

The background of the entire page is a collage of various medical and healthcare icons. These icons are contained within circles of different colors, including orange, blue, teal, and grey. The icons represent a wide range of medical fields: dental (toothbrush, dental chair), surgery (scalpel, forceps, bandage), general medicine (stethoscope, syringe, pill bottle, microscope), mental health (brain, heart, puzzle), and public health (globe, handshake). The top half of the page has a solid dark blue background, while the bottom half features a white background with the colorful icon collage.

# **SOCIAL VALUE FOR HEALTH: UNDERSTANDING, FRAMING AND CAPTURING THE WIDER PSYCHO-SOCIAL OUTCOMES OF HEALTH INTERVENTIONS AND PROGRAMMES**

EDITED BY: Paul R. Courtney, Colin Baker and Marios Goudas

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# SOCIAL VALUE FOR HEALTH: UNDERSTANDING, FRAMING AND CAPTURING THE WIDER PSYCHO-SOCIAL OUTCOMES OF HEALTH INTERVENTIONS AND PROGRAMMES

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# A Comparative Study on the Health Status and Behavioral Lifestyle of Centenarians and Non-centenarians in Zhejiang Province, China—A Cross-Sectional Study

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**Background:** The growth rate of centenarians was unusually rapid in recent decades, ushering in an era of longevity. This study aims to explore the difference between centenarians and non-centenarians using quantitative research, and to scientifically guide residents to develop the correct lifestyle and health care ways.

**Methods:** From October 2013 to August 2017. A cross-sectional survey was conducted on 271 centenarians and 570 non-centenarians by using a questionnaire to assess longevity and health issues which was developed for the needs of the study, who came from 29 counties and districts in 11 cities of Zhejiang province, China. Two hundred and fifty-five valid questionnaires were returned, with an effective response rate of 94.1%. Meanwhile, data of 526 non-centenarians from Zhejiang province was collected as a control group, with an effective response rate of 92.3%.

**Results:** The prevalence rates of tumor, stomach and duodenal ulcer, diabetes, bronchial asthma, and chronic obstructive pulmonary disease, tuberculosis among centenarians were all lower than those among non-centenarians. The oral health of centenarians is better than that of non-centenarians. The consumption of coarse cereals, pasta, other staple foods and fruits among centenarians was higher than that of non-centenarians. The percentage of centenarians who smoke or engage in recreational activities every day was lower than that of non-centenarians.

**Conclusions:** We should give full play to the role of preventive medicine and health management to safeguard the health of residents. Pay attention to oral health, and develop the good habit of loving teeth. The diet should be rich and varied, and increase the intake of grains and fruits. Give up smoking, limit alcohol, spirit-preserving with calming, follow the law of scientific regimen.

**Keywords:** centenarians, longevity, health preservation, traditional Chinese medicine, disease prevention

## INTRODUCTION

Health and longevity have been human dreams since ancient times. With the continuous growth of the economy and the stability and development of society, human life expectancy is increasing. By the end of 2015, China's life expectancy had reached 76.2 years, with 73.2 years for men and 79.9 years for women. Life expectancy in Zhejiang province is 80.5 years, with 77.7 years for men and 83.8 years for women. Given that life expectancy has risen, the number of centenarians is further increasing (1).

The population division of the United Nations department of economic and social affairs released global population by age group in 2015, and it said there are 451,000 centenarians worldwide. There were 355,000 women and 96,000 men, and the number of women was significantly higher than that of men. It will rise to 1.245 million by 2030 and 3.67 million by 2050. Japan has 61,568 centenarians, and it is forecast to reach 272,000 by 2050. Britain had 13,350 centenarians in 2012. Australia is expected to have 12,001 centenarians by 2020 and 50,000 by 2050. The number of centenarians in China has increased year by year (2).

In 1990, 2000 and 2010, there were 6,681, 17,877, and 35,934 centenarians in China, respectively. The average annual growth rate exceeded 10%. And, from 1953 to 2001, it increased more than 4-fold in half a century. The growth rate was unusually rapid, ushering in an era of longevity (3). The number of centenarians in China was 58,789 in 2014, and Chinese centenarians were mostly women, accounting for three-quarters of the total, of which 70% lived in rural areas. By the end of 2016, there were 2,307 centenarians in Zhejiang province, which is much higher than the life expectancy in Zhejiang province. The United Nations has designated 7.5 centenarians per 100,000 people as the "land of longevity," showing the scarcity of this special population.

A paper by Braveman et al. (4) named *The Social Determinants of Health: Coming of Age*, and described the rapidly growing studies on the social determinants of health in the United States and elsewhere, and highlighted health is affected not only by living and working conditions, but also by more upstream determinants, such as the economic and social resources and opportunities, which influence an individual's access to health-promoting living and working conditions (4). She also explained in detail how neighborhood conditions and working conditions and education and income and race and stress affect health (4). Maness and Branscum illustrated the concept of social determinants of health is widely used in health promotion and public health efforts. The World Health Organization (WHO) defined social determinants of health as "the conditions in which people are born, grow, live, work and age circumstances that are affected by the distribution of power, money and resources at local, national and global levels." Social determinants of health problems are the main causes of health inequities, leading to inequitable health disparities within and between countries that could have been avoided. WHO created the Commission on Social Determinants of Health in 2005, which pushed forward the development of the theory, and further

clarified the relationship between societal factors and health outcomes (5).

Centenarians are a special group that gains much attention and admiration of family members, relatives, friends, neighbors, and service providers (6). There are biological, psychological and social reasons for the longevity of centenarians, including genetic reasons, external environment, and behavioral habits. Most of the existing research has been done from a genetic or biological perspective (7). Some studies have been carried out from the perspective of social medicine. However, most of them are qualitative research or quantitative research with a small sample size without a control group. We aimed to explore the difference between centenarians and non-centenarians using quantitative research with large sample size and a control group, and to scientifically guide residents to develop correct lifestyle and health care methods from the psychological and social perspective (8).

## MATERIALS AND METHODS

### Study Population

From October 2013 to August 2017, the methods of stratified sampling and representative sampling were adopted by the research team. First, according to administrative divisions, Zhejiang Province is divided into 11 cities. They are Hangzhou, Wenzhou, Ningbo, Jiaxing, Taizhou, Jinhua, Shaoxing, Zhoushan, Quzhou, Huzhou, and Lishui. Second, according to the geographical location, one of the districts and counties in the east (middle), and west regions were selected in each city. In addition, we considered the representative of characteristics other than geographic location. For example, economy, occupation, education, lifestyle, climate, etc. If some districts and counties are special in these characteristics, then choose them. We finally chose a total of 29 districts and counties. A field survey was conducted on 271 centenarians by using a questionnaire to assess longevity and health issues which was developed for the needs of the study. The centenarians or families who know them best or caregivers were investigated in their homes by the investigator who had received prior standardized training. The exclusion criteria were the centenarians with no clear consciousness or with a long illness in bed or refuse to be investigated. The personal basic information of each subject is recorded in detail, which including age, gender, marriage, the spectrum of disease, diet habits, smoking, drinking, hobbies, characteristics, loneliness and medical behaviors, etc. Two hundred and fifty-five questionnaires were collected, with a response rate of 94.1%. Meanwhile, data of 526 non-centenarians (a total of 570 non-centenarians was investigated, with a response rate of 92.3%) from Zhejiang province was collected as a control group using the same sampling methods, inclusion and exclusion criteria. All of the respondents were informed of the study and signed a letter of consent.

### Measurements

#### Social Demographic Variables

Social demographic variables were collected in the following format: gender (male, female), marital status (having spouses;

having no spouse, it includes single, divorced, and widow), and the age recorded was consistent with their ID card.

### Diseases

The centenarian and/or families and/or caregiver were directly asked if they had ever been diagnosed by a doctor with any of the following: hypertension, stroke, stroke sequelae, tumor, coronary heart disease, stomach and duodenal ulcer, diabetes, bronchial asthma, chronic obstructive pulmonary disease, and tuberculosis. Results were recorded as either presence or absence of the disease or not sure. Dental and visual status variables were collected in the following format: dental status [almost perfect teeth (32 teeth), retained more than 50% of their teeth (16 or more teeth), <50% of their teeth (<16 teeth, and >0 teeth), all teeth removed (0 teeth)], the use of denture (use, not use), visual status (good vision, moderate vision, poor vision, extremely poor vision).

### Diet Habits

Diet habits variables were collected in the following format: diet preferences (vegetarians, meat and vegetable eaters, meat eaters). The respondents were asked whether they ate the following foods: meat, fish and other aquatic products, eggs, tea, bean products, rice, cereals, pasta, other staple foods, fruits. Results were recorded as either eat or not eat or sometimes eat.

### Smoking, Drinking, and Hobbies

Smoking, drinking, and hobbies variables were collected in the following format: smoking (yes, no), drinking (yes, no), engage in recreational activities (every day, sometimes, basically not), watch TV or listen to radio, read books and newspapers (often, not frequently, not).

### Character, Loneliness, and Medical Behaviors

Character, loneliness, and medical behaviors variables were collected in the following format: character type (introverted, extroverted, others), loneliness (always, often, occasionally, never, not aware of), satisfaction of their current lives (Satisfied, relatively satisfied, dissatisfied, very dissatisfied, not aware of), timely medical treatment when they were ill (can, can not).

### Data Analysis

Epidata3.1 software was used for data entry and spss21.0 software for data statistics and analysis. The mean, standard deviation, median, quartile spacing, minimum value, and maximum value for continuous variables were described, as well as the frequency and percentages for nominal variables. The Chi-square test was used to analyze the prevalence and lifestyle differences between centenarians and non-centenarians. The continuous variables did not show a normal trend through the Shapiro-Wilk test, however, in addition to using the median and quartile for describing the age in the paper, the mean and standard deviation was increased to facilitate their interpretation and comparison with other populations.

### Ethical Approval

The Medical Ethics Committee of First Affiliated Hospital of Zhejiang Chinese Medical University granted ethical approval. All participants were informed of the intent and requirements of

the study and asked to sign the informed consent form without any perceived pressure or inducement. All participants were guaranteed their right to refuse to engage in or to withdraw from this study at any time.

## RESULTS

### Basic Social Demographic Characteristics

The average age of 255 centenarians was 102, the standard deviation was 2, the median age was 102, quartile spacing was 101–103, the minimum age was 100, the maximum age was 115. The average age of 526 non-centenarians was 89, the standard deviation was 6, the median age was 89, quartile spacing was 84–94, minimum age 78, maximum age 99. Among the centenarians surveyed, 83 were males, accounting for 32.5%, and 172 were females, accounting for 67.5%. Among non-centenarians, 259 were males, accounting for 49.2%, and 267 were females, accounting for 50.8%. Using the chi-square test, the chi-square value is 19.437 and the *P*-value <0.001. It is showed that the proportion of women in centenarians is higher than that of non-centenarians, and the difference was statistically significant. Consistent with WHO statistics on the global population, women live longer than men. Among the centenarians, 24 people were living with spouses, accounting for 9.6%. Two hundred and twenty-seven people were not living with a spouse, accounting for 90.4%. missing 4 people data. Among non-centenarians, 130 people were living with spouses, accounting for 24.7%. Three hundred and ninety-six people were not living with a spouse, accounting for 75.3%. Using the chi-square test, the chi-square value is 24.551 and the *P*-value <0.001. Among the centenarians, 250 people had been married, accounting for 99.6%. One person had not been married, accounting for 0.4%. Among non-centenarians, 520 people had been married, accounting for 98.9%. Six people had not been married, accounting for 1.1%. The percentage of centenarians who not living with a spouse was higher than that of non-centenarians, and the difference is statistically significant. It can be seen that the percentage of couples who can spend their centenarians together is relatively low. As people age, most people die near the age of life expectancy.

### Spectrum of Disease

The prevalence rates of tumor, stomach and duodenal ulcer, diabetes, bronchial asthma, and chronic obstructive pulmonary disease, tuberculosis among centenarians were 0.8, 1.2, 1.6, 4.7, 0.0%, respectively, and those among non-centenarians were 4.9, 6.8, 6.7, 13.9, 3.8%, respectively. The chi-square test showed that the former was lower than the latter, and the difference was statistically significant. It is showed that the prevalence rates of tumor, stomach and duodenal ulcer, diabetes, bronchial asthma, and chronic obstructive pulmonary disease, tuberculosis among centenarians were all lower than those among non-centenarians. The prevalence rate of hypertension among centenarians was significantly higher and that of non-centenarians (Table 1).

Among centenarians, 9 people had almost perfect teeth (32 teeth), accounting for 4.5%. Eighteen people retained more than 50% of their teeth (16 or more teeth), accounting for 9.0%.

**TABLE 1** | A comparative analysis of the prevalence of centenarians and non-centenarians.

		Centenarians	Non-centenarians	Chi-square	P
Hypertension	No	168 (65.9%)	384 (73.0%)	4.203	0.044
	Yes or not sure	87 (34.1%)	142 (27.0%)		
Stroke, Stroke sequelae	No	242 (94.9%)	508 (96.6%)	1.266	0.328
	Yes or not sure	13 (5.1%)	18 (3.4%)		
Tumor	No	253 (99.2%)	500 (95.1%)	8.593	0.002
	Yes or not sure	2 (0.8%)	26 (4.9%)		
Coronary heart disease	No	231 (90.6%)	464 (88.2%)	0.989	0.393
	Yes or not sure	24 (9.4%)	62 (11.8%)		
Stomach and duodenal ulcer	No	252 (98.8%)	490 (93.2%)	11.628	<0.001
	Yes or not sure	3 (1.2%)	36 (6.8%)		
Diabetes	No	251 (98.4%)	491 (93.3%)	9.362	0.001
	Yes or not sure	4 (1.6%)	35 (6.7%)		
Bronchial asthma and chronic	No	243 (95.3%)	453 (86.1%)	14.898	<0.001
Obstructive pulmonary disease	Yes or not sure	12 (4.7%)	73 (13.9%)		
Tuberculosis	No	255 (100.0%)	506 (96.2%)	9.951	<0.001
	Yes or not sure	0 (0.0%)	20 (3.8%)		

Because the number of people choosing not to know was small, they were classified as the number of people who were ill.

There were 66 people with <50% of their teeth (<16 teeth, and >0 teeth), accounting for 33.2%, and 106 people with all teeth removed (0 teeth), accounting for 53.3%, and 56 people have missing data. Those among non-centenarians were 1 (0.2%), 39 (7.4%) 278 (52.9%), 208 (39.5%), respectively. Using the chi-square test, the chi-square value was 38.206, and the *P*-value <0.001.

The number of centenarians who used denture was 53, accounting for 20.8%, and 202 people who did not use it, accounting for 79.2%, and those among non-centenarians were 160 (30.7%), 361 (69.3%), respectively. Using the chi-square test, the chi-square value was 8.470, and the *P*-value was 0.004. The percentage of centenarians using denture was lower than that of non-centenarians, and the difference was statistically significant. It can be seen that the oral health of centenarians is better than that of non-centenarians.

Among centenarians, 128 had good vision, accounting for 51.0%, 62 had a moderate vision, accounting for 24.7%, 26 had poor vision, accounting for 10.4%, and 35 had extremely poor vision, accounting for 13.9%, and 4 people have missing data. Those among non-centenarians were 395 (75.5%), 51 (9.8%), 69 (13.2%), 8 (1.5%), respectively, and 3 people have missing data. Using the chi-square test, the chi-square value was 89.228, and the *P*-value <0.001. The visual condition of centenarians was worse than that of non-centenarians, and the difference was statistically significant.

## Diet Habits

The diet preferences for meat and vegetable combination of centenarians was higher than that of non-centenarians, and the diet preferences for vegetarian of centenarians was lower than that of non-centenarians, the difference was statistically significant. The consumption of meat, fish and other aquatic products, eggs, tea, bean products among centenarians was lower

than that of non-centenarians, and the difference was statistically significant. The consumption of coarse cereals, pasta, other staple foods and fruits among centenarians was higher than that of non-centenarians, and the difference was statistically significant (Table 2).

## Smoking, Drinking, and Hobbies

The percentage of centenarians who smoke was lower than that of non-centenarians. Non-smoking has been shown to promote healthy longevity. The percentage of centenarians who engage in recreational activities every day was lower than that of non-centenarians. The percentage of centenarians who often watch TV or listen to the radio was lower than that of non-centenarians. It is showed that as older people age, they become less interested in outside entertainment (Table 3).

## Character, Loneliness, and Medical Behaviors

The percentage of centenarians who were introverted was higher than that of non-centenarians. The percentage of centenarians who were never lonely was higher than that of non-centenarians. The percentage of centenarians who were able to receive timely medical treatment when they were ill was lower than that of non-centenarians (Table 4).

## DISCUSSION

We examined the differences of the health status and behavioral lifestyle between centenarians and non-centenarians in Zhejiang province, China, and aims to guide residents to develop the correct lifestyle and health care ways. The chi-square test showed that there may be a correlation between the longevity of centenarians and their better health. The oral health of centenarians is better than that of non-centenarians.



**TABLE 2 |** A comparative analysis of diet types between centenarians and non-centenarians.

		Centenarians	Non-centenarians	Chi-square	P
Meat	Eat	205 (82.0%)	513 (100.0%)	98.127	<0.001
	Not eat	45 (18.0%)	0 (0.0%)		
Fish and other aquatic products	Eat	100 (40.0%)	516 (100.0%)	384.99	<0.001
	Not eat	150 (60.0%)	0 (0.0%)		
Eggs	Eat	77 (30.8%)	514 (100.0%)	459.806	<0.001
	Not eat	173 (69.2%)	0 (0.0%)		
Tea	Eat	35 (14.1%)	285 (56.5%)	123.137	<0.001
	Not eat	214 (85.9%)	219 (43.5%)		
Bean products	Eat	10 (4.0%)	439 (84.3%)	446.285	<0.001
	Not eat	239 (96.0%)	82 (15.7%)		
Rice	Eat	242 (97.6%)	519 (98.7%)	1.209	0.368
	Not eat	6 (2.4%)	7 (1.3%)		
Coarse cereals	Eat	21 (8.5%)	1 (0.2%)	41.817	<0.001
	Not eat	227 (91.5%)	525 (99.8%)		
Pasta	Eat	54 (21.8%)	6 (1.1%)	100.340	<0.001
	Not eat	194 (78.2%)	520 (98.9%)		
Other staple foods	Eat	16 (6.5%)	0 (0.0%)	34.652	<0.001
	Not eat	232 (93.5%)	526 (100.0%)		
Fruits	Eat	65 (26.4%)	57 (10.9%)	41.054	<0.001
	Sometimes eat	154 (62.6%)	339 (64.6%)		
	Not eat	27 (11.0%)	129 (24.6%)		

The missing data was not included.

**TABLE 3 |** A comparative analysis of smoking, drinking, and hobbies between centenarians and non-centenarians.

		Centenarians	Non-centenarians	Chi-square	P
Smoking	Yes	34 (13.9%)	111 (21.1%)	5.714	0.017
	No	211 (86.1%)	415 (78.9%)		
Drinking	Yes	58 (23.9%)	144 (27.4%)	1.056	0.333
	No	185 (76.1%)	382 (72.6%)		
Engage in recreational activities	Everyday	12 (5.2%)	82 (15.6%)	15.753	0.000
	Sometimes	95 (41.5%)	196 (37.3%)		
	Basically not	122 (53.3%)	247 (47.0%)		
Watch TV or listen to radio	Often	31 (12.6%)	110 (20.9%)	8.387	0.015
	Not frequently	99 (40.2%)	178 (33.8%)		
	Not	116 (47.2%)	238 (45.2%)		
Read books and newspapers	Often	18 (7.4%)	42 (8.0%)	5.375	0.068
	Not frequently	30 (12.3%)	38 (7.2%)		
	Not	195 (80.2%)	445 (84.8%)		

The missing data was not included.

The visual condition of centenarians was worse than that of non-centenarians. The consumption of coarse cereals, pasta, other staple foods and fruits among centenarians was higher than that of non-centenarians. As older people age, they become less interested in outside entertainment. The percentage of centenarians who were never lonely was higher than that of non-centenarians. The percentage of centenarians who were able to receive timely medical treatment when they were ill was lower than that of non-centenarians.

This study found that the proportion of women (67.5%) in centenarians was much higher than that of men (32.5%), while in non-centenarians, the proportion of men and women was not much different. This is consistent with Newman and Brach's findings (9). Possible reasons are as follows: The mortality rates for many diseases are higher in men than in women. For example, heart disease, stroke, cancer, motor vehicle accident, chronic lung disease (9). Men's overweight rate, smoking rate, and other unhealthy lifestyles are higher than women (9).

**TABLE 4 |** A comparative analysis of character, loneliness, and medical behaviors of centenarians and non-centenarians.

		Centenarians	Non-centenarians	Chi-square	P
Character type	Introverted	60 (24.5%)	35 (6.7%)	49.475	<0.001
	Extroverted	140 (57.1%)	381 (72.4%)		
	Others	45 (18.4%)	110 (20.9%)		
Loneliness	Always	2 (0.8%)	7 (1.3%)	190.772	<0.001
	Often	18 (7.3%)	60 (11.4%)		
	Occasionally	87 (35.4%)	395 (75.1%)		
	Never	109 (44.3%)	29 (5.5%)		
	Not aware of	30 (12.2%)	35 (6.7%)		
Satisfaction with your current life	Satisfied	150 (64.7%)	360 (68.4%)	3.147	0.533
	Relatively satisfied	65 (28.0%)	120 (22.8%)		
	Dissatisfied	7 (3.0%)	22 (4.2%)		
	Very dissatisfied	1 (0.4%)	1 (0.2%)		
	Not aware of	9 (3.9%)	23 (4.4%)		
Timely medical treatment	Can	156 (62.7%)	445 (94.1%)	115.510	<0.001
	Can not	93 (37.3%)	28 (5.9%)		

The missing data was not included.

Men have more accidents and less use preventive health care services than women (9). This study found that the prevalence rates of tumor, stomach and duodenal ulcer, diabetes, bronchial asthma, chronic obstructive pulmonary disease and tuberculosis in centenarians were lower than that of non-centenarians, and the difference was statistically significant. The results of this study are consistent with those of Pedro and Ailshire. Pedro et al. pointed out that centenarians have a high self-perception of health, low frequency of diabetes, dyslipidemia, cardiovascular disease (1). Ailshire, Beltran-Sanchez, and Crimmins found that centenarians are generally healthier than non-surviving members of their cohort, and several centenarians with no self-reported diseases or functional impairments. About 23% of centenarians with no major chronic disease and ~18% had no disability. 55% of centenarians without cognitive impairment (10). The previous study have identified the several important aspects of socioeconomic indicators for longevity: higher overall economic development level, public expenditure on health, and so on (11, 12). da Silva et al. confirmed that the low-frequency consumption of red meat, cholesterol, and heme iron may be one of the keys to longevity for centenarians (13). Stathakos et al. implied that it is possible to achieve longevity while the elder still being relatively healthy, autonomous and socially active (14). Deng et al. found that socioeconomic factors such as local infrastructure, health care facilities, and economic status might be the most important contributors to the longevity of people aged 60–90 years in Guangxi, China (15).

