. Abba R, Abdulkarim I, Sarki A. Prevalence and spatial distribution of hypertension and its correlates in a rural setting of northern Nigeria: a cross-sectional study. *Int J Prevent Public Health Sci*. (2017) 3. doi: 10.17354/ijpphs/2016/77

37. Ndawula A. *Piloting the use of geographic information system (GIS) technology for health interventions: a case study of cervical Cancer prevention in Western Uganda*. Master's thesis. Salford: The University of Salford (2022).

38. Nakalevu S. *The knowledge, attitude, practice and behaviour of women towards cervical Cancer and pap smear screening. A cross sectional study in the Rewa subdivision*' Masters in Public Health Thesis. Fiji: (2009).

39. National Information Technology Authority *National Information Technology Authority Survey 2017/18*. (2017). Available at: https://www.nita.go.ug/statistics-0

40. Bansil P, Lim J, Byamugisha J, Kumakech E, Nakisige C, Jeronimo J. Performance of cervical Cancer screening techniques in HIV-infected women in Uganda. *J Low Genit Tract Dis*. (2015) 19:215–9. doi: 10.1097/LGT.0000000000000090

41. Mbulawa Z, Marais D, Johnson L, Boulle A, Coetzee D, Williamson A. Influence of human immunodeficiency virus and CD4 count on the prevalence of human papillomavirus in heterosexual couples. *J Gen Virol*. (2010) 91:3023–31. doi: 10.1099/vir.0.020669-0

42. Pantanowitz L, Michelow P. Review of human immunodeficiency virus (HIV) and squamous lesions of the uterine cervix. *Diagn Cytopathol*. (2011) 39:65–72. doi: 10.1002/dc.21364

43. Cobucci R, Lima P, de Souza P, Costa V, Cornetta M, Fernandes J, et al. Assessing the impact of HAART on the incidence of defining and non-defining AIDS cancers among patients with HIV/AIDS: a systematic review. *J Infect Public Health*. (2015) 8:1–10. doi: 10.1016/j.jiph.2014.08.003

44. Choudhury S, Choudhury N, Humphrey A, Berthaud V, Ladson G, Tucker V, et al. Higher prevalence of human papillomavirus-related cervical precancerous abnormalities in HIV-infected compared to HIV-uninfected women. *J Natl Med Assoc*. (2016) 108:19–23. doi: 10.1016/j.jnma.2015.12.003

45. Odafe S, Torpey K, Khamofu H, Oladele E, Adedokun O, Chabikuli O, et al. Integrating cervical cancer screening with HIV care in a district hospital in Abuja, Nigeria. *J Nigeria Med Assoc*. (2013) 54:176–84. doi: 10.4103/0300-1652.114590

46. Stein L, Urban M, O'Connell D, Yu X, Beral V, Newton R, et al. The spectrum of human immunodeficiency virus associated cancers in a South African black population: results from a case-control study, 1995–2004. *Int J Cancer*. (2008) 122:2260–5. doi: 10.1002/ijc.23391

47. UNAIDS data. *HIV and AIDS Estimates* (2022). Country factsheets, Uganda. Available at: https://www.unaids.org/en/regionscountries/countries/uganda

48. Ministry of Health, Uganda *Uganda Population-based HIV Impact Assessment (UPHIA) 2016-2017: Final Report. Kampala: Ministry of Health; July, 2019* (2017). Available at: https://phia.icap.columbia.edu/wp-content/uploads/2020/02/UPHIA_Final_Report_Revise_07.11.2019_Final_for-web.pdf

49. Sia D, Onadja Y, Hajizadeh M, Heymann S, Brewer T, Nandi A. What explains gender inequalities in HIV/AIDS prevalence in sub-Saharan Africa? Evidence from the demographic and health surveys. *BMC Public Health*. (2016) 16:1136. doi: 10.1186/s12889-016-3783-5

50. Bandali S. Exchange of sex for resources: HIV risk and gender norms in Cabo Delgado, Mozambique. *Cult Health Sex*. (2011) 13:575–88. doi: 10.1080/13691058.2011.561500

51. Beegle K, Ozler B. *Unpublished manuscript. Young women, rich(er) men, and the spread of HIV*. Washington, DC: World Bank (2007).

52. Mojola S. Fishing in dangerous waters: ecology, gender and economy in HIV risk. *Soc Sci Med*. (2011) 72:149–56. doi: 10.1016/j.socscimed.2010.11.006

53. Njue C, Voeten H, Remes . Porn video shows, local brew, and transactional sex: HIV risk among youth in Kisumu, Kenya. *BMC Public Health*. (2011) 11:635. doi: 10.1186/1471-2458-11-635

54. Pascoe S, Langhaug L, Mavhu W, Hargreaves J, Jaffar S, Hayes R, et al. Poverty, food insufficiency and HIV infection and sexual behaviour among young rural Zimbabwean women. *PLoS One*. (2015) 10:e0115290. doi: 10.1371/journal.pone.0115290

55. Auma J. *Exploring effective approaches of integrating cervical screening services into the normal routine care within HIV clinics: A qualitative study in a Ugandan community health facility*, MSc by research thesis. Salford: University of Salford (2021).

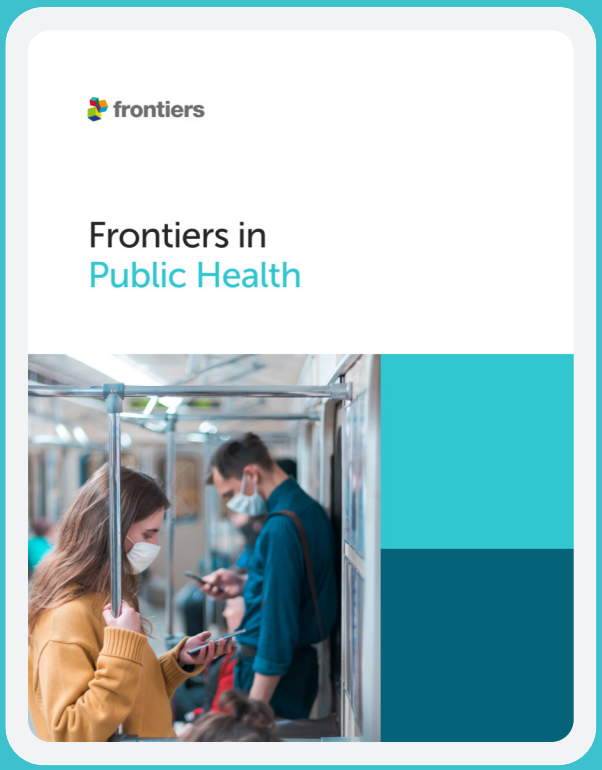
Frontiers in Public Health

Explores and addresses today's fast-moving healthcare challenges

One of the most cited journals in its field, which promotes discussion around inter-sectoral public health challenges spanning health promotion to climate change, transportation, environmental change and even species diversity.

Discover the latest Research Topics

See more →



Frontiers

Avenue du Tribunal-Fédéral 34
1005 Lausanne, Switzerland
frontiersin.org

Contact us

+41 (0)21 510 17 00
frontiersin.org/about/contact