This study suggests that there may be a correlation between the longevity of centenarians and their better health. Therefore, it is very necessary to maintain the good health of residents. The family doctor contract service currently being implemented in China, and use the “Internet plus” method to regularly collect data on residents’ health conditions, carry out a health risk assessment and health intervention. We should give full play

to the role of preventive medicine and health management to safeguard the health of residents.

This study found that the tooth retention of centenarians was better than that of non-centenarians, and the proportion of centenarians using dentures was lower than that of non-centenarians, with statistically significant differences. It can be seen that the oral health of centenarians is better than that of non-centenarians, and oral health is related to spleen and stomach and the absorption of nutrients. Tan, Peres, and Peres found that the retention of teeth is associated with better oral health-related quality of life (16). It was observed by Shiue that adults reported ever hypertension, depression, diabetes, poor mental health status, and poor self-rated health were dissatisfied with their current teeth appearance (17). Oral health is an important part of human health. WHO regards oral health as one of the ten signs of human health. Therefore, we should pay attention to oral health, and develop the good habit of loving teeth.

Those who are centenarians have a meat and vegetable collocation diet habit are higher than those who are non-centenarians. The consumption of meat, fish and other aquatic products, eggs, and soy products among centenarians is lower than that of non-centenarians. Centenarians eat more coarse cereals, pasta, other staples and fruits than non-centenarians. The above differences were statistically significant. Accordingly, the edible of flesh and fish should not be overmuch, meat and vegetable collocation are advisable. The study by Robert and Fulop found that nutritional factors play an important role in longevity, in addition, unhealthy nutrition combined with a marked sedentary life is a major cause of obesity, reaching up to 30% of our population. Obesity is a serious risk factor for many diseases (18). The diet should be rich and varied, and increase the intake of grains and fruits.

The percentage of centenarians who smoke is lower than that of non-centenarians, and the percentage who watch TV and radio regularly every day is lower than that of non-centenarians. It is



proved again that non-smoking promotes health and longevity. The study by Robert and Fulop also found that smoking and alcohol are the most important risk factors for longevity (18). Willig et al. also proposed the correct use of medicines and having physical, mental and spiritual health are considered by the oldest-old as essential for health preservation (19). This study found the percentage of centenarians who were introverted was higher than that of non-centenarians. This view is consistent with Law et al. who pointed out that Australian centenarians were currently low in openness and extraversion and high in neuroticism (20). However, Martin et al. had a different view, and showed that Georgia centenarians had several unique traits: low levels of neuroticism, high competence, and high Extraversion. The reason for the difference may be that the subjects come from different countries (21). Davey indicated that centenarians had the following characteristics; impulsiveness, higher self-consciousness, and deliberation, but lower ideas, compliance, and self-discipline (22).

The study also shows that as people get older, their interest in outside entertainment diminishes. The percentage of centenarians who are introverted and never feel lonely is higher than that of non-centenarians. People should respond to the lifestyle of smoking cessation and alcohol restriction and mentality balance advocated by WHO. Meanwhile, follow the regimen thoughts of traditional Chinese medicine (TCM). One of four classics of Chinese medicine—Huang Di Nei Jing (Huangdi's Internal Classic) has a classic discussion on regimen: People of the ancient time who knew how to cultivate health, regulate yin and yang, conform to the ways of health preservation, control feed and drinks, live regularity and not to work absurdly, is thus in the state of somatic and spiritual harmony, and could fulfill their natural span of life of 100 years. Experts of health preservation in successive dynasties pay lots of attention to the close relationship between quiescence based vitality preserving and health. They lay stress on the thought of “spirit-preserving with the calming pattern.” In the regimen in TCM, “keeping the mind in the interior” is the base of disease prevention and treatment as well as the core of mind cultivation. It mainly refers to self-control and regulation of man's consciousness, thoughts, and mental state to keep the harmony between the human body and environment. We suggested that give up smoking, limit alcohol, spirit-preserving with calming, follow the law of scientific regimen.

This study had some limitations. Firstly, only Zhejiang province was selected as a sample province to survey this research program, which does not represent the whole longevity situation of China. As this study was restricted to Zhejiang province only, it may not apply to international populations either, given the specificities of the Chinese human species. Secondly, this study only focused on longevity, but the quality of life of the

centenarians was not investigated. Thirdly, there are other factors associated with longevity that were not investigated, such as educational level, economic status, living situation, and these factors are worth further study. Fourth, this study was a cross-sectional one, and such type of studies are only indicative of differences between segments of the population and cannot provide definite answers regarding the causes of longevity.

## CONCLUSIONS

We should give full play to the role of preventive medicine and health management to safeguard the health of residents. Pay attention to oral health, and develop the good habit of loving teeth. The diet should be rich and varied, and increase the intake of grains and fruits. Give up smoking, limit alcohol, spirit-preserving with calming; follow the law of scientific regimen. This study has important guiding significance for advocating people to form healthy lifestyles. Using the international universal scale to measure the quality of life of centenarians is worthy of further research in the future.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the First Affiliated Hospital of Zhejiang Chinese Medical University. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## AUTHOR CONTRIBUTIONS

L-WX, QH, and X-MW designed the present study. S-HS, H-XW, and Z-XL assisted in the literature reviews and investigation. The data analysis and original draft were conducted by CR and H-TL. All authors contributed to and have approved the final manuscript.

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

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# Health Impact and Social Value of Interventions, Services, and Policies: A Methodological Discussion of Health Impact Assessment and Social Return on Investment Methodologies

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**Introduction:** Assessing the positive and negative impact of policies, services and interventions on health and well-being is of great importance to public health. Health Impact Assessment (HIA) and Social Return on Investment (SROI) are established methodologies which assess potential effects on health and well-being, including social, economic and environmental factors, indicating synergies, and cross-over in their approach. Within this paper, we explore how HIA and SROI could complement each other to capture and account for the impact and social value of an assessed intervention or policy.

**Methods:** A scoping review of academic and gray literature was undertaken to identify case studies published between January 1996 and April 2019 where HIA and SROI methodologies have been used to complement each other previously. Semi-structured interviews were carried out with nine international experts from a range of regulatory and legislative contexts to gain a deeper understanding of past experiences and expertise of both HIA and SROI. A thematic analysis was undertaken on the data collected.

**Results:** The scoping review identified two published reports on scenarios where HIA and SROI have both been used to assess the same intervention. Results from the interviews suggest that both methods have strengths as standalone methodologies. HIAs were noted to be well-structured in their approach, assessing health and well-being in its broadest context. SROI was noted to add value by monetizing social value, as well as capturing the social and environmental impact. Similarities of the two methods was suggested as their strong emphasis on stakeholder engagement and common shared principles. When questioned how the two methods could complement each other in practice, our results indicate the benefits of using HIA as an initial exploration of impact, potentially using SROI subsequently to monetize social value.

**Conclusion:** HIA and SROI have many synergies in their approaches. This research suggests potential benefits when used in tandem, or combining the methods to assess impact and account for social value. Further research is needed to understand the implications of this in practice, and to understand how the results of the two methods could be used by decision-makers.

**Keywords:** health impact, social value, HIA, SROI, health economics, wider determinants

## INTRODUCTION

The world is continuously changing, now faster than ever, creating a global transformation of unprecedented scale, scope, and complexity. Social, environmental and economic imbalance threaten all, especially the most vulnerable. Globalization processes have direct and indirect impacts on human health and well-being, and on our planet, pushing the sustainability of systems to their limits. Innovative, integrated and sustainable solutions are urgently needed to ensure peace and prosperity, and the well-being of people and our planet. This requires commitment and comprehensive action, involving stakeholders from all governance levels, across the public and private sectors, the academia and civil society.

Developing and implementing new, as well as reforming old, policies, planning initiatives, services, and interventions can have both positive and negative impacts on the health and well-being of individuals, communities, and populations, as well as on their surrounding physical and socio-economic environment (1, 2). Assessing the possible multiple impacts and measuring the related value using well-established robust methodologies can enable decision-makers to take evidence-informed action for the benefit of those directly or indirectly affected (3), or mitigate for any potential unintended negative impacts.

Health Impact Assessment (HIA) and Social Return on Investment (SROI) are two established methods, which are used to assess the range of health and wider outcomes and impacts of different public policies, services, and interventions. Both methods apply an inter-sectoral cross-cutting approach, which allows impact assessment to be performed by involving society and key stakeholders (those directly affected by or having an interest in the assessed policy, service or intervention) in a participatory way. In addition, both HIA and SROI aim to capture the holistic (social, economic, and environmental) value and maximize benefits to people and society (Table 1). Applying these methodologies provides a direct route and useful evidence for including and considering health and equity in health and non-health sector decision-making, prioritization and investment processes, thus contributing to the “Health in all Policies” agenda and reducing health inequity (4).

HIA is a well-known methodology, commonly defined as “a combination of procedures, methods, and tools by which a policy, intervention or service may be judged as to its potential effects on the health of a population, and the distribution of those effects within a population” (5). Developed as a flexible and scalable tool, HIA allows health and well-being to be considered in all policy arenas as a method of implementing

“Health in all Policies” approaches, and has the power to influence the decision-making process by promoting cross-sector collaboration (6). As practiced in Wales and applied by the Wales Health Impact Assessment Support Unit (WHIASU), HIA is a systematic, equity focused and participatory process which views health in its holistic definition (7). It also considers all possible impacts through a wider determinant lens, including health behaviors, social and community networks, living and working conditions, and general socioeconomic, cultural, and environmental conditions which can influence individual choice and population behavior (8). Broad approach HIA (which is based on mixed methods of evidence collection including health intelligence and other data and research, qualitative and quantitative evidence) focuses on the implications for the community, population and health equity (by focusing on those affected and how any impacts may be distributed), and directly involves stakeholders who have an interest in, or are affected by the public policy, plan, intervention or service under assessment. Thus, HIA has a method and evidence driven, inclusive participatory nature that incorporates high levels of stakeholder engagement throughout the process and accounts for multiple wider impacts, as well as health, well-being and (in)equality implications. This includes a stakeholder analysis to identify specific and appropriate levels of engagement taking into account the nature of assessment and context of the proposal to be assessed. Outcomes identified by individuals traditionally through methods of participatory workshops, interviews, and focus groups are presented collectively in a written format to relevant stakeholders (6, 9) to inform and aid decision making. As applied in Wales, HIA follows a “salutogenic approach” that takes into account the wider social and health and well-being and what contributes to well-being and being well, rather than solely focusing on the impact of disease on health and what makes individuals and populations sick. In addition, HIA in Wales does not only focus on the negative impacts of some purely tight approach and risk-focused HIAs or health integrated Environmental Impact Assessments (EIA), but also takes into account the potential positive impacts and any opportunities for health improvement.

Although HIA is a recognized robust methodology, existing evidence suggests that impact assessments could potentially benefit from methods to quantify the effect of social and economic outcomes (10, 11). Particularly with the introduction of the Public Services (Social Value) Act 2012 in the United Kingdom (12), a wide range of sectors are considering how to measure social value through economic analysis in order to aid and inform decisions. For example, capturing,



and understanding social value (such as the value created to individuals, families, communities and the environment) in relation to the built environment and infrastructure development (13).

New economic methodologies have been developed to better understand, evaluate and value the wider societal impact of different interventions and policies, thus capturing and measuring their “social value” (14). SROI is defined as an economic method, which accounts for the broader concept of social value by incorporating social, environmental and economic costs and benefits in the valuation. Unlike traditional economics methodologies, such as cost-effectiveness and cost-benefit analyses, SROI is looking also at non-financial impacts that add real value to people’s lives, to communities and society, and to the wider economic and environmental setting. Through a stakeholder engagement, the SROI defines outcomes, and allows a monetary value to be placed on the non-financial returns on investment by applying proxy values (15). This approach provides a holistic framework, reflecting the wider determinants of health (and sometimes equity) by valuing outcomes, which are not measured by the traditional financial value for money approaches (Table 1). This is particularly relevant for public health policies and interventions, which usually have multiple “soft” and difficult to quantify impacts, such as improving or promoting health, well-being and equity of population groups

**TABLE 1 |** Key steps of the Health Impact Assessment (HIA) and Social Return on Investment (SROI) methodologies.

#### Health impact assessment

Step 1 Screening: Determining whether a HIA is warranted and whether it would be valuable in the decision-making process. This includes understanding what is already known and identifying gaps.  
 Step 2 Scoping: Using the results of the screening stage to decide on the scope of the assessment, including data sources to use, affected groups/populations to cover, identification of stakeholders and methods of engagement.  
 Step 3 Appraisal of evidence: Undertaking the defined methodology and triangulating both qualitative and quantitative evidence.  
 Step 4 Reporting and recommendations: Produce a written report and disseminate what was learned to the community in question.  
 Step 5 Review and reflection including monitoring and evaluation: Monitor implemented recommendations to see if they are working as expected and evaluate the process itself.

#### Social return on investment

Step 1 Establishing scope and identifying stakeholders: Setting clear boundaries about what the SROI will cover, who will be involved in the process and how.  
 Step 2 Mapping outcomes: Engaging qualitatively with stakeholders to develop an impact map or theory of change to show the relationship between inputs, outputs and outcomes.  
 Step 3 Evidencing outcomes and giving them a quantifiable value: Finding data to show whether outcomes have occurred and placing a value on them.  
 Step 4 Establishing impact: Undertake process to account for change which would have happened anyway or are a result of other factors.  
 Step 5 Calculating the SROI: Adding up all of the benefits, subtracting any negatives and comparing the result to the investment.  
 Step 6 Reporting, using and embedding: Sharing findings with stakeholders.

and communities, as well as bringing additional benefits to their living, social, or working environment (16, 17).

The methodological processes of HIA and SROI indicate synergies and cross-over in their approaches. Combining the two methodologies, running them alongside one another, or using HIA as a platform to build on, could have an added value to both and provide useful information for decision-makers. The Institute of Environmental Management and Assessment (IEMA) notes how the “social value” approach used within SROI can be applied to a range of health determinants within health and well-being checklists used within HIAs (18). Assigning a monetary value to these impacts can give greater clarity to the concluding report and possible application and impact of a HIA. And vice-versa, HIA can provide a well-structured robust platform for the SROI stakeholder engagement, participation, and gathering evidence, also ensuring the balance in use and interpretation of difference types of evidence.

Vice-versa, stakeholder engagement methodologies outlined in the SROI process have been described as vague in their approach, particularly in relation to stakeholder participation, and have been claimed to prioritize stakeholder evidence over other types (19, 20). In addition, HIA can complement the SROI method in understanding how and why impacts occur, which can help decide which outcomes would be more important or useful to value (21).

The World Health Organization (WHO) Collaborating Center (CC) on Investment for Health and Well-being at Public Health Wales and WHIASU have started exploring the synergies and potential joint application of HIA and SROI to assess and measure impact and value of public policies, interventions, services, or planning. Within this paper, we explore and discuss how HIA and SROI methodologies could complement each other to capture and account for the multiple health and well-being, social, economic, equity and environmental impacts, and the holistic value of an assessed intervention or policy. We investigate how HIA and SROI approaches have been used in combination previously, aim to understand how the two methodologies could be linked in practice and discuss the added value of doing so.

## MATERIALS AND METHODS

A scoping review of existing academic and gray literature was undertaken to identify case studies where HIA and SROI methodologies have been used in tandem previously to understand the potential impact of a policy, service, or intervention. The search terms used to search within peer reviewed databases (PubMed and ProQuest) were “Health Impact Assessment” or “Impact Assessment,” and “Social Return on Investment” or “Social Value.” The gray literature was also searched using the same search terms to identify any existing evidence. Evidence was identified via review of titles, abstracts, or executive summaries, found by searching on Google Scholar and organizational websites (WHIASU, World Health Organization, Social Value UK).

For both the academic and gray literature, we searched for evidence published between January 1996 and April 2019. This timeframe was chosen as the first SROI study was published in 1996 so it was agreed no published literature would be found prior to this date. Snowballing techniques were also used to identify and capture additional studies, alongside communications with SROI and HIA practitioners to provide any further examples that they were aware of. Two researchers independently conducted the search and initial screening of findings. Final inclusion of studies was based on strict inclusion and exclusion criteria. Evidence was only included if it was published in the timeframe identified above, included reference to both HIA and SROI, and was published in the English language. A data extraction table was used to capture study information and informative findings for the purpose of this study.

Finally, semi-structured qualitative interviews were undertaken with key international experts from a range of regulatory and legislative contexts (i.e., United States, Australia, and the United Kingdom) to gain a deeper understanding of their past experiences and expertise of both HIA and SROI methodologies. For the purpose of this research, approval from an Ethics Committee was not required as per guidance from the NHS Health Research Association ethics decision tool. This research posed no potential risk to the individuals participating, and no participant identifiable data was collected from respondents. Individuals who had knowledge of HIA and/or SROI methodologies were identified from the small number of case studies identified in the scoping review, and existing networks. These interviews explored past experiences to gain insight into current thinking and the potential for future developments of the methodologies. Potential participants were approached with an invitation to interview via email, alongside an information sheet including a description of the HIA and SROI methodologies. Informed consent was collected by the interviewers ahead of the interviews. Interviews were undertaken either face-to-face or via telephone, depending on the location of the interviewee. All interviews were digitally recorded and transcribed by a professional transcription company. The interviews followed a semi-structured approach, which allowed participants to describe their experiences and expertise at length, but participants were gently guided to discuss areas of particular interest. The questions within the interview schedule were guided by and developed through initial exploratory work reviewing the main guidance documents for the two methods. Developed by WHIASU, “*Health Impact Assessment. A Practical Guide*” (9) was used as a guidance resource to fully understand the HIA process and established steps for undertaking a formal HIA. For SROI, “*A guide to Social Return on Investment*” (15) outlines the SROI process in stages and allowed the study team to think through and discuss potential overlaps between the two methodologies, and also appreciate the potential benefits and weaknesses. Topics covered by the interview questions included the following: past experience of HIA and SROI, benefits of both HIA and SROI, thoughts on how either methodology could be changed or improved, potential overlaps between the two methodologies, whether they had used the two methods before

in tandem, what the added value would be of running the two in tandem, and whether there would be any potential negative effects of doing so. A thematic analysis was undertaken on the interview data collected.

## RESULTS

### Scoping Review

The scoping review identified two published reports on scenarios where HIA and SROI have both been used to assess the same intervention or policy. These findings were identified from within the gray literature, with no findings being detected through the academic literature search. The identified case studies are outlined in **Table 2** and highlight the potential use of the two methodologies to evaluate and present the wider impacts and social value.

### Semi-structured Interviews

Due to available resources and timeframes allocated to this stage of the study, 13 international HIA Impact Assessment and SROI experts were invited to participate in an interview.

**TABLE 2 |** Case studies identified within the scoping review.

#### Health disability sport partnership

Funded by Sports Wales in 2015, Disability Sport Wales (DSW) in partnership with Betsi Cadwaladr University Health Board (BCUHB) undertook a standalone retrospective HIA which was completed as part of a mid-term evaluation of the Health Disability Sport Partnership (22). The aim of the partnership was to improve the health and well-being of disabled people by up-skilling health professionals and supporting them to signpost disabled people toward physical activity. Supported by the Wales Health Impact Assessment Support Unit (WHIASU), a community profile was developed of people with disabilities and physical activity levels in the area. A stakeholder group was established and the impact of the intervention was assessed, not only for participating individuals, but also for a wide range of stakeholders such as family and health professionals. An action plan was developed at the end of the HIA process.

In addition to the HIA process, an evaluative SROI was undertaken on the intervention in 2016 (23) with the aim of capturing the social value created by the partnership. The outcomes identified in the previous HIA process were used in the SROI, and were developed by additional stakeholder interviews. The Housing Associations' Charitable Trust (HACT) Social Value Bank (24) was then used to assign a monetary value to outcomes where possible. Costs provided by the Health Board were used to calculate the inputs to the intervention and enable the SROI ratio to be calculated. The final SROI report concluded that for every £1 invested, £124 of social value was created.

#### “Secure Warm Modern” homes in Nottingham: Decent Homes Impact Study

In their evaluation of the Decent Homes Impact Study (25), Nottingham City Homes carried out both a HIA and SROI. The initiative was introduced to improve the homes of social housing tenants by addressing a backlog of repairs in local authority housing. In partnership with Nottingham Trent University and Nottingham City National Health Service (NHS), a HIA was undertaken to understand the wider health impact of the Decent Homes service as part of the social inequalities in health section of the wider service. An SROI was also carried out on a case study area in receipt of the service to create a theory of change to measure the social, environmental and economic outcomes through stakeholder engagement. The final report indicated that for every £1 invested, £4.76 of social value is generated.

Nine responded to the invite and were interviewed in October 2019. The number of interviews achieved satisfied the needs of this initial exploratory study with responses gained from a wide range of individuals who were keen to engage in this work. Of those nine, three individuals were experienced in the use of HIA, two had experience of being involved in one previous HIA, with the remainder having no past experience. With regards to SROI, five individuals reported past experience of using SROI methodology, one had undertaken formal training in SROI but had no experience to date of putting the training into practice, and three individuals had no experience of SROI. Two individuals had experience of using both methods previously. The mean length of interview was 25.5 min.

## Strengths of HIA and SROI as Standalone Methodologies

When asked for thoughts on the benefits of undertaking a HIA, just over half of the respondents ( $n = 5$ ) agreed that the HIA process is well-structured using prescriptive method, with two participants reporting that they felt HIA is a methodology that considers health and well-being in its broadest context. Just under half of the respondents ( $n = 4$ ) recognized the importance of involving stakeholders in the HIA process and the tangible benefits from involving different parties (individuals and organizations) who may be directly or indirectly affected by a proposal or plan. It was thought that enabling participation through robust methods such as workshops and interviews allowed stakeholders to get their voices heard. In addition, several respondents highlighted the importance of both the screening and scoping stages to enable planning and engagement with a wider range of individuals, which provides a higher validity to the methods undertaken. Other benefits of the HIA approach which were highlighted by interviewees was the strong focus on health inequalities, using a clear set of principles and following a process which is scalable and flexible, and can be used both prospectively and retrospectively.

In response to identifying the benefits of undertaking an SROI, all respondents stated the added value of the importance of monetizing outcomes to help show what difference the service or intervention has made. One respondent noted that this can be particularly useful in relation to funding decisions, and in the field of public health:

*So it is a really good way of quantifying things that you wouldn't think are quantifiable...put a cost to things that actually don't bring money back in but just have that value in the future for people's health and the wider economy.*

Over half of the respondents ( $n = 5$ ) noted the positive impact of recognizing and seeking to quantify the triple bottom line (social, economic, and environmental) of outcomes and impacts:

*I think it's a really useful way of sort of combining multiple types of outcomes in a sort of consistent framework. So anything from environmental outcomes, to health and local economic outcomes, you can kind of put them all in the mix.*

**TABLE 3 |** Identified strengths and limitations of HIA and SROI.

	Strengths	Limitations
HIA	<ul style="list-style-type: none"> <li>Well-structured and prescriptive method.</li> <li>Considers health and well-being in its broadest context.</li> <li>Stakeholder involvement and participatory in nature.</li> <li>Screening and scoping stages to enable planning and engagement with a wide range of individuals.</li> <li>Focus on health inequalities.</li> <li>Can be used prospectively, concurrently and retrospectively.</li> <li>Scalable and flexible.</li> </ul>	<ul style="list-style-type: none"> <li>No economic quantification of outcomes.</li> <li>Screening and monitoring/evaluation stages not undertaken thoroughly in some HIAs.</li> <li>Room for methodological development and evolution.</li> <li>Some HIAs can be narrowly focused i.e., assess only environmental determinants as part of wider impact assessment processes.</li> </ul>
SROI	<ul style="list-style-type: none"> <li>Allows for monetization of social, environmental and economic outcomes.</li> <li>Stakeholder engagement and participatory in nature.</li> <li>Can be used prospectively and retrospectively.</li> </ul>	<ul style="list-style-type: none"> <li>Valuation process needs to be improved to reduce subjectivity.</li> <li>Process of stakeholder engagement to identify outcomes needs to be improved to increase quality.</li> <li>No use of checklists to ensure clear process</li> </ul>

*It places health and well-being in its broadest sense at the heart of the considerations which I do not feel conventional health economic analysis does. It also places those who are directly affected by or involved in the intervention at the heart of the analysis.*

Another identified benefit of the SROI method which emerged as a theme, was the strong emphasis on stakeholder engagement. It was noted that this approach enables an inclusivity by combining perspectives of different people (and organizations), not only those who are participating in an intervention but also wider stakeholders, such as family and friends:

*It's obtaining the participant voice and the value they place on an outcome.*

Additional benefits of SROI raised by respondents were also the process of impact mapping through which all inputs and outcomes are identified, and also accounting for different factors which would have happening anyway to avoid overstating the impact.

All strengths and weaknesses of the methodologies as reported by respondents are outlined in **Table 3**.

## Similarities Between HIA and SROI Methodologies

By outlining the benefits of both methodologies, it is possible to identify similarities and synergies between them. All interviewees recognized the common approach in both methods, looking at the holistic value and the wider determinants of health and equity through stakeholder engagement and involvement throughout the process. It was also noted that both processes: acknowledge unintended consequences and impacts; increase the accuracy and validity of their results through being inclusive of the relevant



stakeholders and related outcomes; use methods of triangulation on both qualitative and quantitative data; can be carried out prospectively or retrospectively; and follow social values and principles, such as equity, diversity, inclusion, and transparency. A number of similarities were identified between stages of both the HIA process and the SROI process. For example, both begin with a scoping stage, carry out similar reporting procedures, and monitoring and quality assurance.

## Potential for Adding Value to the HIA and SROI Methodological Processes

Interviewees were also questioned about their thoughts on what elements could add value to either of the two processes to help us explore how the two processes could potentially complement one another (see HIA and SROI stages in **Table 1**). With regards to HIA, respondents noted the following: the Screening and Monitoring stages could be used to better potential as sometimes the Stages can lack emphasis and commitment by those undertaking the HIA; further methodological developments are needed to better engage with vulnerable stakeholders identified in the scoping stage, but not typically engaged with later in the process, to collect outcomes data; and outcomes are not currently quantified in an economic sense (monetized) to capture their value.

With regards to the SROI process, a theme emerged regarding the heavy importance placed on evidence collected from stakeholders over other types of evidence. In addition, it was suggested that it needs to be made clearer at the reporting stage of the process that the monetary value produced is only a proxy value, as opposed to an actual financial figure which needs to be communicated in an appropriate way to the target audience.

## Benefits and Disadvantages of Undertaking HIA and SROI on the Same Intervention

A number of benefits were highlighted by eight out of the nine interviewees regarding the potential benefits of running both methodologies on the same intervention, service or policy (**Table 4**).

When questioned how this would work in practice, the main emerging theme was to potentially use the HIA approach for initial exploration of impact when undertaking a prospective evaluation, and to use HIA for the scoping stages to identify impact, then move toward then use SROI to quantify the outcomes previously identified in the HIA:

*So if I hadn't done the HIA and just come straight across to social return on investment, the first step I would've done would have essentially still been a HIA because you still had to collect all the outcomes from your wider stakeholders to be able to set your outcomes for you to be able to do the social return on investment. So, actually, I think it, it wouldn't, to me, have made sense to do a social return on investment without having done the HIA first.*

However, it is important to note that it very much depends on the service or intervention being assessed as to what methodology would be the most beneficial. For example, one interviewee

**TABLE 4 |** Identified benefits and disadvantages of undertaking a HIA and SROI on the same intervention.

Benefits	Disadvantages
<ul style="list-style-type: none"> <li>Using both processes allows the illustration of the well-rounded impact of the service, intervention or policy.</li> <li>The use of impact mapping in the SROI process would benefit the HIA process to help identify the outcomes in addition to the methods already in place in HIA methodology.</li> <li>Adding a monetary value to outcomes through the SROI process can help to build a more compelling case for health and well-being</li> <li>Undertaking an SROI after completing a HIA can help to focus on the necessary stakeholders to be involved in the SROI process.</li> <li>Using the HIA checklists within SROI can help to address focus on inequalities and vulnerable groups.</li> </ul>	<ul style="list-style-type: none"> <li>Running both processes may cause confusion, so would need to be communicated effectively to understand the added value.</li> <li>Need to ensure the focus on health and equity in HIA isn't lost through a change in focus to the monetization of outcomes.</li> </ul>

commented that undertaking SROI at a strategic policy level may be more challenging than undertaking one on a local intervention. By undertaking an SROI after a HIA, it was suggested that it presents the opportunity to provide stakeholders with additional background from the HIA process to help focus their approach to quantifying the value.

As reported in Box 3, the theme of monetizing the outcomes identified through the HIA process by using SROI emerged strongly:

*It is having a quantifiable element given many large-scale infrastructure developments/service reconfigurations require an economic element to business cases.*

In addition, some interviewees commented how the two methodologies could learn from each other. For example, a theme emerged that the HIA process could be more explicit when stating why particular stakeholders are included or excluded from the engagement processes. An additional comment was to think about incorporating the impact more explicitly within HIA participatory workshops to focus on short, medium and long-term outcomes. With regards to improving the SROI methodology, several interviewees suggested that the methodology could be enhanced if elements of the HIA process were adopted, such as the use of the wider determinants checklists.

## DISCUSSION

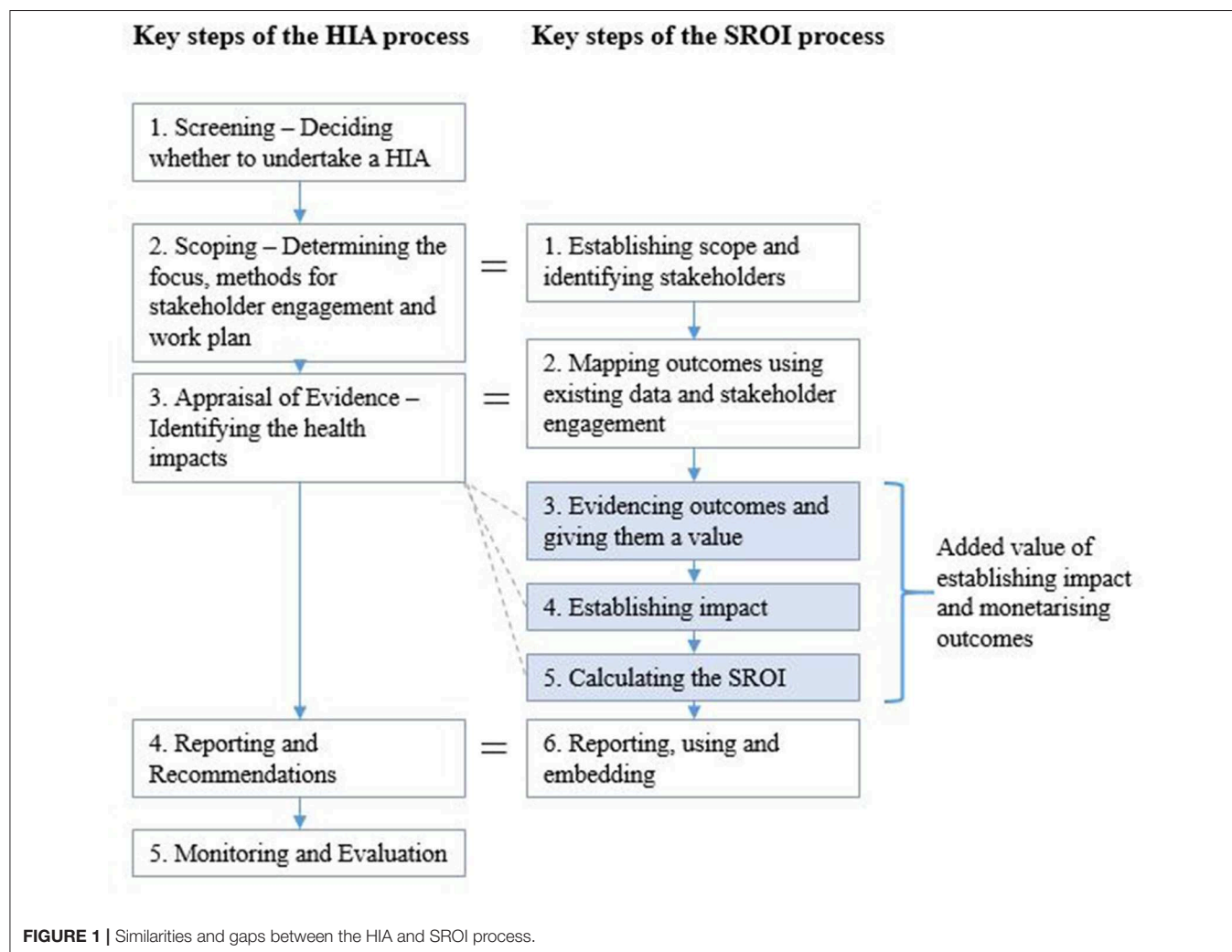
Overall, this study has identified very limited evidence of applying both HIA and SROI methodologies on the same policies, services or interventions. The two case studies found and acknowledged in this scoping review have provided some context of how they have been used together previously to

aid the evaluation and future development of services (22, 23, 25). These examples may reflect that the two methodologies discussed in this paper can be applied together on interventions or services, as opposed to assessing a wide range of impact and social value of strategic initiatives and policies. In addition, the lack of academic literature found in this scoping review is reflective of other reviews which note the little uptake of SROI methodology by academics (16, 20). This could potentially be due to lack of resources to use SROI methodology, or a lack of awareness or understanding by practitioners and policy makers of the methodology. This could be determined through further research.

By obtaining viewpoints from both experts in HIA and SROI, we were able to identify themes related to how the two methodologies could be used together to develop and potentially advance approaches to capturing impact on health and well-being, and social value. Results have indicated that both methodological processes involve a number of similar elements. Both methods are underpinned by a social or holistic model of health, recognizing that health outcomes are shaped by wider

social, economic and environmental factors, and follow similar principles such as stakeholder participation and transparency (9, 15). The two methods strongly understand that health means different things to different people, capturing this through engagement with multiple stakeholders to portray both intended and unintended outcomes. This links with existing literature that notes the relationship between depth of involvement of stakeholders in a service or intervention and the likelihood of good social value outcomes (13). Finally, it was noted that both methods can be used prospectively, concurrently, or retrospectively.

Existing evidence regarding both HIA and SROI methodologies individually states that they can be used in their own right to inform and support effective decision-making, and to drive dialogue and decisions to be outcome-focused, taking into account the wider determinants of health and health equity (15, 26–29). However, this research has highlighted some fundamental differences between the methods, which illustrate how they could be used to complement each other and potentially fit into existing processes (Figure 1). For example,



although heavily promoted within SROI, engagement methods used could be strengthened by replicating approaches taken within the HIA approach. For example by using the health and well-being and population checklists (9) which list a range of health and well-being determinants and outcomes and population groups who could be potentially affected. This could ensure a wide range of potential outcomes and indicators are covered, including vulnerable groups, inequities and inequalities. SROI was also noted to potentially privilege stakeholder perspectives over other types of evidence (20) which could be avoided by triangulation used within HIAs to consider and compare different available evidence.

A major benefit of the SROI process which currently does not exist in HIA has been identified within this research, as the process of placing a monetary value on outcomes not traditionally quantified (**Figure 1**). There is the potential for adding this into the Appraisal stage of a HIA (**Figure 1**). However, if this is the main factor which results in HIA and SROI being run on the same intervention, it is important that subjectivity is accounted for within the valuation process, including remaining cautious around overstating the value of the SROI ratio and how it is used so that the focus on health equity highlighted through the HIA process isn't displaced.

Although this paper has taken the first steps to understand the relationship between SROI and HIA methodologies, there is major scope for future research to be undertaken to develop the concept of applying the two methodologies in combination to accurately measure and report the health and well-being impact, as well as the social value of services, policies or interventions. Due to the limited published evidence and literature in this space, further research and learning from case studies is needed, in order to better comprehend the advantages and disadvantages, and to further develop both SROI and HIA methodologies. In addition, the relatively small number of interviews undertaken in this study is acknowledged and reflects the limited practice of utilizing both methods together. Extra benefit would be created by capturing the views of decision-makers who would be using the results to understand if they would add value and how are they going to apply them.

Evidence suggests there is current limited knowledge about how to embed social value in the development of strategies or services in some sectors (30). The UK Green Business Council (UK GBC) note that although HIA is used within the sector, there is not yet a common methodology for measuring social

value in real estate, or an industry wide framework to provide consistency (13). Further methodological developments in both HIA and SROI could promote a framework or process to capture this, however this would require further investigation.

## CONCLUSION

Despite the increasing use of HIA and SROI methodologies at an international level, very little previous research has been undertaken to investigate how these approaches complement each other to capture and account for the health impacts and the social value of policies, interventions, and services. This paper demonstrates that there are some clear synergies between the two methodologies within their well-established processes, principles and reliance upon stakeholder engagement to identify the real outcomes, both experienced and predicted. Our research also indicates the added value of applying both processes (in tandem or sequentially) to help measure health impact and social value due to the subtle differences, for example the checklists used within the HIA process and the monetization of outcomes in the SROI methodology. Although this review identified the two methodologies had only been applied twice previously on the same intervention, the conducted interviews acknowledged scope to continue to develop this work further. This understanding and building evidence could inform and enable decision-makers to incorporate health impact and social value in developments and initiatives across sectors, on a national and local level. This is going to be explored further by the WHO CC and WHIASU, in collaboration with partners nationally and internationally.

## DATA AVAILABILITY STATEMENT

The qualitative datasets for this article will not be made publicly available as consent was not gained from interview respondents to share transcripts external to the study team. Requests to access these datasets should be directed to KA (kathryn.ashton@yahoo.co.uk).

## AUTHOR CONTRIBUTIONS

KA and LG developed and designed the research. KA undertook the scoping review. KA and LP-W undertook the qualitative data collection. KA analyzed the data and drafted the manuscript. All authors edited and approved the final manuscript.

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

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# Prosocial Behavior Can Moderate the Relationship Between Rumination and Mindfulness

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**Objective:** Rumination, which is a coping style to distress, has become a common mode of thinking about mental illnesses such as depression and anxiety. Improving mindfulness is an effective way to help people cope with rumination. Individuals who had higher prosocial behaviors reported a high level of mindfulness. This study aimed to explore whether prosocial behavior helps individuals with high-level rumination improve their mindfulness, and explain the reason why prosocial behavior can influence the relationship between mindfulness and rumination.

**Methods:** Introducing prosocial behavior situations, the first study chose 51 high-level rumination and 53 low-level rumination participants and measured the influence of prosocial behavior on mindful attention awareness in the present moment. In the second study, a questionnaire was conducted among 261 participants to explore the moderating effect of prosocial behavior between rumination and mindfulness.

**Results:** In individuals with high-level rumination,  $\Delta$ MAAS (mindful attention awareness scale) (posttest-baseline) scores in the prosocial behavior condition were significantly higher compared to those in the control condition ( $p=0.003$ ). Meanwhile, prosocial behavior played a moderating effect between reflective pondering of rumination and mindfulness ( $R^2 = 0.03$ ,  $p=0.004$ ).

**Conclusions:** Encouraging prosocial behavior is an effective way to improve mindfulness in highly ruminative individuals.

**Keywords:** rumination, mindfulness, prosocial behavior, moderating effect, mental health

## INTRODUCTION

Rumination is a coping style to distress that involves a repetitive and passive focus on symptoms of distress and the likely causes and consequences of these symptoms (1). Studies have shown that rumination is highly correlated with negative emotion; people have symptoms such as depression, anxiety, fear, and addiction largely because their attention is focused on deep rumination from which they find it difficult to extricate themselves (2–6). Therefore, an important aim in mental health or psychotherapy is to find ways to cope with rumination.

Initial research has suggested that distraction is a coping skill that decreases rumination by discarding unpleasant thoughts and feelings, often by focusing on other thoughts or activities (7). However, this strategy only works for a short time and under certain conditions. Mindfulness appears to be a different construct than distraction and may have greater potential as an alternative to ruminative thought processes (8, 9). Mindfulness refers to the self-regulation of attention in the present moment without analyzing and criticizing, which involves two components. First, mindfulness involves bringing one's full attention to the present moment, rather than dwelling on past events or future possibilities (10). Second, mindfulness is characterized by an attitude of nonjudgmental acceptance of internal and external events (8). Several studies have indicated that heightened mindfulness can decrease rumination, which in turn results in less depression and anxiety (11–14). Shapiro trained 83 college students in mindfulness-based stress reduction (MBSR) to reduce successfully the degree of rumination (15). While monitoring the 42-day mindfulness-based intervention (MBI) process of 45 participants, Andreotti found that the degree of rumination decreased significantly after 1 week and 1 month (16). Mindfulness cultivates nonjudgmental, nonreactive attention to the present moment; however, it can also be experienced in other ways, except for professional mindfulness training (17, 18). Prosocial behaviors include a range of positive and friendly behaviors that individuals display toward others (19). According to previous studies, individuals who exhibited a higher prosocial behavior trait reported a high level of mindfulness, especially the mindful attention awareness (20, 21). The reason why prosocial behaviors relate to mindfulness may be based on the relationships of their features. On the one hand, the premise of prosocial behavior is being aware of the needs of others in the present; this present-focused attention increases positive emotions and mindful awareness of individuals (19, 22). On the other hand, within helping situations, it is the nonjudgmental acceptance attitude that may allow people to disengage from their own emotions and focus on those in need of help (23). In particular, individuals with a heightened tendency to ruminate may likely improve their mindful awareness in case they are able to invest cognitive resources on the present moment, without assigning a judgment value to the emotions experienced (24). That is to say, prosocial behavior can help individuals with high-level rumination to improve their mindful awareness. Therefore, introducing the prosocial behavior task, the first study aimed to explore to what extent the prosocial behavior helps individuals with high-level rumination improve their mindful awareness.

It is acknowledged that there are negative correlation between rumination and mindfulness (3, 25). If the first study indicated that engaging in prosocial behavior helps individuals with a high level of rumination improve their mindful perception, this would imply that prosocial behavior may moderate the relationship between rumination and mindful awareness. What is the reason for this? In fact,

Treynor et al. (26) found two distinct components of rumination emerging from the following items: *reflective pondering*, a “purposeful turning inward to engage in cognitive problem-solving to alleviate one's depression,” and *brooding*, “a passive comparison of one's current situation with some unachieved standard” (26). To some extent, both of these components can be seen as a repetitive thinking style, and even when it is problem-orientated, it may not always be the most adaptive approach to experience mindfulness and positive emotion (1, 27). Furthermore, although both of them showed an association with more depression concurrently, compared to the brooding component, the reflective pondering component is a more adaptive problem-orientated ability for humans (26, 28). Research showed that the ability to be mindful may represent an important prerequisite for adaptive engagement in reflective pondering (12). Thus, it is likely that problem-orientated reflective pondering helps individuals engage in the helping situation and improve mindfulness perception. As a result, using the ruminative response scale (RRS), consisting of reflective pondering and brooding components, the second study assessed the reason why prosocial behavior is a potential moderator of the relationship between mindfulness and rumination. One goal of the current study was, therefore, to test whether the level of prosocial behavior moderates the relationship between reflective pondering and mindfulness.

Our first study measured whether prosocial behavior could help individuals with high-level rumination improve their mindful awareness. Because the experiment was introduced in scenes requiring participants to imagine engaging in prosocial behavior, the mindful attention awareness (measured by mindful attention awareness scale, MAAS), which represents a mindful awareness variable in the present moment (29, 30), was used to measure the change of mindful states over time. Our first hypothesis was that for individuals with high-level rumination, their mindful attention awareness of the experimental group after intervention would be significantly higher than that of the control group. Using a questionnaire analysis, the second study measured the reason why prosocial behavior was a potential moderator of the relationship between mindfulness and rumination. According to the reviews, among all components of rumination, the reflective pondering of rumination helps individuals engage in helping situation and improve mindfulness perception. Our second hypothesis was that prosocial behavior can moderate the relationship between reflective pondering and mindfulness. Besides, previous study reported that MAAS just focused on the presence or the absence of attention to and the awareness of what was occurring in the present rather than other facts of mindfulness such as acceptance and observing (30). Therefore, in the second study, the Five Facet Mindfulness Questionnaire (FFMQ), comprising reasonable psychometric properties, is currently the one that assesses a more comprehensive concept of mindfulness (31).

## STUDY 1

### Methods

#### Participants

Two hundred participants were recruited by posting flyers at local university buildings and through an advertisement on a website. Upon initial contact, all participants were asked to fill in the Ruminative Responses Scale (RRS) and participate in an online interview, which was conducted to establish eligibility for the study through an assessment of mental and physical health history. Exclusionary criteria for participants included a history of psychiatric disorders and the current use of psychotropic drugs or alcohol and other drug abuse. Three participants were excluded for their history of a psychiatric disorder, two participants were excluded for taking psychotropic drugs, and seven participants were excluded because they did not fill out all the questions nor had only one option for all questions in the RRS. The resulting dataset included 188 students (88 male, 100 female). According to the RRS score of each participant, out of the total of 188 students, 50 participants (27%) were in the high-level rumination group, and 50 participants (27%) were in the low-level rumination group. According to the random matching condition, half of each group was placed in the experimental condition while the remaining half was put in the control condition. However, an additional eight participants were excluded because they did not write down what they thought under different conditions. In order to make sure there were more than 20 people in each condition, we added three participants in each of them. This implied the study actually used top and bottom 30% as the criterion of higher and lower rumination. The RRS scores of the higher and lower rumination were significantly different ( $p=0.003$ ). Ultimately, the data of the high-RRS group (23 participants in the experimental condition and 28 participants in the control condition) and the low-RRS group (28 participants in the experimental condition and 25 participants in the control condition) were included in the statistical analysis.

The study was approved by the local ethics committee and carried out in accordance with the Declaration of Helsinki. All participants signed informed consent forms.

#### Procedure

Participants in two groups were invited to a quiet lecture theatre at the same time. First, after 10 min of rest, everyone filled out the MAAS. Then, those in the experimental condition were asked to consider some specific ways to help others in created helping situations while the remaining half in the control condition were primed with irrelevant stimulation. This process took 15 min. After these, the MAAS was filled again. Finally, all subjects were paid for their participation.

#### Materials

The RRS was compiled by Nolen-Hoeksema (7), and the Chinese version was revised by Xiu and Hong fei (32). It consists of 22 items and is divided into three subscales related

to depressive symptoms (12 items; e.g., “Think about how alone you feel”), the Brooding scale (5 items; e.g., “Think why do I always react this way?”), and the Reflection scale (5 items; e.g., “Go away by yourself, and think about why you feel this way”). It was scored using a Likert-type scale of 4 points ranging from 1 (almost never) to 5 (almost always). The results of the RRS measurement for Chinese college students suggest that the Cronbach's coefficient is 0.86 (33). In this study, the alpha coefficient of the questionnaire was 0.79.

The MAAS was compiled by Brown and Ryan and assesses mindful awareness of individuals (30). It focuses on the presence or absence of attention and awareness of what is occurring in the present (34, 35), which can assess individual differences in the frequency of mindful states over time (30). The MAAS has 15 items such as “I find myself preoccupied with the future or the past.” It was scored using a six-point Likert-type scale ranging from 1 (*almost always*) to 6 (*almost never*). Higher scores reflect higher mindful attention awareness. The Cronbach's coefficient of the Chinese version is 0.89 (36). In this study, the alpha coefficient of the questionnaire was 0.87.

The task for those in the experimental condition was composed of prosocial behavior response missions, which were developed by Chinese scholar Ma based on characteristics of Chinese prosocial behavior (37). Informed by situations of social need in China, this task included six situations that could arouse the participants' desire to help others successfully (e.g., “Zhou, a freshman of your major, just came to the city from a remote village in Yunnan province for study. He has difficult family economic conditions, and his Mandarin Chinese is not good enough to communicate with others. You are his classmate; what should you do to help him?”). For each story situation, participants were asked to imagine and concentrate on the situation, and then write down two or more ways to help. Further, the instructions asked the participants to delineate the steps necessary to those methods of helping. These response missions, printed individually on note cards, were designed to influence the thought content of the participants by requiring them to focus their attention and imagine how they could help. The aim is to take the attention of the participants away from themselves and shift it to help others. Ma asserted these missions could motivate prosocial behaviors because people showed a higher proportion of donations after similar situations were in the news (37).

The tasks for those in the control condition were distraction missions created by Morrow and Nolen-Hoeksema (35). Participants engaged in the distraction missions were asked to focus on items not related to themselves and related to imagining external events, similar to the experimental group; however, these were not centered on helping others (e.g., “if a ship is heading for the coast, please describe the scene you imagined” and “the layout of a typical classroom, please describe the scene you imagined”). The distraction missions have been previously rated as equally neutral by nondysphoric judges (38). Consistent with the tasks of those in the experiment condition, participants were asked to read six questions printed individually on note cards and answer them in turn.



## Study Design and Statistical Analysis

To avoid the effect of repeated measurements, we adopted 2 (condition: prosocial behavior and control)  $\times$  2 (group: high-level rumination and low-level rumination) between-subject design. With these types of designs, the number of people assigned to each condition was random, causal estimates are obtained by comparing the change of MAAS in experimental condition with the change of those in control condition. Given that the baseline data of MAAS significantly differed in the high and low rumination groups, we used the D-value ( $\Delta$ MAAS = posttest-baseline) as the dependent variable to indicate the effect sizes. Meanwhile, 2  $\times$  2 intergroup ANOVAs were performed ( $p < 0.05$ ). All data were analyzed using SPSS 22.0.

## Results

### Demographic Variables and Correlations

According to their scores on the RRS, we divided the participants into a highly ruminative group and a lowly ruminative group. The result of an independent sample *T*-test displayed that the differences of RRS [ $t(102)=21.33, p < 0.001$ ] and MAAS [ $t(102) = -13.85, p < 0.001$ ] between the two groups were significant.

Furthermore, in the highly ruminative group, there were no differences in age, RRS and MAAS [all  $t(49) < 1.87$ , all  $p > 0.09$ ] between those in the experimental and control conditions. Likewise, in the lowly ruminative group, there were no differences in age, RRS and MAAS [all  $t(51) < 0.18$ , all  $p > 0.38$ ] between the experimental and control conditions. **Table 1** shows the mean and standard deviation of age and questionnaires.

### Mindfulness Measurement Under Experimental and Control Condition

The results revealed that the main effect of the experimental group ( $F_{(1, 102)}=15.21, p < 0.001$ ) and the control ( $F_{(1, 102)}=9.04, p$

$< 0.001$ ) were significant. The  $\Delta$ MAAS (posttest-baseline) of those in the experimental condition was higher than those in the control condition. In addition, significant differences also existed in interaction of group and conditions ( $F_{(1, 102)}=4.12, p=0.045$ ). Simple effect analysis indicated that the  $\Delta$ MAAS of the highly ruminative group was significantly higher than that of the lowly ruminative group in the prosocial behavior condition ( $F_{(1, 102)}=14.84, p < 0.001$ ); further, for the highly ruminative group, the  $\Delta$ MAAS in the prosocial behavior condition was significantly higher than that in the control condition ( $F_{(1, 102)}=9.55, p=0.003$ ). **Table 2** shows the mean and standard deviation of MAAS in different stages.

## STUDY 2

### Method

#### Participants

The second study conducted was a questionnaire survey, including the RRS, Five Facet Mindfulness Questionnaire (FFMQ), and the Prosocial Tendency Measurement (PTM), on 300 college students. These participants were recruited by posting flyers at a local university and through an advertisement on a website. None were psychology majors or had any experience of social work. Thirty-four participants were excluded because they did not fill out all the questions, and five participants were excluded for their history of psychiatric disorders, leaving a total of 261 participants (144 male and 177 female). There were no significant differences in age between

**TABLE 1 |** Demographic variables and questionnaire scores.

	High Rumination		Low Rumination	
	Prosocial condition	Control condition	Prosocial condition	Control condition
Age	18.30 $\pm$ 2.15	18.17 $\pm$ 1.44	18.24 $\pm$ 2.12	18.36 $\pm$ 1.82
RRS	54.65 $\pm$ 6.20	53.75 $\pm$ 6.87	32.68 $\pm$ 3.58	32.84 $\pm$ 2.81
MAAS	51.34 $\pm$ 5.37	48.23 $\pm$ 6.02	66.32 $\pm$ 6.11	66.64 $\pm$ 6.92

RRS, ruminative responses scale; MAAS, mindful attention awareness scale.

**TABLE 2 |** The MAAS score in difference stages.

		MAAS			N
		Baseline	Post test	Posttest-baseline ( $\Delta$ )	
HR	Prosocial condition	51.34 $\pm$ 5.37	56.78 $\pm$ 6.33	4.83 $\pm$ 3.52 <sup>a,b</sup>	23
	Control condition	48.23 $\pm$ 6.02	50.32 $\pm$ 5.40	1.63 $\pm$ 2.32	28
LR	Prosocial condition	66.32 $\pm$ 6.11	67.32 $\pm$ 5.77	1.07 $\pm$ 1.56	28
	Control condition	66.64 $\pm$ 6.92	67.08 $\pm$ 6.85	0.40 $\pm$ 2.45	25

HR, high rumination; LR, low rumination; MAAS, mindful attention awareness scale. Baseline, the data of MAAS measured before test; Post test, the data of MAAS measured after test. Posttest-baseline, the data of post test minus the data of baseline.

<sup>a</sup>Significantly different from the prosocial condition in LR group.

<sup>b</sup>Significantly different from the control condition in HR group.

**TABLE 3 |** Sociodemographic profile of the participants (N=261).

	n	%	M	SD
<b>Age</b>	261		20.68	2.4
Male	144	55.2%	20.55	2.1
Female	117	45.8%	21.04	2.8
<b>Education level</b>				
Undergraduate	222	85.1%	—	—
Post graduate	39	14.9%	—	—
<b>Parental education</b>				
UNIV DIP or above	88	33.7%	—	—
High school	132	50.6%	—	—
Junior high school	41	15.7%	—	—

UNIV DIP, university diploma.

males and females ( $p=0.31$ ). **Table 3** is the sociodemographic profile of the participants.

## Materials

The FFMQ is a 39-item questionnaire that measures five facets of mindfulness (31): observing (eight items; e.g., “I notice the smells and aromas of things”), describing (eight items; e.g., “I’m good at finding the words to describe my feelings”), acting with mindful awareness (eight items; e.g., “I am easily distracted”), nonjudging (eight items; e.g., “I criticize myself for having irrational or inappropriate emotions”), and nonreactivity (seven items; e.g., “I watch my feelings without getting lost in them”). Items were scored on a five-point Likert-type scale ranging from 1 (never or very rarely true) to 5 (very often or always true). Higher scores indicate more mindfulness. The Cronbach’s coefficient of the Chinese version is 0.81 (39). In this study, the alpha coefficient of the questionnaire was 0.85.

PTM was developed by Carlo and Randall measuring trait prosocial behavior tendencies on six subscales (40): altruism (five items; e.g., “When people ask me to help them, I don’t hesitate”), anonymous prosocial behavior (five items; e.g., “I prefer to donate anonymously”), compliant prosocial behavior (two items; e.g., “I feel that if I help someone, they should help me in the future”), dire prosocial behavior (three items; e.g., “It is easy for me to help others when they are in a dire situation”), emotional prosocial behavior (four items; e.g., “I respond to helping others best when the situation is highly emotional”), and public prosocial behavior (four items; e.g., “I will try my best to help others in the public”). It was scored using a Likert-type scale of five points ranging from 1 (completely out of line) to 5 (completely suitable). The higher the score, the more prosocial tendency the individual has. The Chinese version of the scale was revised with a college student cohort, and its Cronbach’s coefficient is 0.85 (41). In this study, the alpha coefficient of the questionnaire was 0.79.

The RRS was the same as in Study 1.

## Statistical Analysis

The data were analyzed using SPSS 22.0. The premise of moderation analysis is that a correlation between independent and dependent variables exists, and the moderator variable is a reliable predictor of the dependent variable. Thus, Pearson’s correlations were calculated between different subscales of RRS, FFMQ, and PTM scores. Second, the moderation analysis was conducted using the Hayes PROCESS macro in SPSS (42). In order to do that, independent and moderator variables needed to

be centralized. We used 5,000 bootstrap samples, and biases were corrected at 95% confidence intervals (CIs) to calculate the indirect effect of each variable. The presence of a significant effect is denoted if zero is not included by the upper and lower bound of 95% CI.

## Results

### Demographic Variables and Correlations

Initially, we transformed all RRS, FFMQ, and PTM scores into standard Z scores. We compared the correlations among every subscale of RRS, PTM and FFMQ. The results indicated that every subscale of RRS (all  $p < 0.05$ ) correlated significantly with FFMQ, and that there was a significant correlation between PTM and FFMQ ( $p < 0.001$ ). Although the correlation between the reflective pondering of RRS and PTM was not significant ( $p=0.75$ ), PTM could be used as a moderator variable for analysis. Furthermore, no gender differences were found in the RRS, FFMQ, and PTM (all  $p > 0.205$ ). The correlations are presented in **Table 4**.

### Moderation Analysis

The outcomes of the interaction tests for potential moderators are shown in **Table 5**. A significant moderation effect existed in prosocial behavior on the relationship between the reflective pondering component of rumination and mindfulness ( $R^2 = 0.03$ ,  $F=8.27$ ,  $p = 0.004$ ). In order to clearly reveal the direction of the moderator, we divided the high- prosocial behavior group (mean value + 1 standard deviation) from the low- prosocial

**TABLE 5 |** Moderating effects of prosocial behavior on the relationship between rumination and mindfulness (N=261).

	Variables	$\beta$	SE	P value	LLCI	ULCI
RRS-1	Constant	-.003	.058	.955	-.117	.110
	PTM	.318	.058	< 0.001	.204	.432
	<b>RRS-Reflection</b>	-.153	.058	.009	-.268	-.038
	<b>Interaction</b>	.166	.057	.004	.052	.279
RRS-2	Constant	.015	.056	.795	-.095	.124
	PTM	.260	.056	< 0.001	.149	.371
	<b>RRS-Depression</b>	-.353	.056	< 0.001	-.463	-.243
	<b>Interaction</b>	.098	.059	.092	-.016	.216
RRS-3	Constant	.013	.056	.821	-.097	.122
	PTM	.268	.056	< 0.001	.156	.378
	<b>RRS-Brooding</b>	-.345	.056	< 0.001	-.455	-.235
	<b>Interaction</b>	.099	.059	.093	-.017	.215

RRS, ruminative responses scale; RRS-1 is reflection subscale, RRS-2 is depressive subscale, and RRS-3 is brooding subscale; PTM, prosocial tendency measurement. The interaction term was generated by multiplying the mean-centered values of PTM and every subscale of RRS.  $\beta$ , unstandardized coefficient; SE, standard error; CI, confidence interval (LLCI lower bound CI; ULCI upper bound CI).

**TABLE 4 |** The descriptive statistics for Z scores of questionnaires and their correlation.

	M	SD	1	2	3	4	5
1 RRS	2.04	0.59	–	–	–	–	–
2 RRS-Depression	2.01	0.81	0.909**	–	–	–	–
3 RRS-Brooding	2.05	0.76	0.862**	0.837**	–	–	–
4 RRS-Reflection	2.06	0.69	0.594**	0.262**	0.149**	–	–
5 FFMQ	3.13	0.29	–0.399**	–0.390**	–0.375**	–0.158*	–
6 PTM	3.33	0.41	–0.113	–0.146**	–0.128*	0.020	0.297**

\* $p < 0.001$ , \*\* $p < 0.05$ .. RRS, ruminative responses scale; FFMQ, Five Facet Mindfulness Questionnaire; PTM, prosocial tendency measurement.

behavior group (mean minus value  $-1$  standard deviation) so that the predictive effect of reflective pondering on mindfulness could be clearly shown under the different levels of prosocial behavior. For individuals who demonstrate highly reflective pondering, the higher prosocial behavior trait they have, the more experience of mindfulness. **Figure 1** shows the predictive effect of the moderator.

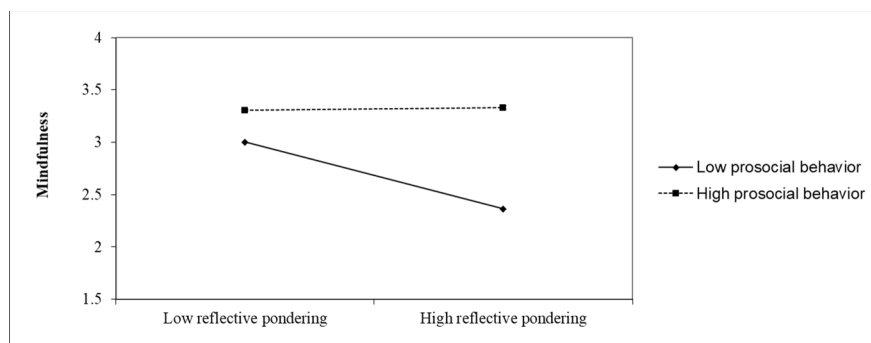
## DISCUSSION

Our study found that engaging in prosocial behavior is a way to help highly ruminative individuals improve their mindfulness, and prosocial behavior can moderate the relationship between reflective pondering component of rumination and mindfulness. This implied that reflective pondering of rumination helps individuals engage in a helping situation and improves mindfulness perception.

The first study investigated to what extent prosocial behavior helps individuals with high-level rumination improve their mindful awareness when they are immersed in the helping scene. The results, consistent with our first hypothesis, showed that for the individuals with high-level rumination, the mindful awareness of the experimental condition was significantly higher than that of the control condition. Compared with the distraction task, which emphasized focusing on other thoughts or activities, the prosocial behavior task asked the participants to focus on the present and the awareness of the needs of others. For one thing, this present-focused attention aroused people's empathy and psychological flexibility, which allowed people to disengage from their own emotions and obtain more mindful attention awareness (43–45). For another, it is the nonjudgmental acceptance attitude that may allow people to disengage from their own emotions and focus on those in need of help (23). For this reason, the participants were asked to perform helping behaviors based on the specific needs of others; this action implied that they must reduce their internal or external judgments and emotion, which to some extent increased their level of mindful awareness. Furthermore, individuals with a heightened tendency of rumination may likely improve their mindful awareness and invest cognitive resources on the present moment, without assigning a judgment value to the emotions experienced (24). This may explain why individuals with high-

level rumination can improve their mindful awareness through prosocial problem-solving. However, our results found that for individuals with low-level rumination, the difference between the two conditions is not significant. Researchers reported that individuals with low-level rumination and high-level mindfulness exhibit stronger flexibility and efficiency in switching attention (46, 47). A 15-min experience of prosocial behavior may be common to them and not sufficient to cause significant changes in mindfulness levels compared to distraction condition. Individuals with high-level rumination did not have much voluntary empathy experience (27), and passively shifting their attention from themselves to others may be an effective way for them to increase mindful awareness. Above all, the occurrence of prosocial behavior can increase the mindful awareness of individuals with high-level rumination.

The first study demonstrated that individuals with high-level rumination can improve their mindful awareness through prosocial problem-solving, which implied that prosocial behavior could moderate the relationship between rumination and mindfulness. The second study aimed to identify the reason for this. Previous studies indicated that compared to the depressive and brooding components of rumination, the reflective pondering component is a more adaptive problem-orientated ability for humans. The ability to be mindful may represent an important prerequisite for adaptive engagement in reflective pondering of rumination (12, 26). Consistent with our hypothesis, the results revealed that prosocial behavior can moderate the relationship between reflective pondering and mindfulness. For highly reflective pondering individuals, the higher the prosocial behavior trait is, the more experience of mindfulness. Unlike other components of rumination, the reflection is a more adaptive strategy per se. Ramel proposed that the ability to be mindful represent an important prerequisite for adaptive engagement in reflective pondering (12). However, the effects of reflection were not consistently adaptive but differed, depending on the type of coping styles; for example, in those with a less active coping style, reflection was related to elevated levels of depression and decreased mindfulness, whereas in those with a more active coping style, this was not the case (48). In other words, the prosocial behavior may be an active style of coping for ruminators. Prosocial behavior can enhance



**FIGURE 1 |** The predictive effect of prosocial behavior.

the psychological flexibility of individuals to a certain extent and enable individuals to release their negative emotion. It is a positive active trait for people (49, 50). In short, reflective pondering helps individuals engage in a helping situation and improve mindfulness perception. The prosocial behavior moderates the relationship between reflective pondering and mindfulness.

To sum up, our study found that engaging in prosocial behavior is a way to help highly ruminative individuals improve their mindfulness, and prosocial behavior can moderate the relationship between reflective pondering component of rumination and mindfulness. This implied that reflective pondering of rumination helps individuals engage in a helping situation and improves mindfulness perception. However, this study has certain limitations. First, the assessment of mindful awareness is based on self-report measures; therefore, there is the possibility of a response bias. More measurements (e.g., cognition task and physical index) need to be added in future studies. Second, the imagination of prosocial behavior is different from engagement in real situations. Thus, effective simulations of prosocial behavior need to be developed for academic research.

## DATA AVAILABILITY STATEMENT

The data cannot be shared at this time as the data also forms part of an ongoing study. After all the researches are done, the data

will be made available by the authors. Requests to access these datasets should be directed to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by ethical standards of the research committee of Nanjing University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. Material preparation, data collection were performed by GM. The data were analyzed and first draft of the manuscript was written by YM. All authors commented on previous versions of the manuscript and read and approved the final manuscript.

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# Attitude Toward Seeking Professional Psychological Help Among Community-Dwelling Population in China

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**Objective:** To explore the attitudes and factors in seeking professional psychological help among a Chinese community-dwelling population in order to promote positive help-seeking behaviors and better utilization of mental health services.

**Methods:** Using system and simple random sampling with Kish selection table methods, 912 community-dwelling residents were included in this study and asked about their attitudes toward seeking professional psychological help, depression symptoms, family function, depression literacy, help-seeking intention, and stigma.

**Results:** Scores on the Attitudes Toward Seeking Professional Psychological Help scale (ATSPPH-SF) indicated a neutral attitude toward openness to seeking treatment for psychological problems and a negative attitude toward the value and need to seek treatment with a negative total score. Multiple linear regression analysis showed that gender, age, social support (employment status and family function), depression literacy, stigma, and help-seeking intention are significantly associated with attitude toward seeking professional psychological help.

**Conclusion:** The overall attitude toward seeking professional psychological help is not optimistic, thus, more efforts are needed to enhance understanding. Effective interventions including mental health education, training of mental health professionals, and popularizing the use of mental health services are essential, especially for the at-risk population.

**Keywords:** attitude, Chinese, community-dwelling population, help-seeking behaviour, professional psychological help

## INTRODUCTION

Mental disorders have become a serious problem worldwide, with over 300 million (4.4%) and 264 million (3.6%) people experiencing depression and anxiety disorders respectively (1). A recent large-scale survey in China showed that the lifetime prevalence of depression and anxiety was 6.9 and 7.6%, respectively (2). Mental disorders can cause high rates of disability and mortality as well as increase the burdens of other diseases and related health care costs (3–5) and suicide is the most serious consequence (6, 7). A majority of individuals (76–85%) with mental disorders receive no treatment in low- and middle-income countries compared with 35–50% in high-income countries (8). A low rate of help-seeking behaviors (9–11) and delayed help-seeking (12) are barriers to receiving timely and effective treatment for persons with mental disorders. Professional help-seeking (e.g. from mental health professionals, physicians) is more effective in the prevention and management of mental health problems and protects individuals against suicide (13, 14).

Currently, the outlook is not optimistic regarding the use of professional help-seeking behaviors for mental health issues in many countries, especially China (15, 16). In Canada, one in 10 young people had consulted professionals for their problems (17). In another study across four Chinese provinces, it was found that only 11 (7.3%) of the suicide decedents (151) and four (3.3%) of those who attempted (120) had previously sought psychological or medical treatment for psychological problems (18). A recent study indicated that 7.9% of participants with depressive symptoms had sought help from mental health professionals (MHPs) and 3.7% from general physicians (19).

Based on the theory of planned behavior (TPB) (20), attitude can indirectly influence help-seeking behavior *via* intention (21), and it is a precursor to help-seeking intention and actual help behaviors (22). Thus, improving help-seeking attitude is the first step in promoting further help-seeking behaviors.

Attitudes toward seeking professional psychological help (ATSPPH) vary by geographic location. The National Comorbidity Survey (NCS) of the USA conducted in 1990–1992 showed that one-third of respondents would definitely seek professional help (23). A study in Saudi Arabia (24) noted that 43.5% of participants would use professional assistance for serious emotional problems. In Europe, over 69% of survey participants had a more open attitude toward seeking professional help and approximately 50% recognized the value of professional help (25). In the Western Pacific region, participants had a poor attitude compared with results in the US and Europe (26). A 40-year review from 1968 to 2008 showed that the ATSPPH has become increasingly negative over time (27). In China, most research about help-seeking attitude has focused on college students (28–30). One study found that 40.4% of Chinese university students expressed willingness to seek help from a psychiatrist if they had suicidal ideation. And they preferred to seek informal social networks rather than professionals to solve their mental health issues (31).

Currently, research about ATSPPH in the Chinese community-dwelling population is lacking.

Attitudes toward seeking professional psychological help can be affected by various factors such as gender (32), age (25), educational level (33), marital status (34), work status (35); sociological and cultural factors such as culture prejudice (36), social support (37), mental health literacy (38); individual factors such as stigma related to mental problems (39), help-seeking intention (40), the experience of mental problems (17), knowledge about the role of health professionals (41), and personality traits (42). Based on the above findings, this study aimed to further explore significant correlates in the Chinese community-dwelling population which have been neglected in previous studies.

## MATERIALS AND METHODS

### Sample Size and Sample Design

This study was a population-based, cross-sectional survey conducted between January 2017 and December 2017 in Wuhan, a major city in central China (43). A stratified random sampling method was applied in the whole sampling process, which was divided into three stages to select target communities, households, and individuals. First, 20 communities from seven central districts of Wuhan were selected using an Excel generate random number table. Second, a systematic sampling method was used by coding all households in each community with a random number from an Excel generated random number table, and identifying 50 target households in each community according to the sampling interval  $K$  (the total number of households in the community divided by 50). Finally, in Kish selection table method, one of eight codes (A, B1, B2, C, D, E1, E2, F) was assigned to the target households; a family registration form (including name, age, gender, member number) was used to assign additional codes to individual family members. This allowed for the use of a Kish code for every household to determine the target individuals. This Kish selection table method is usually used to determine target individuals from every family in a household survey (44). A total of 1,000 questionnaires were distributed; 923 questionnaires were returned (response rate: 92.3%) and 912 questionnaires were valid (effective callback rate: 91.2%). Inclusion criteria were: minimum age of 15 years and able to read and write in Mandarin. Participants with severe somatic illness or other psychosis and related disorders, dementia, and mental impairment due to substance dependence were excluded.

Institutional Review Board of Wuhan University School of Medicine granted approval for this study. Based on the principle of voluntary participation and withdrawal from the study at any time, participants signed informed consent prior to participation. Privacy rights were protected by using coded anonymous questionnaires and the security of these questionnaires was maintained. Small gifts were provided in gratitude for an individual's participation.



## Measures

### Socio-Demographic Characteristics

Participants completed a general demographic questionnaire indicating their gender, age, religion, education level, parents' and spouse's education level, employment, and marital status.

### Attitudes Toward Seeking Professional Psychological Help Scale—Short Form (ATSPPH-SF)

The ATSPPH-SF was developed by Fischer and Farina (45), translated into Chinese in 2017 and revised for cultural applicability after communicating with the original authors. The original questionnaire was translated by two individuals, an assistant professor in mental health nursing with a doctoral degree and having expertise in mental health and concepts used in the scale and a doctoral student majoring in teaching the Chinese language. The researchers then compared and synthesized the differences and modifications in the two translations to develop a preliminary version of the scale. It was submitted for review to two experts who have been engaged in mental health research for 10 years. In addition, two individuals with no experience using the scale were invited separately to do back-translations. One was a nursing professor who is bilingual and has worked in an English-speaking country for at least 10 years and the other was a master's student in English. The researchers compared the back-translation versions with the original scale, discussed and reviewed it with four translators to develop a Chinese version of the original scale.

The scale was used to measure participants' ATSPPH and included two dimensions: openness to seeking professional help for emotional problems (*items 1, 3, 5, 6, 7*) with item scores ranging from zero (disagree) to three (agree); value and need in seeking professional help (*items 2, 4, 8, 9, 10*) with items scored in reverse (zero = agree and three = disagree). The total score of the scale ranges from zero to 30 with higher scores indicating a better help-seeking attitude. The cut-off score on the scale is greater than 20 points and for each dimension is greater than 10 points; otherwise, the attitude is deemed to be negative.

In the original study of college students, the short version of the scale demonstrated internal consistency ranging from 0.82 to 0.84, a one-month test–retest reliability of 0.80; and, a correlation of 0.87 with the longer scale (45). It had good validity and could distinguish whether they were willing to seek professional psychological help (46). In the current study, internal consistency was shown with a Cronbach's  $\alpha$  for the entire scale and the two subscales of 0.681, 0.714 and 0.657, respectively. The test-retest reliability was 0.895 for the entire scale, 0.781 for the openness scale and 0.827 for the value and need scale. The Chinese version of the ATSPPH-SF is suggested to be valid and reliable. The item content validity (I-CVI) was 0.833–1.000, and the scale content validity index (S-CVI) was 0.932. The result of exploratory factor analysis showed that the cumulative contribution rate of the two common factors was 45.346%, the correlation coefficient between each dimension and the total score of the scale was 0.755–0.772, and the correlation coefficient of the two dimensions was 0.167, both of which were statistically significant ( $P < 0.01$ ). The KMO value was 0.783, Bartlett's test

$\chi^2 = 1505.611$ ,  $P < 0.01$ . Confirmatory factor analysis showed that each indicator fit well ( $\chi^2/df = 2.53$ , RMR = 0.035, RMSEA = 0.054, NFI = 0.927, CFI = 0.938) (47). Thus, the use of a two-factor analysis model in this study was found to be robust.

### Centre for Epidemiological Studies Depression Scale (CES-D)

The CES-D scale (48) has 20 items with a four-point Likert scale ranging from 0 (no or hardly) to 3 (almost always) (49), which is used to screen for participants' weekly depressive symptoms. The total score ranges from zero to 60 with higher scores indicating greater depressive symptoms. In the current study, the Cronbach's  $\alpha$  was 0.873.

### Family APGAR Index

To measure an individual's satisfaction with family functioning, the current study used the Family APGAR Index developed by Smilkstein (50). It consists of five items standing for Adaptation, Partnership, Growth, Affection, and Resolution and uses a three-point Likert scoring from 0 (hardly ever) to 2 (almost always). The total score ranges from zero to 10 with higher scores indicating better family function. Good reliability was shown in this study with a Cronbach's  $\alpha$  of 0.889.

### Depression Stigma Scale (DSS)

This scale was used to measure personal and public stigma toward depression (51) and had good reliability with a Cronbach's  $\alpha$  of 0.814. It consists of 18 items with two subscales: personal stigma (personal attitude on depression) and public stigma (attitudes toward others' views on depression). Each subscale includes nine items using a five-point Likert scoring, which ranges from 4 (strongly agree) to 0 (strongly disagree). Total scores on each of the two subscales ranges from zero to 36 points with a higher score representing increased personal and public stigma.

### Depression Specific Self-Management (DSSM) Scale

To measure the depressive knowledge of a community-dwelling population, the current study selected the first dimension of this scale: specific knowledge of depression (items one to four) (52). This scale uses a five-point Likert scoring with a higher score indicating a higher level of depression knowledge. The Cronbach's  $\alpha$  was 0.542 in the current study.

### General Help-Seeking Questionnaire (GHSQ)

The community residents' help-seeking intention for psychological problems was measured by the GHSQ which includes informal and professional help-seeking sources (53). The latter was used to measure the professional help-seeking intention. It uses a seven-point Likert scale ranging from 1 (extremely unlikely) to 7 (extremely likely) with higher scores indicating greater help-seeking intention. Reliability was good with a Cronbach's  $\alpha$  of 0.618.

## Statistical Analysis

Data analysis was conducted using SPSS 22.0. Descriptive statistics were used to analyze variables. Frequency, means, and

standard deviations were used to describe participants' characteristics and ATSPPH-SF scores. To better understand the difference in the ATSPPH between China and other different regions, independent sample *t*-tests were performed. Independent sample *t*-tests and one-way ANOVA tests were conducted to assess ATSPPH-SF scores with categorical variables. Pearson correlation analysis was to explore the relationship between continuous variables (e.g. age, family function, stigma, help-seeking intention, depressive symptoms, and depression knowledge) and help-seeking attitude. Variables that were statistically significant ( $P < 0.05$ ) based on a one-way ANOVA test, independent sample *t*-test, and Pearson correlation analysis were entered into a multiple linear regression model, which was used to explore the significant correlates of help-seeking attitude. The multicollinearity was tested using SPSS when conducting the multiple linear regression analyses, which confirmed that there were no issues of multicollinearity (VIF ranged from 1.016 to 1.670). The pattern of missing data per variable was missing completely at random (Little's MACR test: Chi-square = 51.947, *df* = 44,  $P = 0.192$ ). Respondents with four or more missing values on the included variables were excluded. When a questionnaire lacked  $\leq 4$  item responses, the mean score of non-missing items was used in place of the scores of the missing items. Results were considered statistically significant with a level of  $P < 0.05$ .

## RESULTS

### Sample Characteristics

There were 912 participants included: 255 were male (27.9%) and 657 were female (72.1%). The average age was  $38.66 \pm 17.34$  years (see **Table 1**). In addition, the score of the Family APGAR Index ranged from 0 to 10 (Mean = 7.20, *SD* = 3.01), indicating participants had good family function on average. The score of personal stigma ranged from 2 to 36 ( $M = 19.22$ , *SD* = 5.04) and public stigma ranged from 5 to 36 ( $M = 21.94$ , *SD* = 5.02). The score of depression knowledge ranged from 4 to 20 ( $M = 14.14$ , *SD* = 2.35) and the score of help-seeking intention from professionals ranged from 9 to 63 ( $M = 22.09$ , *SD* = 13.97).

### Scores of the ATSPPH-SF

The total score on the ATSPPH-SF was less than 20 ( $M = 18.13$ , *SD* = 5.63) indicating that overall attitude was negative. The score on openness was near the critical value of 10 ( $M = 10.05$ , *SD* = 3.74) indicating a neutral attitude and the score on value and need was less than 10 points ( $M = 8.09$ , *SD* = 3.53) indicating a negative attitude. Participants were in greatest agreement on the third item "If I were experiencing a serious emotional crisis at this point in my life, I would be confident that I could find relief in psychotherapy" having the highest score ( $M = 2.32$ , *SD* = 0.93) and with the ninth item "Each person should solve their own problem and not seek psychological consultation unless absolutely necessary" having the lowest score ( $M = 1.46$ , *SD* = 1.14) on reverse scoring. Items of least agreement among the participants were the sixth item "I might want to have psychological counseling

**TABLE 1 |** Socio-demographic characteristics of the study sample ( $N = 912$ ).

Characteristics	n	%
Gender ( $n = 912$ )		
Male	255	28.0
Female	657	72.0
Religious affiliation ( $n = 909$ )		
No	865	95.2
Yes	44	4.8
Education level ( $n = 911$ )		
Less than high school	176	19.3
Junior high school/high school/some college	402	44.1
Bachelor's degree or higher	333	36.6
Father's education level ( $n = 889$ )		
Less than high school	468	52.6
Junior high school/high school/some college	329	37.0
Bachelor's degree or higher	92	10.3
Mother's education level ( $n = 887$ )		
Less than high school	565	63.7
Junior high school/high school/some college	263	29.7
Bachelor's degree or higher	59	6.6
Spouse's education level ( $n = 627$ )		
Less than high school	171	27.3
Junior high school/high school/some college	269	42.9
Bachelor's degree or higher	187	29.8
Employment status ( $n = 909$ )		
Unemployed/laid-off/retired	295	32.5
Full time/part time	614	67.5
Employment type ( $n = 860$ )		
Skilled worker/farmer/business man/other	225	26.2
General company/state-owned enterprise or public institution staff/civil servant	483	56.2
Students	152	17.7
Marital status ( $n = 907$ )		
Single/separated/divorced/widowed	319	35.2
Cohabiting/married/remarried	588	64.8

in the future" ( $M = 1.60$ , *SD* = 1.16) and the second item "The idea of talking about problems with a psychologist strikes me as a poor way to get rid of emotional conflicts" ( $M = 2.23$ , *SD* = 1.02) (see **Table 2**).

An investigation of ATSPPH in western Pacific regions showed that a lower score was found in the Philippines ( $M = 16.83$ , *SD* = 4.13,  $t = 2.759$ ,  $P = 0.006$ ), but there were no significant differences in Fiji ( $M = 18.47$ , *SD* = 7.76,  $t = -0.644$ ,  $P = 0.520$ ) and Cambodia ( $M = 18.69$ , *SD* = 3.47,  $t = -1.182$ ,  $P = 0.238$ ) (26). There were also lower average scores ( $M = 17.4$ , *SD* = 5.5,  $t = 3.602$ ,  $P < 0.001$ ) in Europe including Germany ( $M = 17.2$ , *SD* = 4.4,  $t = 4.405$ ,  $P < 0.001$ ), Hungary ( $M = 13.9$ , *SD* = 4.3,  $t = 18.555$ ,  $P < 0.001$ ), Ireland ( $M = 18.4$ , *SD* = 5.4,  $t = -1.070$ ,  $P < 0.001$ ), and Portugal ( $M = 20.0$ , *SD* = 5.7,  $t = -7.222$ ,  $P < 0.001$ ) which had a higher score than the results of this study ( $M = 18.13$ , *SD* = 5.63) (25). Higher scores were also found in the USA ( $M = 20.45$ , *SD* = 5.51,  $t = -5.226$ ,  $P < 0.001$ ) (54).

### Differences in the ATSPPH Scores According to Participants' Socio-Demographic Characteristics

The results of ANOVA-test and *t*-test indicated that there were significant differences in gender, education level, father's and spouse's education level, employment, and marital status related to openness to seeking professional psychological help. Gender,

**TABLE 2 |** Scores on the attitude toward seeking professional psychological help scale-short form (ATSPPH-SF).

Items	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
1. If I believed I was having a mental breakdown, my first inclination would be to get professional attention.	2.05	1.12	0.00	4.00
*2. The idea of talking about problems with a psychologist strikes me as a poor way to get rid of emotional conflicts.	2.23	1.02	0.00	3.00
3. If I were experiencing a serious emotional crisis at this point in my life, I would be confident that I could find relief in psychotherapy.	2.32	0.93	0.00	3.00
*4. There is something to admire about a person who copes with conflicts and fears without going for professional help.	1.46	1.14	0.00	3.00
5. I would want to get psychological help if I was worried or upset for a long period of time.	2.17	1.03	0.00	4.00
6. I might want to have psychological counseling in the future.	1.60	1.16	0.00	4.00
7. A person with an emotional problem is not likely to solve it alone; he or she is likely to solve it with professional help.	1.91	1.01	0.00	3.00
*8. Considering the time and expense involved in psychotherapy, it would have little value for a person like me.	1.72	1.07	0.00	3.00
*9. A person should work out his or her own problems; getting psychological counseling would be a last resort.	1.16	1.11	0.00	3.00
*10. Personal and emotional troubles, like many things, tend to work out by themselves.	1.51	1.16	0.00	3.00
Total score	18.13	5.64	0.00	30.00
Openness to seeking treatment for emotional problems	10.05	3.74	0.00	15.00
Value and need in seeking treatment	8.09	3.53	0.00	15.00

*Openness to seeking professional psychological help for emotional problems (item #1, 3, 5, 6, 7); (0 = disagree, 1 = partially disagree, 2 = partially agree, 3 = agree).*

*\*Value and need in seeking professional psychological help (item #2, 4, 8, 9, 10); (0 = agree, 1 = partially agree, 2 = partially disagree, 3 = disagree).*

*M, mean; SD, standard deviation; Min, Minimum score; Max, Maximum score.*

religion, education level, parents' and spouses' education level, employment, and marital status had statistically significant differences related to value and need in seeking professional help (see **Table 3**).

## Pearson Correlation Analysis Between ATSPPH and Continuous Variables

**Table 4** shows that age, family function, depression literacy, and help-seeking intention positively correlated to "openness" to help-seeking. Of these, age, depression literacy, and help-seeking intention were positively correlated to "value and need" of professional psychological help. In addition, personal stigma was negatively related to help-seeking attitude on "openness" and "value and need." Public stigma was also negatively related to help-seeking attitude on "value and need" (see **Table 4**).

## Influencing Factors on the ATSPPH

Two multiple linear regression models were both statistically significant,  $F_{\text{openness}} = 30.616$ ,  $P < 0.001$ , with a R-square value ( $R^2$ ) of 0.149;  $F_{\text{value and need}} = 39.412$ ,  $P < 0.001$ ,  $R^2 = 0.153$ . Results showed that participants who were female (Beta = 0.079;

95%CI: 0.140, 1.172), were employed (Beta = 0.112; 95%CI: 0.400, 1.389), had better family function (Beta = 0.068; 95%CI: 0.007, 0.160), as well as increased help-seeking intention (Beta = 0.288; 95%CI: 0.060, 0.093) and depression literacy (Beta = 0.156; 95%CI: 0.150, 0.348) were significantly associated with higher scores in openness to seeking professional help for emotional problems. Older participants (Beta = -0.208; 95%CI: -0.056, -0.029), those having personal (Beta = -0.150; 95%CI: -0.159, -0.049) and public stigma (Beta = -0.103; 95%CI: -0.123, -0.021) were significantly associated with lower "value and need in seeking professional help," while those with increased help-seeking intention (Beta = 0.125; 95%CI: 0.016, 0.047) had a more positive attitude (see **Table 5**).

## DISCUSSION

### ATSPPH

The ATSPPH was negative in this Chinese community-dwelling population ( $M = 18.13$ ,  $SD = 5.63$ ). Compared with the findings in different regions, it can be seen that the ATSPPH in China is more positive than in the Philippines ( $M = 16.83$ ,  $SD = 4.13$ ) (26) and most European regions ( $M = 17.4$ ,  $SD = 5.5$ ) such as Germany ( $M = 17.2$ ,  $SD = 4.4$ ) and Hungary ( $M = 13.9$ ,  $SD = 4.3$ ) (25). However, there are still gaps, compared with the more positive help-seeking attitude in the USA ( $M = 20.45$ ,  $SD = 5.51$ ) (54) and Portugal ( $M = 20.0$ ,  $SD = 5.7$ ) (25). Thus, there is a need to focus on improving understanding of and attitudes regarding professional psychological support in China.

There are several reasons from a cultural, social, and individual point of view to explain this negative help-seeking attitude. Culturally, some Chinese perceive psychotherapy as an inefficient and impractical way of dealing with problems affected by traditional beliefs (55). They may be reluctant to discuss their emotions openly with others to save face (56). In addition, some Chinese believe mental illness is caused by emotional disharmony or by evil spirits (56). People who have cultural prejudice would link mental illness to personal shortcomings and reinforce their stigma (57, 58). Hence, they prefer to solve distress on their own by repressing their emotional problems instead of seeking help from others (32).

Socially, mental health literacy is low in the general population and the spread of psychological education is insufficient (59). For instance, some people regard their psychological distresses as normal and these distresses can go away (60). There is a lack of mental health services in China (61) and the number of qualified community MHPs is very low (62), especially in rural regions. There is evidence that one reason for not seeking help is that members of the community do not know where to go to seek professional help (32).

From the individual's perspective, their ATSPPH may be affected by the severity and complexity of their psychological problems. People with less severe mental disorders are more likely to choose informal help (11); but unfortunately, those with severe mental disorders do not seek help due to a lack of insight (63). It is suggested that a negative perception of psychological

**TABLE 3 |** Comparison of the ATSPPH-SF scores by socio-demographic characteristics.

Characteristics	Openness to seeking professional help				Value and need in seeking professional help			
	M(SD)	t	F	P-value	M (SD)	t	F	P-value
<b>Gender (n = 912)</b>		-2.451		0.015		2.211		0.027
Male	9.56(3.71)				8.49(3.39)			
Female	10.23(3.74)				7.93(3.58)			
<b>Religion affiliation (n = 909)</b>		0.190		0.850		2.617		0.009
No	10.04(3.69)				8.15(3.48)			
Yes	9.93(4.71)				6.73(4.24)			
<b>Education level (n = 911)</b>			7.579	0.001			21.144	<0.001
Less than high school	9.06(4.91)				6.68(3.84)			
Junior high school/high school/some college	10.25(3.51)				8.1(3.51)			
Bachelor's degree or higher	10.31(3.18)				8.77(3.14)			
<b>Father's education level (n = 889)</b>			3.809	0.023			8.815	<0.001
Less than high school	9.83(4.03)				7.71(3.64)			
Junior high school/high school/some college	10.55(3.27)				8.76(3.30)			
Bachelor's degree or higher	9.92(2.99)				8.21(3.01)			
<b>Mother's education level (n = 887)</b>			0.949	0.387			8.475	<0.001
Less than high school	10.02(3.90)				7.77(3.59)			
Junior high school/high school/some college	10.40(3.27)				8.80(3.17)			
Bachelor's degree or higher	10.05(3.01)				8.56(3.34)			
<b>Spouse's education level (n = 627)</b>			5.287	0.005			10.706	<0.001
Less than high school	9.27(4.78)				6.62(3.70)			
Junior high school/high school/some college	10.28(3.84)				7.88(3.62)			
Bachelor's degree or higher	10.58(3.44)				8.29(3.39)			
<b>Employment status (n = 909)</b>		-4.051		<0.001		-7.521		<0.001
Unemployed/laid-off/retired	9.33(4.59)				6.85(3.62)			
Full time/part time	10.40(3.20)				8.68(3.34)			
<b>Employment type (n = 860)</b>			2.135	0.119			15.274	<0.001
Skilled worker/farmer/business man/other	9.71(4.51)				7.57(3.84)			
General company/state-owned enterprise or public institution	10.24(3.68)				7.91(3.48)			
staff/civil servant								
Students	9.70(2.80)				9.48(2.89)			
<b>Marital status (n = 907)</b>		-1.165		0.244		4.105		<0.001
Single/separated/divorced/widowed	9.86(3.30)				8.71(3.25)			
Cohabiting/married/remarried	10.15(3.96)				7.74(3.64)			

M, mean; SD, standard deviation; t, independent sample t-test; F, ANOVA-test ATSPPH-SF, attitude toward seeking professional psychological help scale-short form.

**TABLE 4 |** Correlation between age, help-seeking intention, stigma, depressive symptoms, depression literacy, family function, and ATSPPH.

Variables	Openness to seeking professional help		Value and need in seeking professional help	
	Correlation coefficient(r)	P-value	correlation coefficient(r)	P-value
Age	-0.081	0.014	-0.306	<0.001
Help-seeking intention	0.278	<0.001	0.198	<0.001
Personal stigma	-0.119	<0.001	-0.304	<0.001
Public stigma	-0.042	0.208	-0.222	<0.001
Depression symptoms	0.019	0.570	-0.029	0.389
Depression literacy	0.203	<0.001	0.079	0.018
Family function	0.103	0.002	0.031	0.356

professionals is also a barrier to seeking professional help (10), for instance, being skeptical about the effectiveness of psychological help or the competence of MHPs (64) or having had an unpleasant experience with professionals (63).

## Factors Related to ATSPPH Socio-Demographic Characteristics

Participants in this study had an increasingly negative attitude toward value and need in seeking professional psychological help with increasing age. Older persons may tend to seek help from family or friends rather than professional resources (65). They are rich in life experience and more deeply influenced by Chinese culture (66), making them feel that they have abilities to solve problems and are not willing to seek help. This perspective contrasts with that of younger people who suffer from more mental problems caused by various stresses related to maladaptation, so their demand for professional psychological help is higher than that of older people (67, 68). Moreover, younger people easily obtain more information about mental health from school, the workplace, or the Internet, thus they have a better attitude toward the value of professional help (34).

Consistent with most studies, men had a more negative ATSPPH (32, 33, 69). Masculinity including masculine norms and alexithymia may limit men's ability to express grief (69). They feel shamed talking about emotional problems (70) and fear damaging the ideal image of the male when seeking help from others (41). In addition, men have alternative solutions to alleviate



**TABLE 5 |** Correlates of attitudes toward seeking professional psychological help (ATSPPH) conducted by multiple linear regression.

Variables	Openness to seeking professional help				Value and need in seeking professional help			
	B(SE)	Beta	P-value	95%CI	B(SE)	Beta	P-value	95%CI
Gender (Male = 0, Female = 1)	0.656(0.263)	0.079	0.013	0.140 1.172	—	—	—	—
Employment status (No = 0, Yes = 1)	0.894(0.252)	0.112	<0.001	0.400 1.389	—	—	—	—
Age	—	—	—	—	−0.042(0.007)	−0.208	<0.001	−0.056 −.029
Help-seeking intention	0.077(0.008)	0.288	<0.001	0.060 0.093	0.031(0.008)	0.125	<0.001	0.016 0.047
Family function	0.083(0.039)	0.068	0.033	0.007 0.160	—	—	—	—
Personal stigma	—	—	—	—	−0.104(0.028)	−0.150	<0.001	−0.159 −0.049
Public stigma	—	—	—	—	−0.072(0.026)	−0.103	0.006	−0.123 −0.021
Depression literacy	0.249(0.050)	0.156	<0.001	0.150 0.348	—	—	—	—

"Stepwise" method used in the multivariate models.

B, unstandardized coefficients; SE, standard error; Beta, standardized coefficients.

Employment status: No: Unemployed/laid-off/retired; Yes: Full/part time.

pain such as alcohol, drugs, and aggressive behaviors (41). These explain why they do not actively seek professional help.

### Social Support

This study found that people who have good social support (relative to employment status and good family function) have a better ATSPPH. There is evidence that employment status is positively associated with psychological openness (35). Individuals who are employed have more opportunities for communication and interaction with others in their work setting, could solve problems more effectively and have a greater sense of self-worth; thus, they are more open to seek mental health professionals when encountering psychological problems (35). In addition, having a source of income also provides financial support to facilitate help-seeking actions (26).

Good family function had a positive effect on help-seeking attitude. In China, family plays a vital role in providing affective support and psychological comfort (71, 72). Family members can offer advice and share guidelines on problem-solving (73) and decision making (74) and they are always the first source of help-seeking when a family member encounters emotional distress (19, 26, 65).

### Depressive Literacy

Consistent with previous research, having greater depressive knowledge was significantly associated with a positive attitude toward professional help-seeking (26, 32, 36). People with greater knowledge may diminish the stigma related to mental disorders, and they are more willing to seek professional help according to their need (26, 33, 75).

### Stigma and Help-Seeking Intention

Consistently, stigma was cited as a negative factor affecting professional psychological help-seeking attitude (10, 76, 77). On one hand, people with personal stigma may hide their thoughts to avoid addressing emotional problems, as they would feel uncomfortable, ashamed, and embarrassed to talk about these with professionals (67). Another issue is related to how the public labels individuals with mental disorders as "sick, neurotic," so individuals are fearful of being laughed at and discriminated against when seeking professional psychological help (78).

Notably, a significant finding of this study revealed that increased help-seeking intention is positively associated with help-seeking attitude. As previously known, the theory of planned behavior (TPB) confirmed that the more positive an individual's attitude, the stronger an individual's intention would be (20). However, a confirmatory study found that changing a person's intention can result in a change of attitude in turn (40), that is, the greater the intention, the better the attitude.

It is worth noting that the R-square values for the two regression models were both small. However, a low R-square value does not negate the importance of any significant variables (79). The theory of planned behavior (TPB) (20) suggests that attitudes can be affected by behavioral beliefs and attitudes can predict behaviors by indirectly affecting intentions. The theory of knowledge-attitude-practice (KAP) (80) espouses that knowledge can change one's attitude. Based on these theories, this study explored the relationship between ATSPPH and help-seeking intention, stigma, social support, and depression literacy. And the results showed that these factors were significantly associated with ATSPPH though they might not account for more variance. This provides a reference for further exploration of help-seeking attitudes, intention, and behaviors in future research. Moreover, it can be seen that regression models in psycho-social studies (including the studies of help-seeking attitude) usually had small R-square values. For example, one study about the help-seeking attitude found that the factors accounted for 11.4% of the variance in the multiple regression model (81) and another study had an R-square value of 0.16 (82).

### LIMITATIONS

There are several limitations to this research which derived from a large-scale survey. First, this is a cross-sectional survey, so a causal relationship between help-seeking attitude and its influencing factors cannot be drawn. Second, the use of self-rating scales focused on depressive symptoms, personal and public stigma related to depression, and help-seeking intention may result in bias as participants may respond in a socially desirable manner. Third, this study was completed in one city in central China, which limits the generalizability of the findings to other areas of the country. While this study identified statistically



significant predictors for the ATSPPH score, the clinical implications and characteristics related to these findings should be considered due to the low beta coefficient values.

## CONCLUSIONS AND IMPLICATIONS

In general, the Chinese attitude toward seeking professional assistance with mental health issues is not positive. Positive factors affecting this attitude include being female, of a younger age, having social support and help-seeking intention, while the negative factor is stigma. More attention should be paid to vulnerable groups (e.g. older adults, males, and the unemployed).

Based on the current research findings, it is important to consider methods to promote better help-seeking attitudes in the general population by eliminating cultural bias and reducing stigma associated with mental health issues and educating the public about the importance of mental health. The focus of these efforts should be centered on older adults and males. Emphasis should be placed on the use of social media channels to spread relevant information to increase mental health literacy. Government programs focused on mental health education and services should be expanded to close the gap between urban and rural areas and increase accessibility to these programs for the community-dwelling population. In addition, there is a need to strengthen education and training of mental health professionals to promote greater trust between those who seek services and the providers.

## DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article.

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## ETHICS STATEMENT

Institutional Review Board of Wuhan University School of Medicine granted approval for this study. Written informed consent was obtained from all participants.

## AUTHOR CONTRIBUTIONS

BY, XW and PC designed the study and wrote the research protocol. PC, XL, BY, XW, ZL and JR did the literature review, managed the field survey, quality control, and statistical analysis, and prepared the manuscript draft. XW and BY contributed to the revisions in depth for the manuscript. ZL, XW, BY and JR supervised the survey and checked the data. All authors contributed to and approved the final manuscript.

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# Multidimensional and Physical Frailty in Elderly People: Participation in Senior Organizations Does Not Prevent Social Frailty and Most Prevalent Psychological Deficits

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**Purpose:** The study explores how the involvement in community-based senior organizations affects the prevalence of multidimensional and physical frailty among community dwelling elderly people.

**Materials and Methods:** The group of 1,024 elderly people (270 males) over the age of 65 years (mean age  $72.6 \pm 6.3$  years; range 65–93 years) took part in this study. The subjects completed a questionnaire regarding multidimensional (i.e., the Tilburg Frailty Indicator, TFI) and physical frailty (i.e., the FRAIL scale), as well as factors associated with frailty and participation in senior organizations.

**Results:** The prevalence of multidimensional frailty (if at least 5 points in the TFI) was 54.6%, and the prevalence of physical frailty (if at least 3 points in the FRAIL scale) and a non-robust status (if any point in the FRAIL scale was positive) was 6.3 and 52.9%, respectively. The most prevalent frailty deficits were missing other people (66.6%), feeling nervous or anxious (65.9%), and feeling down (65.5%). Members of senior organizations presented a lower prevalence of multidimensional and physical frailty comparing with non-members. This was mainly caused by a lower prevalence of physical deficits and problems with memory; however, the prevalence of social deficits was similar in both groups. Senior organizations had no influence on the most widespread frailty deficits, i.e., missing other people, feeling nervous or anxious, and feeling down.

**Conclusions:** Multidimensional frailty and physical non-robust status are common among people over the age of 65 years. Participation in senior organizations is associated with lower risk of physical frailty; however, it has no effect on social frailty and the most prevalent psychological deficits. This information has important implications for practical management with senior problems and may influence community strategies concerning elderly people.

**Keywords:** frailty, multidimensional frailty, non-robust, frail scale, Tilburg Frailty Indicator



## INTRODUCTION

Since the human society is aging, age-related problems are becoming more and more prevalent in the general population (1). Frailty is one such problem associated with the ongoing demographic changes, and it constitutes a significant burden for both health and social systems as well as national economies (2, 3). Frailty is usually considered as a set of physical deficits causing a decrease in overall reserve capacity; however, it can also concern psychological and social domains of human functioning (4–7). Deficits in any of these domains may result in deficits in another, and their interactions accelerate functional decline of the elderly people. Therefore, an approach to frailty should be multidimensional (i.e., physical, psychological, and social) because such a concept more adequately reflects a complexity of the decrease in physiological reserves associated with aging (6, 8, 9). Moreover, the elderly people may present different types of functional deterioration and hence require an individualized approach to ensure their independence and good functioning (10).

Community-based senior organizations are considered to be a platform which may increase physical activities among elderly people, their social connections, and their mental functions. Such organizations gather people in a social atmosphere in their community-based meeting points and may help in promotion and realization of various healthy projects (11). However, despite all these potentials, little is known about how the participation in these organizations influences the prevalence of frailty and, particularly, its impact on different frailty dimensions.

This study explores how the involvement in community-based senior organizations affects the frailty prevalence as well as physical, psychological, and social domains of human functioning among community dwelling elderly people.

## MATERIALS AND METHODS

### Participants

People at the age over 65 years living in a community in Opole District (southwest Poland) were considered for this cross-sectional study. The subjects completed a questionnaire regarding multidimensional and physical frailty, as well as factors associated with frailty and participation in senior organizations. The questionnaire was anonymous and contained short information on the study purpose as well as rationale; the study protocol was approved by the Ethics Committee at the Poznan University of Medical Sciences. Questionnaires were distributed during healthy lifestyle promoting meetings organized by local community-based senior organizations in the period December 2017 and December 2018. These open-access meetings were dedicated to all elderly people living in a region (not only to the organizations members) and they were advertised by appropriate posters. Details on the data collection have been described elsewhere (10).

Multidimensional frailty has been evaluated using part B of the Tilburg Frailty Indicator (TFI) which contains 15 frailty components arranged according to three different domains. The physical domain (0–8 points) consists of eight items related

to poor physical health, unintentional weight loss, difficulty in walking, difficulty in maintaining balance, poor hearing, poor vision, lack of strength in hands, and physical tiredness. The psychological domain (0–4 points) comprises four components related to problems with memory, feeling down, feeling nervous or anxious, and inability to cope with problems. The social domain (0–3 points) consists of three elements associated with living alone, missing other people, and lack of support from other people. The TFI total score may rank from 0 to 15; by definition, frailty is established if the TFI score is at least 5 (9). Part A of TFI is the basis for the assessment of risk factors predisposing to frailty which includes age, gender, education level, economic status, lifestyle, marital status, experiences with different unfavorable events in recent time, and satisfaction with living conditions (9). The TFI has been adapted and validated for Polish population by Uchmanowicz et al. (12, 13).

Physical frailty has been assessed with the help of the FRAIL scale which includes five components related to physical tiredness/fatigue, inability to walk up one flight of stairs, inability to walk 200 m, unexplained body mass loss, and a number of chronic diseases (14, 15). Unexplained body mass loss is scored 1 if respondents report their weight decline of 6 kg or more during the last 6 months, or 3 kg or more during the last month. The presence of 5 or more chronic diseases yields score 1; otherwise, it is scored 0. FRAIL scale scores range from 0–5 and may represent frail (3–5 points), pre-frail (1–2 points), and robust (0 points) status (14, 15).

The subjects were also asked about a place of living (city or village), former occupation (intellectual or physical one), and whether they participated in community-based senior organizations.

### Community-Based Senior Organizations

In Poland, senior organizations are financed either by local government or by non-profit organizations, and they are run by seniors themselves; in addition, they may be supported by workers of local social centers. These organizations integrate elderly people from different societies and generations, and their goal is to motivate seniors to take active part in the local social life, establish new connections, and spend time together. Such organizations promote healthy lifestyle, particularly encourage seniors to increase their physical and mental activities, propagate culture and art, and provide courses concerning computer technologies and diverse domains of knowledge as well as language courses. They organize trips, social meetings, theater and movie shows, as well as meetings with various experts and personalities. The organizations cooperate with each other and they also establish international cooperation. Activities are scheduled monthly and they are announced on websites and local meeting points. Memberships in these organizations is voluntary and usually free of charge.

### Statistical Analysis

Descriptive data are presented as mean  $\pm$  standard deviation (SD) or frequency and percentage as appropriate. The normality of the variables was tested using the Kolmogorov–Smirnov test and visual inspection of histograms. Although most variables



did not reveal a normal distribution, they were presented as mean  $\pm$  SD to enable numerical comparisons. Differences between variables were compared using the Mann-Whitney-*U*-test or the Fisher's exact test. Independent determinants of participation in community-based senior organizations were identified with logistic regression through multiple testing. Variables with  $p > 0.1$  in adjusted analyses were not retained in the final model. Determination coefficient ( $R^2$ ) and area under curve (AUC) were calculated for the regression model. The threshold probability of  $p < 0.05$  was taken as the level of statistical significance. All analyses were performed using NCSS 12 Statistical Software (2018), NCSS, LLC, Kaysville, Utah, USA, [ncss.com/software/ncss](http://ncss.com/software/ncss).

## RESULTS

### Participants Characteristics

The study group comprised 1,024 participants over the age of 65 years (mean age  $72.6 \pm 6.3$  years; range 65–93 years) and 270 were males. Most of the subjects presented a high school education level and a moderate economic status, they usually followed a partially healthy or healthy lifestyle, and 44.9% of them participated in senior organizations. A majority of them lived in a city and previously had intellectual occupations, half of them lived in relationships, some of them experienced various events and diseases; however, 88.2% declared satisfaction with living conditions. The detailed characteristics including frailty components are given in **Table 1**. The prevalence of multidimensional frailty (i.e., if at least 5 points in the TFI) was 54.6%, the prevalence of physical frailty (i.e., if at least 3 points in the FRAIL scale) was 6.3%, and a non-robust status (i.e., if any point in the FRAIL scale was positive) was diagnosed in 52.9%. Among all frailty components, those with the highest prevalence were missing other people (66.6%), feeling nervous or anxious (65.9%), and feeling down (65.5%).

### Participation in Community-Based Senior Organizations

**Table 2** presents differences between members and non-members of senior organizations. Subjects participating in senior groups were slightly younger and presented a higher education level and economic status, a majority of them lived in a city and had a former intellectual occupation; they less commonly experienced the death of a loved person, serious illness, or a traffic accident, and they also declared higher satisfaction with living conditions. In terms of TFI, the individuals from senior groups revealed a lower prevalence of all physical components (items 1–8) and problems with memory (item 9); however, they more often lived alone (item 13). Consequently, they presented a lower rate of multidimensional frailty comparing with non-members of senior groups, i.e., 44.1 vs. 63.1%,  $p < 0.0001$ , respectively. This was mainly caused by a lower number of physical deficits and memory problems. However, the sum of social deficits and the prevalence of the most common frailty components (i.e., missing other people, feeling nervous or anxious, and feeling down) were not different in both groups (**Table 2**). According to the FRAIL scale, members of senior groups presented lower levels

**TABLE 1 |** Study group characteristics.

Characteristic	Overall group (N = 1,024)
Age	72.6 $\pm$ 6.3
Male sex	270 (26.4)
Primary school education level	258 (25.2)
High school education level	464 (45.3)
University education level	302 (29.5)
Low economic status	152 (14.8)
Moderate economic status	835 (81.5)
High economic status	37 (3.6)
Unhealthy lifestyle	54 (5.3)
Partially healthy lifestyle	532 (52.0)
Healthy lifestyle	438 (42.8)
Participation in a senior organization	460 (44.9)
Living in a city	746 (72.9)
Living in a relationship	529 (51.7)
Former intellectual occupation	646 (63.1)
Death of a loved person in the recent time	389 (38.0)
Serious illness in the recent time	229 (22.4)
Serious illness of a loved person in the recent time	245 (23.9)
End of an important relationship in the recent time	70 (6.8)
Traffic accident in the recent time	59 (5.8)
Criminal event in the recent time	23 (2.2)
Satisfaction with living conditions	903 (88.2)
<i>The Tilburg Frailty Indicator (TFI)</i>	
1. Poor physical health	331 (32.3)
2. Unexplained body mass loss	133 (13.0)
3. Difficulty in walking	371 (36.2)
4. Difficulty in maintaining balance	261 (25.5)
5. Poor hearing	358 (35.0)
6. Poor vision	414 (40.4)
7. Lack of strength in hands	283 (27.6)
8. Physical tiredness/fatigue	465 (45.4)
9. Problems with memory	138 (13.5)
10. Feeling down	671 (65.5)
11. Feeling nervous or anxious	675 (65.9)
12. Inability to cope with problems	188 (18.4)
13. Living alone	384 (37.5)
14. Missing other people	682 (66.6)
15. Lack of support from other people	185 (18.1)
Sum of physical deficits (components: 1–8)	2.6 $\pm$ 2.1
Sum of psychological deficits (components: 9–12)	1.6 $\pm$ 1.1
Sum of social deficits (components: 13–15)	1.2 $\pm$ 0.9
Total score of TFI (all components)	5.4 $\pm$ 3.1
Multidimensional frailty according to TFI	559 (54.6)
<i>The FRAIL scale</i>	
1. Physical tiredness/fatigue	465 (45.4)
2. Inability to walk up one flight of stairs	87 (8.5)
3. Inability to walk 200 m	101 (9.9)
4. Unexplained body mass loss	133 (13.0)
5. Number of chronic diseases	1.9 $\pm$ 1.6
Total score for physical frailty according to the FRAIL scale	0.8 $\pm$ 0.9
Physical frailty according to the FRAIL scale	64 (6.3)
Non-robust status according to the FRAIL scale	542 (52.9)

Values are n (%) or mean  $\pm$  SD.

**TABLE 2 |** Comparison of members and non-members of senior organizations.

Characteristic	Members of senior organizations (N = 460)	Non-members of senior organizations (N = 564)	P-value
Age	<b>71.6 ± 5.8</b>	<b>73.5 ± 6.6</b>	<b>&lt;0.0001</b>
Male sex	108 (23.5)	162 (28.7)	0.06
Primary school education level	<b>61 (13.3)</b>	<b>197 (34.9)</b>	<b>&lt;0.0001</b>
High school education level	<b>241 (52.4)</b>	<b>223 (39.5)</b>	<b>&lt;0.0001</b>
University education level	<b>158 (34.3)</b>	<b>144 (25.5)</b>	<b>&lt;0.01</b>
Low economic status	<b>45 (9.8)</b>	<b>107 (19.0)</b>	<b>&lt;0.0001</b>
Moderate economic status	<b>399 (86.7)</b>	<b>436 (77.3)</b>	<b>&lt;0.001</b>
High economic status	16 (3.5)	21 (3.7)	0.86
Unhealthy lifestyle	24 (5.2)	30 (5.3)	0.94
Partially healthy lifestyle	250 (54.3)	282 (50.0)	0.17
Healthy lifestyle	186 (40.4)	252 (44.7)	0.17
Participation in a senior organization	–	–	–
Living in a city	<b>370 (80.4)</b>	<b>376 (66.7)</b>	<b>&lt;0.0001</b>
Living in a relationship	231 (50.2)	298 (52.8)	0.41
Former intellectual occupation	<b>343 (74.6)</b>	<b>303 (53.7)</b>	<b>&lt;0.0001</b>
Death of a loved person in the recent time	<b>144 (31.3)</b>	<b>245 (43.4)</b>	<b>&lt;0.001</b>
Serious illness in the recent time	<b>76 (16.5)</b>	<b>153 (27.1)</b>	<b>&lt;0.001</b>
Serious illness of a loved person in the recent time	100 (21.7)	145 (25.7)	0.14
End of an important relationship in the recent time	26 (5.7)	44 (7.8)	0.19
Traffic accident in the recent time	<b>19 (4.1)</b>	<b>40 (7.1)</b>	<b>&lt;0.05</b>
Criminal event in the recent time	14 (3.0)	9 (1.6)	0.13
Satisfaction with living conditions	<b>423 (92.0)</b>	<b>480 (85.1)</b>	<b>&lt;0.001</b>
<i>The Tilburg Frailty Indicator (TFI)</i>			
1. Poor physical health	<b>106 (23.0)</b>	<b>225 (39.9)</b>	<b>&lt;0.0001</b>
2. Unexplained body mass loss	<b>45 (9.8)</b>	<b>88 (15.6)</b>	<b>&lt;0.01</b>
3. Difficulty in walking	<b>116 (25.2)</b>	<b>255 (45.2)</b>	<b>&lt;0.0001</b>
4. Difficulty in maintaining balance	<b>74 (16.1)</b>	<b>187 (33.2)</b>	<b>&lt;0.0001</b>
5. Poor hearing	<b>115 (25.0)</b>	<b>243 (43.1)</b>	<b>&lt;0.0001</b>
6. Poor vision	<b>147 (32.0)</b>	<b>267 (47.3)</b>	<b>&lt;0.0001</b>
7. Lack of strength in hands	<b>84 (18.3)</b>	<b>199 (35.3)</b>	<b>&lt;0.0001</b>
8. Physical tiredness/fatigue	<b>154 (33.5)</b>	<b>311 (55.1)</b>	<b>&lt;0.0001</b>
9. Problems with memory	<b>36 (7.8)</b>	<b>102 (18.1)</b>	<b>&lt;0.0001</b>
10. Feeling down	297 (64.6)	374 (66.3)	0.57
11. Feeling nervous or anxious	303 (65.9)	372 (66.0)	0.97
12. Inability to cope with problems	75 (16.3)	113 (20.0)	0.13
13. Living alone	<b>190 (41.3)</b>	<b>194 (34.4)</b>	<b>&lt;0.05</b>
14. Missing other people	316 (68.7)	366 (64.9)	0.2
15. Lack of support from other people	73 (15.9)	112 (19.9)	0.1
Sum of physical deficits (components: 1–8)	<b>1.8 ± 1.9</b>	<b>3.1 ± 2.1</b>	<b>&lt;0.0001</b>
Sum of psychological deficits (components: 9–12)	<b>1.5 ± 1.0</b>	<b>1.7 ± 1.1</b>	<b>&lt;0.05</b>
Sum of social deficits (components: 13–15)	1.3 ± 0.9	1.2 ± 0.9	0.23
Total score of TFI (all components)	<b>4.6 ± 2.8</b>	<b>6.0 ± 3.2</b>	<b>&lt;0.0001</b>
Multidimensional frailty according to TFI	<b>203 (44.1)</b>	<b>356 (63.1)</b>	<b>&lt;0.0001</b>
<i>The FRAIL scale</i>			
1. Physical tiredness/fatigue	<b>154 (33.5)</b>	<b>311 (55.1)</b>	<b>&lt;0.0001</b>
2. Inability to walk up one flight of stairs	<b>17 (3.7)</b>	<b>70 (12.4)</b>	<b>&lt;0.0001</b>
3. Inability to walk 200 m	<b>16 (3.5)</b>	<b>85 (15.1)</b>	<b>&lt;0.0001</b>
4. Unexplained body mass loss	<b>45 (9.8)</b>	<b>88 (15.6)</b>	<b>&lt;0.01</b>
5. Number of chronic diseases	<b>1.7 ± 1.5</b>	<b>2.0 ± 1.6</b>	<b>&lt;0.05</b>
Total score for physical frailty according to the FRAIL scale	<b>0.5 ± 0.8</b>	<b>1.0 ± 1.0</b>	<b>&lt;0.0001</b>
Physical frailty according to the FRAIL scale	<b>14 (3.0)</b>	<b>50 (8.9)</b>	<b>&lt;0.001</b>
Non-robust status according to the FRAIL scale	<b>181 (39.3)</b>	<b>361 (64.0)</b>	<b>&lt;0.0001</b>

Values are n (%) or mean ± SD. Statistically significant differences and p-values are marked in bold.

**TABLE 3 |** Determinants of participation in community-based senior organizations.

Independent variables	Participation in senior organizations $R^2 = 0.22$ . AUC = 0.75 $p < 0.00001$	
	B (SE)	p-value
Age		
Male sex		
High school education level	<b>1.03 (0.19)</b>	<b>&lt;0.00001</b>
University education level	<b>0.88 (0.21)</b>	<b>&lt;0.0001</b>
Moderate economic status		
High economic status		
Partially healthy lifestyle		
Healthy lifestyle	<b>-0.71 (0.33)</b>	<b>&lt;0.05</b>
Participation in a senior organization	–	–
Living in a city	<b>0.59 (0.17)</b>	<b>&lt;0.001</b>
Living in a relationship	<b>-0.52 (0.15)</b>	<b>&lt;0.001</b>
Former intellectual occupation		
Death of a loved person in the recent time	<b>-0.74 (0.15)</b>	<b>0.00001</b>
Serious illness in the recent time	<b>-0.35 (0.18)</b>	<b>&lt;0.05</b>
Serious illness of a loved person in the recent time		
End of an important relationship in the recent time		
Traffic accident in the recent time		
Criminal event in the recent time	<b>1.04 (0.48)</b>	<b>&lt;0.05</b>
Satisfaction with living conditions		
<i>The Tilburg Frailty Indicator (TFI)</i>	331 (32.3)	
1. Poor physical health		
2. Unexplained body mass loss		
3. Difficulty in walking		
4. Difficulty in maintaining balance	<b>-0.47 (0.18)</b>	<b>&lt;0.01</b>
5. Poor hearing	<b>-0.57 (0.15)</b>	<b>&lt;0.001</b>
6. Poor vision		
7. Lack of strength in hands		
8. Physical tiredness/fatigue	<b>-0.42 (0.15)</b>	<b>&lt;0.01</b>
9. Problems with memory		
10. Feeling down		
11. Feeling nervous or anxious		
12. Inability to cope with problems		
13. Living alone		
14. Missing other people	<b>0.41 (0.15)</b>	<b>&lt;0.01</b>
15. Lack of support from other people	<b>-1.07 (0.31)</b>	<b>&lt;0.001</b>
<i>The FRAIL scale</i>		
1. Physical tiredness/fatigue	<b>-0.42 (0.15)</b>	<b>&lt;0.01</b>
2. Inability to walk up one flight of stairs		
3. Inability to walk 200 m		
4. Unexplained body mass loss		
5. Number of chronic diseases		

Statistically significant coefficients and p-values are marked in bold.

of physical tiredness and a smaller number of chronic diseases; in addition, they less frequently reported an inability to walk up one flight of stairs or 200 m, and an unexplained body mass loss. Consequently, physical frailty was significantly less frequent in members than in non-members of senior organizations (3.0 vs. 8.9%,  $p < 0.001$ ), while a non-robust status accounted for 39.3 vs. 64%,  $p < 0.0001$ , respectively.

Logistic regression analysis revealed several independent determinants for participation in the organized senior groups (Table 3). A high school and university education level as well as living in a city positively determined membership in the senior groups. Subjects were also more likely to belong to these groups if they experienced a criminal event in recent time or missed other people. On the other hand, a healthy lifestyle, living in a relationship, death of a loved person, serious illness, difficulty in maintaining balance, poor hearing, physical tiredness, and a lack of support from other people decreased the likelihood of being involved in senior organizations (Table 3).

## DISCUSSION

In this study, multidimensional frailty was present in 54.6% of 1,024 subjects over the age of 65 years and 6.3% revealed physical frailty, whereas 52.9% were non-robust (i.e., either physically frail or pre-frail). A concept which is intended to solve some of the deficits associated with aging, and consequently, decrease the prevalence of frailty, is a community-based senior organization (11). A wide range of initiatives of such organizations may potentially cover various types of seniors' needs; however, little is known about their impact on different frailty dimensions and which factors encourage people to participate in such initiatives. In this study, subjects who took part in senior organizations presented lower prevalence of all physical frailty deficits in both TFI and the FRAIL scale, as well as had fewer memory problems, yet, they more frequently lived alone. As a result, elderly people associated with senior organizations presented significantly lower prevalence of multidimensional frailty, physical frailty, and non-robust status. Several independent determinants for the participation in senior organizations have been identified, but it is not clear which of these variables are causes and which are effects of the involvement in senior groups. Indeed, numerous physical deficits may preclude elderly people from active participation in the organized senior life, e.g., poor hearing may prohibit them from establishing social connections. On the other hand, it is possible that the involvement in senior communities may motivate elderly people to a higher physical activity, and consequently, such a cohort presents lower physical frailty. However, despite these favorable effects in the physical domain, no such positive outcomes were observed in terms of social domain; in other words, social deficits were not less prevalent, and the sum of these deficits was not smaller in organized senior groups. Poor social relationships are some of the main reasons for low quality of life among elderly people (16–19). Moreover, for frail older individuals social contact is the most important factor for their life, while non-frail subjects

consider health as the most critical one (17). It has been shown that loneliness is an independent determinant for functional decline and mortality in old age (20, 21). Thus, social factors are paramount in elderly populations; however, the present form of senior organizations seems to be ineffective in improving social life. In addition, senior organizations also had no influence on the most prevalent psychological deficits, i.e., feeling down and feeling nervous or anxious. In the report by Gobbens and van Assen (19), feeling down was the only frailty component that had an effect on all aspects of quality of life. Therefore, psychological problems seem to constitute the biggest challenge in dealing with the elderly people. Indeed, aging is associated with an unavoidable awareness of elapsing time, which reminds elderly people of the approaching end of life and significantly affects their psychological condition (7). Depression appears to be an ingredient of the aging process, and hence, it should be early recognized and appropriately treated, giving a chance to improve people's mood and motivation for their active life (22–24). Loneliness and a lack of occupation may lead to the loss of the life purpose which is a key element to activate elderly individuals. It has been shown that a stronger purpose in life among subjects over 50 years is associated with a decreased all-cause and some cause-specific mortality (25). Purposeful living may potentially improve both social and psychological domains of individual's functioning, and thus, this should be a task for community-based senior organizations. Moreover, a life purpose is a correctable risk factor and as such may be subjected to interventions. There are some data indicating that the prevention of physical frailty may defer psychological (cognitive) frailty, and this aspect should also be considered by senior organizations in planning an appropriate management (26, 27). Circumstances and external stimuluses may involve some activities in the elderly people provided that the intensity of these factors does not cross the limits of their capabilities. The necessity to deal with daily needs and various kinds of problems may extract some layers of energy in the elderly people, and it is connected to the aforementioned purposeful life and having a task in life. This is directly related to the idea of aging-in-place, the ideology promoted worldwide by the World Health Organization (28–32). Senior organizations may constitute a critical ingredient for this ideology; however, the present study shows that social and psychological aspects are not sufficiently covered by the current form of these organizations.

Since societies are aging, problems of social frailty along with psychological (or cognitive) frailty will be growing; hence, public awareness of these problems and an adequate adjustment of the activities of senior organizations are essential to abort or defer the functional elderly degradation. In fact, the approach to seniors should be individualized to their needs. Recently, it has been shown that simultaneous employment of TFI and the FRAIL scale may identify elderly people who require different managements, i.e., subgroups presenting predominantly social and psychological frailty and those with mainly physical deficits (10). These simple tools can be used by both seniors themselves or professionals in senior organizations to detect particular needs and plan an individualized management strategy. Moreover, these instruments may be utilized for monitoring the effects of senior organization activities. Indeed, such quality measures of

social, psychological, and physical effects in subjects participating in the senior organizations may reflect their real value and help to improve their effectiveness.

## STUDY LIMITATIONS

The present study has, however, some limitations which should be acknowledged. First, we used self-reported questionnaires which were distributed among elderly people attending meetings dedicated for healthy lifestyle promotion, and therefore, some selection bias cannot be ruled out. Particularly, the participants were predominantly females, which is presumably due to the fact that the meetings probably attracted more females than males. Second, the cross-sectional nature of this study does not permit adequate cause-effect interpretations of the associations between various variables (i.e., the relationships between frailty deficits and the involvement in senior organizations). Third, although the FRAIL scale has been validated as a tool for quick diagnosis of physical frailty, whereas TFI for diagnosis of multidimensional frailty, they do not provide data coming from direct measurements of physical performance.

## CONCLUSIONS

In the community dwelling elderly people over the age of 65 years, more than one half present multidimensional frailty which corresponds to a similar percentage of non-robust subjects (i.e., physically frail or pre-frail). Participation in community-based senior organizations is associated with lower risk of physical frailty, yet, it has no effect on social frailty and the most common psychological problems. Social and psychological deficits are common among elderly people; however, since the present concept of senior organizations seems to be ineffective in solving these problems, some measures should be undertaken in order to adjust the activities of such organizations for the needs of elderly people. These observations have important implications for practical management with senior problems and may influence community strategies concerning elderly people.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available (for scientific cooperation) on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Komisja Bioetyczna przy Uniwersytecie Medycznym w Poznaniu Ul. Bukowska 70, 60-812 Poznań. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.



## AUTHOR CONTRIBUTIONS

MS, JS, and KW-T contributed to the study design, analysis and interpretation of data for the manuscript, critically revised the manuscript for important

intellectual content, and approved the final version of the manuscript to be published. MS collected the data. MS and JS drafted the manuscript. All authors contributed to the article and approved the submitted version.

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

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# The Short-Term Value of the “Healthy Primary School of the Future” Initiative: A Social Return on Investment Analysis

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**Background:** This study examines the social return on investment (SROI) of the “Healthy Primary School of the Future” initiative after 2 years.

**Methods:** Healthy Primary Schools of the Future (HPSF) provide a healthy lunch and daily structured physical activity sessions, whereas Physical Activity Schools (PAS) focus on physical activity only. We evaluated the 2-years investments and effects ( $N = 1,676$  children) of both school environments (four schools) compared to control schools (four schools). Investments and outcomes were grouped within the healthcare, education, household & leisure, and labor & social security sector. Outcomes that could be expressed in monetary terms were used for the calculation of social return on investment.

**Results:** HPSF and PAS created outcomes for the healthcare sector by favorable changes in health behaviors, body mass index [both significant], and medical resource use [not significant]. Outcomes for the education sector included a favorable impact on perceived social behaviors and school satisfaction, and absenteeism from school [latter not significant], and more engagement with the community was experienced. The per child investments, €859 (HPSF) and €1017 (PAS), generated a benefit of €8 (HPSF) and €49 (PAS) due to reduced school absenteeism and medical resource use.

**Conclusions:** Within 2 years of intervention implementation, the HPSF initiative created outcomes in several sectors, but the benefits did not outweigh the investments. Follow-up assessments as well as modeling long-term outcomes are needed to assess the total value of the interventions. Until then, the SROI framework can inform strategies for obtaining stakeholder support and intervention implementation.

**Trial registration:** The study was registered in the ClinicalTrials.gov database on 14 June 2016 (NCT02800616).

**Keywords:** social return on investment, health promotion/economics, child, health promoting schools, economic evaluation

## INTRODUCTION

The environment in which today's children are growing up is characterized by many opportunities for unhealthy dietary intake and few facilities for physical activity (1, 2). Adverse consequences, such as overweight and obesity have been steadily increasing over the last decades. In 2009, 13–15% of Dutch boys and girls aged 2–21 years were overweight compared to 5–7% in 1980 (3). As a response to this growing public health concern, the Healthy Primary School of the Future initiative was developed (4). Key elements of this initiative are the provision of a daily healthy lunch and structured physical activity sessions, which are innovative elements within the Dutch primary school setting (corresponding to 4–12 years of age). The HPSF initiative consists of a full intervention, named the “Healthy Primary Schools of the Future” (HPSF), and a partial intervention, referred to as “Physical Activity Schools” (PAS). Within 2 years of intervention, Bartelink et al. (14) found that HPSF was effective in increasing healthy dietary behaviors and physical activity (5). Both HPSF and PAS were also effective in lowering children's body mass index (BMI) z-scores (BMI adjusted for age and sex) (6).

Cost-effectiveness studies aim to inform implementation and funding decisions. Ideally, the time over which costs and outcomes of childhood programs are evaluated should go beyond childhood, because the impact of weight reductions on chronic diseases, health-related quality of life (HRQOL), and costs do not fully occur within childhood. Evaluations of short-term cost and effects are, however, more in line with the time horizons that policy makers tend to work with (usually 3–5 years) (7, 8), and provide information for decision-making on the implementation, continuation, and scaling-up of interventions.

In the current study, we use the social return on investment (SROI) framework for examining the investments, outcomes, and societal value of HPSF and PAS. The SROI framework aims to examine all outcomes of a program (no matter who incurs them). To aggregate investments and outcomes and calculate return on investment or cost-effectiveness, outcomes are assigned to a monetary value (financial benefits) and are divided by the investments. This calculation (SROI calculation) results in an estimate on the amount of benefits returned for every euro spent (9, 10). The SROI framework also recognizes that not all outcomes can be assigned to a monetary value (and can be expressed quantitatively). Outcomes that cannot be expressed in monetary terms are included in a SROI story, which articulates the non-monetary value. The objective of this study is to examine the short-term SROI generated by HPSF and PAS in the first 2 years of intervention implementation.

## METHODS

A quasi-experimental study, which started in 2015 in the south of the Netherlands, evaluates the effects of two “Healthy

Primary Schools of the Future” (HPSF) and two “Physical Activity Schools” (PAS) compared to four control schools who maintained the usual school curriculum. No randomization was applied because voluntary participation was key to the intervention implementation. A healthy morning snack and daily healthy lunches were provided (at HPSF only) in combination with structured physical activity sessions including structured sports activities, free play, and creative activities. At HPSF, the lunch break was prolonged to about 1 h, which led to an extension of the school day with ~30 min (some lunch breaks involved an educational component to meet the education hour requirements). Children and their parents were invited to participate in data collection at baseline (no blinding), and could join at all measurement waves as children continuously leave and enter primary school (dynamic cohort design). Further details on the interventions and data collection procedures have been published elsewhere (4, 11).

A SROI analysis was performed by taking five steps, according to the methods of Nicholls et al. (2012): (1) defining the scope and identifying key stakeholders; (2) identifying investments and outcomes; (3) evidencing outcomes; (4) establishing impact, and (5) assessing the SROI (12).

### Step 1: Scope and Key Stakeholders

Whilst the quasi-experimental study examines the effects of HPSF and PAS for a period of 4 years (baseline: school year 2015/2016, year 4: 2019/2020), the current study focuses on the impact after 2 years (baseline: school year 2015/2016, year 1: 2016/2017, year 2: 2017/2018). Several stakeholders contributed to the delivery of HPSF and PAS, and may be directly or indirectly affected by the interventions. Stakeholders were grouped within the healthcare, education, household & leisure, and labor & social security sector (**Figure 1**: box H, box E, box HL, and box L, respectively).

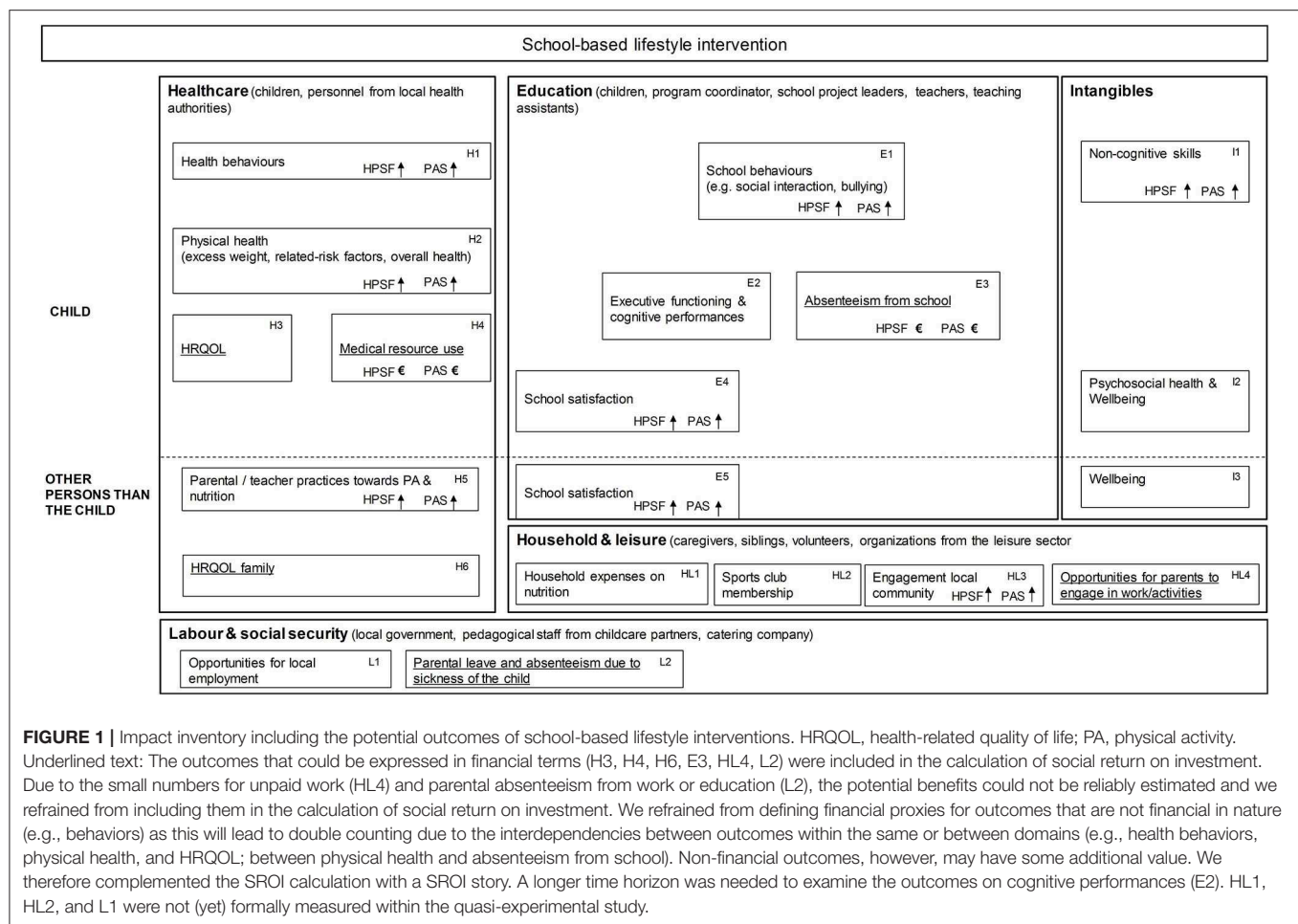
### Step 2 and 3: Identifying Investments and Outcomes and Evidencing Outcomes Investments

In a previous study, we made an overview of the activities provided at HPSF and PAS in comparison to the regular school curriculum, and the corresponding investment costs (13). The cost analysis also revealed cost offsets: children's lunches were provided at school and led to a cost offset within the household, and the extended school day at HPSF provided caregivers with additional time (productivity cost) that could be spent on paid or unpaid work. These cost offsets were deducted from the investments to calculate the net investments. For more details on the cost calculation see **Appendix 2**.

### Qualitative Outcomes

Semi-structured interviews with stakeholders were held at the end of the second year about the implementation and perceived changes (11). School coordinators ( $N = 4$ ), coordinators of the pedagogical employees ( $N = 4$ ), school health promoters from the regional Public Health Services ( $N = 4$ ), and the

**Abbreviations:** BMI, body mass index; HPSF, Healthy Primary Schools of the Future; HRQOL, health-related quality of life; PAS, Physical Activity Schools; PedsQL, Pediatric Quality of Life Inventory; QALY, quality-adjusted life year; SES, socioeconomic status; SROI, social return on investment; WTP, willingness to pay.



project coordinator ( $N = 1$ ) were interviewed (**Figure 1** and **Appendix 3**). More information can be found in the paper written by Bartelink et al. (14).

### Quantitative Outcomes

The selection of quantitative outcomes was made by the interdisciplinary scientific project group, and presented in an impact inventory (**Figure 1**) (4). Quantitative outcomes were measured annually (T0: 2015, T1: 2016, T2: 2017) and covered height and weight measurements, child questionnaires, and parental questionnaires. School records contained information on absenteeism from school. Routine school satisfaction surveys were administered among caregivers and children between 2016 and 2018. In the current study, we included children that were enrolled at the participating schools and exposed to the interventions from baseline onwards. Children in grade 8 at baseline were excluded as no follow-up measurements could be obtained. We also excluded the children that switched between schools between 2015 and 2017. Benefits were calculated by multiplying the outcomes over 2 years (measured in volumes/quantity) by the unit cost for that outcome. Benefits were assessed at the group level in order

to calculate an average per child benefit. Standardized prices from national costing guidelines were used for outcomes that were financial in nature (medical resource use, productivity) (15), and published proxy values were applied for other outcomes (QALY and school absenteeism) (**Table A3.1**) (16, 17). The outcome measurement and valuation, and the selection of the study sample ( $N = 1,676$ ) are further described in **Appendix 3**.

### Step 4: Establishing Impact

This step is used to estimate what proportion of the outcome can be isolated as being added by the intervention. In the current study, the quasi-experimental design with a control group and 2-years time frame was used to account for this element.

### Step 5: SROI Assessment

The SROI calculation included the outcomes on children's HRQOL, medical resource use (**Figure 1**: H3 and H4), and school absenteeism (**Figure 1**: E3). The outcomes for medical resource use and absenteeism, which represented a cost, were rescaled so that all outcomes would indicate a benefit. Benefits were calculated as the sum of outcomes over year 1 and 2. Firstly,

the per child benefits were aggregated within each sector, and were then summed up across the sectors (within-dimension approach) (18). An annual discount rate of 2.5% was used for investments and benefits to account for the differences in the time at which investments and outcomes occur (16). The reasons for in/excluding outcomes from the SROI calculation, and the calculation of benefits are further detailed in **Appendix 4**.

## Statistical Analysis

Descriptive statistics were used to explore baseline sociodemographic and outcome variables. Multiple imputation was used to account for possible selective non-response (missing at random assumption) and to use all available data (see **Appendix 4** for details on the handling of missing data). Imputations were generated with the MICE package in R using 50 imputed datasets with 20 iterations (for details see **Appendix 4**) using predictive mean matching. The mean differences in the per child benefits over year 1 and 2 were examined with a generalized linear model with a Gamma distribution and a log link function to account for the zero values and skewness of the data. The analyses were adjusted for sex, study year at baseline, socioeconomic status (SES), ethnicity, baseline BMI z-scores (BMI adjusted for age and sex), and baseline outcome scores to account for imbalances in covariates (**Appendix 4**). The social return on investment was calculated as the ratio of benefits to net investments. Additionally, the incremental net monetary benefit was calculated as the difference in benefits (for HPSF and PAS vs. control schools) minus the difference in net investments. All statistical analyses were performed in IBM SPSS Statistics for Windows version 23 (Armonk, NY: IBM Corp) and R version 3.5.1.

## Scenario and Sensitivity Analysis

Scenario analyses were performed to analyse the SROI of HPSF and PAS for specific situations. For details and reasoning behind the scenario analyses we refer to **Appendix 5**. (1) Lower investments at HPSF for pedagogical staff (eight instead of 12 pedagogical workers) based on changes in the way activities are organized. (2) Lower investments for HPSF and PAS that are expected to occur on the long-term (so-called steady state) (13). (3) Excluding children in grade 7 at baseline who are leaving school after the eighth grade and missed the 2-years follow-up measurement. Sensitivity analyses were conducted to see how the results would change under different assumptions: (1) Including spillover effects on caregiver's HRQOL and productivity (paid work) (**Figure 1**: H6, HL4). (2) No offsets due to the extended school day at HPSF in the calculation of the net investment for HPSF. (3 and 4) Willingness to pay (WTP) thresholds of €20,000 and €50,000 per QALY gained instead of €36,000 per QALY gained. (5) No discounting of benefits and investments instead of an annual discount rate of 2.5%. (6) A complete case analysis (non-imputed outcomes). For details on the sensitivity analyses, see also **Appendix 5**.

## RESULTS

At baseline (T0),  $N = 1,403$ , 60.3% children and their parents joined the study. For the current study,  $N = 1,676$  children and their parents were included based on the selection of school years and school switchers excluded (see **Appendix 1** for the flow diagram) (6). Children from control schools had higher BMI z-scores (0.232 vs. 0.051 at HPSF and 0.092 at PAS) and chronic diseases were more prevalent (36 vs. 30% at HPSF and PAS) (**Table 1**).

## Investments

For the first year of implementation, the total investments amounted to €1,448 per child for HPSF and €665 per child for PAS. The offsets for HPSF included the forgone household expenses on children's lunches as they were provided by the schools, the value of the extended school day in terms of parental productivity, and the forgone household expenses on the fee for the lunch break (used for supervision during the lunch break) which was not applied (total €−1,019 per child). The net investment costs of HPSF were €429 per child for the first year of intervention implementation (€2.68 per child per day) (not discounted). The offsets for PAS only included the forgone household expenses on the fee for the lunch break (the offsets for the lunch and the prolonged school day were not applicable for PAS), and the net investment amounted to €505 per child for the first year (€3.16 per child per day) (not discounted) (19). In the second year, the costs for transport and accommodations were not incurred, which resulted in a net investment of €399 (HPSF) and €475 (PAS) per child (not discounted). The net investment for year 1 and 2 together were €828 per child for HPSF (€2.59 per child per day) and €980 for PAS (€3.06 per child per day) (discounted results: €859 per child year and €2.69 per child per day for HPSF, and €1,017 per child year and €3.18 per child per day for PAS).

## SROI Story (Non-monetized Outcomes) Child Outcomes

### Healthcare

Bartelink et al. (2019) previously reported that water consumption, the intake of different food types during the lunch, and time spent in light physical activity had increased more at HPSF compared to control schools (5). Several participants on the interviews reported that dietary behaviors of children at HPSF became more diverse, and children were more willing to taste unfamiliar products (**Figure 1**: H1) (14). Standardized BMI scores had decreased more in children at HPSF compared to children at PAS and control schools, and for children at PAS in comparison to children at control schools (6) (**Figure 1**: H2).

### Education

From the interviews with stakeholders it emerged that children were less bored during recess time and fewer conflicts happened at the schoolyard and in the classroom (**Figure 1**: E1) (14). The school satisfaction surveys showed that children were satisfied with the lunch (60–83% at the two HPSF schools), and with



**TABLE 1** | Summary of covariates and baseline outcomes for each group separately (pre-imputation).

Baseline characteristics (N = 1,676)		HPSF (N = 537)	PAS (N = 478)	Control (N = 661)	Total (N = 1,676)	Missing (%)
Covariates	Gender Boys (N, %)	256 (47.7%)	226 (47.3%)	312 (47.2%)	794 (47.4%)	0%
	Grade (mean ± sd)	4.0 ± 2.00	3.8 ± 2.01	4.1 ± 1.99	4.0 ± 2.00	0%
	Age in years (mean ± sd)	7.6 ± 2.16	7.4 ± 2.22	7.6 ± 2.13	7.5 ± 2.16	0%
	Ethnicity (N, %) <sup>a</sup>					39.4%
	Native background	273 (80.1%)	283 (86.8%)	285 (81.7%)	841 (82.8%)	
	Western background	44 (12.9%)	30 (9.2%)	41 (11.7%)	115 (11.3%)	
	Non-Western background	24 (7.0%)	13 (4.0%)	23 (6.6%)	60 (5.9%)	
	Education level mother at baseline (N, %)					33.7%
	Low	63 (17.6%)	62 (17.0%)	77 (19.8%)	202 (18.2%)	
	Intermediate	171 (47.9%)	181 (49.6%)	178 (45.8%)	530 (47.7%)	
	High	123 (34.5%)	122 (33.4%)	134 (34.4%)	379 (34.1%)	
	Education level father at baseline (N, %)					60.4%
	Low	32 (14.2%)	47 (20.2%)	47 (22.9%)	126 (19.0%)	
	Intermediate	110 (48.7%)	107 (45.9%)	83 (40.5%)	300 (45.2%)	
	High	84 (37.2%)	79 (33.9%)	75 (36.6%)	238 (35.8%)	
	Net monthly household income (N, %)					
	Up to €1,500	20 (11.8%)	19 (10.6%)	22 (13.3%)	61 (11.8%)	69.2%
	€1,500 to <€2,500	21 (12.4%)	25 (13.9%)	32 (19.3%)	78 (15.1%)	
	€2,500 to <€3,500	64 (37.6%)	70 (38.9%)	53 (31.9%)	187 (36.2%)	
	€3,500 and above	65 (38.2%)	66 (36.7%)	59 (35.5%)	190 (36.8%)	
	Socioeconomic status at baseline (N, %) <sup>b</sup>					33.4%
	Low	104 (28.8%)	118 (32.3%)	142 (36.3%)	364 (32.6%)	
	Intermediate	129 (35.7%)	130 (35.6%)	121 (30.9%)	380 (34.0%)	
	High	128 (35.5%)	117 (32.1%)	128 (32.7%)	373 (33.4%)	
	BMI z-score (mean ± sd)	0.051 ± 1.01	0.092 ± 0.95	0.232 ± 1.07	0.135 ± 1.02	33.8%
	Chronic diseases (medication/admission/visit) (N, %)	70 (29.5%)	73 (29.9%)	78 (36.1%)	221 (31.7%)	58.4%
HRQOL	Utility of the child (mean ± sd)	0.954 ± 0.10	0.945 ± 0.11	0.946 ± 0.11	0.948 ± 0.11	41.5%
Medical resource use within the last 12 months	GP visits, costs per child (mean ± sd)	21.3 ± 41.04	31.1 ± 54.31	19.3 ± 39.40	24.1 ± 45.95	58.4%
	Speech therapist visits, costs per child (mean ± sd)	45.7 ± 212.35	58.3 ± 238.40	60.0 ± 244.40	54.6 ± 231.65	58.4%
	Specialists visits, costs per child (mean ± sd)	74.4 ± 193.34	77.1 ± 193.26	72.8 ± 270.38	74.8 ± 219.78	58.4%
	Physiotherapist/occupational therapist visits, costs per child (mean ± sd)	13.5 ± 140.03	5.1 ± 43.94	6.0 ± 51.38	8.2 ± 89.63	55.0%
	Youth care visits, costs per child (mean ± sd)	46.4 ± 435.58	4.6 ± 39.90	27.7 ± 187.70	25.8 ± 274.84	58.4%
	Psychologist / social worker visits, costs per child (mean ± sd)	13.8 ± 65.51	23.0 ± 162.12	37.9 ± 256.75	24.5 ± 176.50	58.4%
	Hospital admissions, costs per child (mean ± sd)	103.7 ± 1260.76	106.2 ± 762.09	82.9 ± 588.89	98.1 ± 921.56	58.2%
	Medication, costs per child (mean ± sd)	38.8 ± 180.18	10.8 ± 51.61	9.9 ± 66.33	20.0 ± 115.81	59.0%
	Total healthcare costs (mean ± sd)	360.4 ± 1526.36	318.6 ± 969.27	320.4 ± 961.65	333.3 ± 1183.82	59.2%
	Utility of the primary caregiver (mean ± sd) <sup>c</sup>	0.922 ± 0.17	0.922 ± 0.14	0.917 ± 0.13	0.921 ± 0.15	57.2%
Absenteeism from school	Annual health-related absenteeism days (mean ± sd)	7.25 ± 7.63	8.05 ± 9.96	6.67 ± 8.31	7.29 ± 7.72	44.0%
	Annual other absenteeism days (mean ± sd)	0.86 ± 3.12	0.68 ± 2.05	0.83 ± 3.38	0.79 ± 2.93	44.0%
Parental absenteeism	Any absenteeism (N, %)	8 (3.4%)	4 (1.6%)	2 (0.9%)	14 (2.0%)	58.6%
	Parental absenteeism days from work or education due to health of the child (mean ± sd)	0.08 ± 0.59	0.06 ± 0.54	0.01 ± 0.15	0.05 ± 0.48	

(Continued)



TABLE 1 | Continued

Baseline characteristics (N = 1,676)		HPSF (N = 537)	PAS (N = 478)	Control (N = 661)	Total (N = 1,676)	Missing (%)
Parental working hours	Working hours/week for paid work (mean $\pm$ sd)					
	Total	57.73 $\pm$ 16.97	58.90 $\pm$ 15.06	57.49 $\pm$ 15.90	58.07 $\pm$ 15.97	60.5%
	1 caregiver per household	25.44 $\pm$ 8.14	25.00 $\pm$ 7.84	34.90 $\pm$ 3.90	28.81 $\pm$ 8.05	
	2 caregivers per household	59.19 $\pm$ 15.84	60.10 $\pm$ 13.82	58.65 $\pm$ 15.41	59.35 $\pm$ 15.00	
	Any working hours for unpaid work (N, %)	9 (3.8%)	9 (3.6%)	20 (8.8%)	38 (5.2%)	57.2%
	Working hours/week for unpaid work (mean $\pm$ sd)					
	Total	0.396 $\pm$ 2.16	0.212 $\pm$ 1.36	0.890 $\pm$ 4.30	0.49 $\pm$ 2.85	
	1 caregiver per household	1.06 $\pm$ 2.91	0.70 $\pm$ 2.36	1.86 $\pm$ 5.04	1.23 $\pm$ 3.67	
	2 caregivers per household	0.35 $\pm$ 2.10	0.17 $\pm$ 1.24	0.79 $\pm$ 4.22	0.42 $\pm$ 2.76	

BMI, body mass index; GP, general practitioner; HPSF, Healthy Primary School of the Future; HRQOL, health-related quality of life; PAS, Physical Activity School.

<sup>a</sup>Combined for baseline, T1, and T2 due to static nature of ethnicity.

<sup>b</sup>Average of standardized scores on the education of the mother, education of the father, and income adjusted for household size.

<sup>c</sup>HRQOL measured with the EuroQol-5 Dimensions Questionnaire (EQ5D). This measure evaluates the subjective HRQOL of a person. Health states are then adjusted for the preference of a health state (valuations obtained from the general public), which results in a value between 0 (worst possible health state) and 1 (perfect health).

the PA sessions at HPSF and PAS (75–93%). Nearly half of the children at HPSF enjoyed the school day more (39–50%) compared to the pre-intervention period, compared to 46–57% of children at PAS (Figure 1: E4).

### Intangibles

Regarding non-cognitive skills, the interview respondents noticed that children learnt from the offered games as children were better able to create and manage their own activities during recess time (Figure 1: I1). No significant differences were found between groups for children's self-efficacy scores (adjusted mean differences HPSF vs. control:  $-0.48$  [95% CI:  $-1.38$ ;  $0.42$ ] PAS vs. control:  $0.30$  [95% CI:  $-0.60$ ;  $1.19$ ]). Self-reported psychosocial health (Figure 1: I2), measured with the Pediatric Quality of Life (PedsQL) instrument, decreased somewhat from baseline to year 2 (no statistically significant differences between groups). This was, however, not observed for parent-reports about children's psychosocial health (Appendix 6).

### Outcomes in Other Persons Than the Child

#### Healthcare

Some teacher and parental practices (discussing and educating about nutrition and PA) changed in a favorable direction (Figure 1: H5) (14).

#### Education

Caregivers were generally satisfied with the organization (67–74%) and the content of the lunch (70–76%) at HPSF, and with the structured sports activities, free play, and creative activities at HPSF and PAS (50–79%). The majority would recommend HPSF to other caregivers (64–76%) (Figure 1: E5).

### Intangibles

No significant changes over time were found between groups for parental well-being (adjusted mean differences HPSF vs. control:  $0.28$  [95% CI:  $-0.37$ ;  $0.93$ ], PAS vs. control:  $0.08$  [95% CI:  $-0.61$ ;  $0.76$ ]) (Figure 1: I3).

### Household and leisure

Organizations for sport and leisure were invited to provide workshops. Activities did not only take place at school, but the school gym and the green area around the school were also used for free play and games (Figure 1: HL3). At year 2, 12–18% of the respondents on the parental questionnaire reported that their own working hours and/or the working hours of their partner changed as a result of HPSF and PAS, varying from minor to a lot of influence.

### Labor and social security

No statistically significant differences were found for parental absenteeism from work or education (Appendix 6) (Figure 1: L2). As this result was based on only few cases (known for <10% of the analyzed study participants) the benefits could not be reliably estimated, and we refrained from including this benefit in the calculation of social return on investment.

### SROI Calculation (Monetized Outcomes)

No statistically significant differences were found between groups for the number of QALYs accrued by children and for children's medical resource use within the 2-years of follow-up (Figure 1: H3 and H4). No statistically significant differences were found for health-related and non-health related absenteeism (Figure 1: E3). Because absenteeism represents a cost, absenteeism days were represented as a negative benefit. The monetary value (per child per 2 years) for health-related absenteeism amounted to € $-309$  (PAS) and € $-352$  (HPSF) vs. € $-338$  (control schools), and were € $-29$  (PAS) and € $-25$  (HPSF) vs. € $-31$  (control schools) for non-health related absenteeism (Table 2). No significant differences were found between groups for the number of QALYs accrued by caregivers (Figure 1: H6); rate ratio HPSF vs. control: 1.00 [95% CI: 0.97; 1.04], rate ratio PAS vs. control: 1.01 [95% CI: 0.97; 1.04]. No statistically significant differences were found for time spent on paid work (Figure 1: HL4): rate ratio HPSF vs. control: 1.02 [95% CI: 0.97; 1.08], PAS vs. control: 1.05 [95% CI: 0.99; 1.12]. The net investment for HPSF (€859/child/2 years),

**TABLE 2 |** Social return on investment (€) in year 1 and 2 ( $N = 1,676$ , adjusted for covariates).

Panel A: Net investment		HPSF vs. control schools				PAS vs. control schools			
		€ per child (discounted results)				€ per child (discounted results)			
Net investment year 1		440				518			
Net investment year 2		420				499			
Total social opportunity costs (year 1 and 2) <sup>a</sup>		859				1,017			

Panel B: Benefits	Unit cost	Control schools		HPSF		PAS		HPSF vs. control schools				PAS vs. control schools			
								Rate ratio <sup>b</sup>		Benefit		Rate ratio <sup>b</sup>		Benefit	
										€ per child Y1 + Y2 <sup>c</sup>				€ per child Y1 + Y2 <sup>c</sup>	
		Mean	(SE)	Mean	(SE)	Mean	(SE)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
QALYs child	€36,000/QALY <sup>d</sup>	68,508	(335.0)	68,554	(332.6)	68,531	(319.6)	1.00	(0.98; 1.02)	0	(−1304; 1304)	1.00	(0.98; 1.02)	0	(−1304; 1304)
Medical resource use	See <b>Appendix 2<sup>a</sup></b>	−1,056	(211.3)	−997	(204.9)	−1,010	(194.4)	0.98	(0.81; 1.18)	20	(−180; 191)	0.98	(0.81; 1.18)	20	(−180; 191)
HR absenteeism	€26.48/day <sup>e,f</sup>	−338	(15.6)	−352	(17.6)	−309	(15.9)	1.05	(0.92; 1.19)	−16	(−61; 26)	0.92	(0.81; 1.06)	26	(−19; 61)
Other school absenteeism	€26.48/day <sup>e,f</sup>	−31	(6.8)	−25	(7.4)	−29	(6.6)	0.85	(0.93; 1.16)	4	(−5; 2)	0.90	(0.63; 1.24)	3	(−7; 11)
Total benefits (total year 1 and year 2)										8	(−1085; 1057)			49	(−1041; 1097)

Panel C: Social return on investment		HPSF vs. control schools		PAS vs. control schools	
		€ per child Y1 + Y2		€ per child Y1 + Y2	
		Estimate (95% CI)	(95% CI)	Estimate	(95% CI)
Ratio of benefits to investments <sup>g</sup>		0.01	(−1.3; 1.2)	0.05	(−1.0; 1.1)
Net monetary benefit <sup>h</sup>		−851	(−1945; 198)	−968	(−2058; 80)
Net monetary benefit per child per day <sup>i</sup>		−2.66	(−6.08; 0.62)	−3.03	(−6.43; 0.25)

The analyses were adjusted for sex, study year at baseline, socioeconomic status (SES), ethnicity, baseline BMI z-scores, and baseline outcome scores.

<sup>a</sup>Net investment = investments minus delivery-related offsets (HPSF: household expenses on lunches for children, and the value of the extended school day for parental productivity. HPSF & PAS: forgone household expenses regarding the fee for the lunch break).

<sup>b</sup>Ratio of mean benefits for HPSF or PAS vs. control schools.

<sup>c</sup>Benefits of HPSF or PAS = mean value at control schools \* rate ratio (repeated for lower and upper bound of the confidence interval). Discounted with an annual discount rate of 2.5% to account for differential timing of investments and benefits.

<sup>d</sup>Pomp et al. (16).

<sup>e</sup>Because medical resource use and school absenteeism represent a cost, they are represented as a negative benefit.

<sup>f</sup>Guideline for intersectoral costs and benefits of preventive interventions (OCW kerncijfers 2007–2011) (16).

<sup>g</sup>Ratio of total of benefits and net investments.

<sup>h</sup>Incremental net monetary benefit = incremental benefits – incremental net investments.

<sup>i</sup>For a total of 160 schooldays per year (total of 320 days for 2 years).

CI, confidence interval; HPSF, Healthy Primary School of the Future; HR, health-related; IQR, interquartile range; PAS, Physical Activity School; QALYs, quality-adjusted life years; SE, standard error.

**TABLE 3 |** Breakdown of social return on investment (€) in year 1 and 2 by sector.

Panel A: Net investments	HPSF vs. control schools						PAS vs. control schools					
	Healthcare sector		Education sector		Household & leisure sector		Healthcare sector		Education sector		Household & leisure sector	
	€ per child (discounted results)		€ per child (discounted results)		€ per child (discounted results)		€ per child (discounted results)		€ per child (discounted results)		€ per child (discounted results)	
Net investment year 1	0		1,248		−999		0		663		−146	
Net investment year 2	0		1,433		−1,014		0		649		−149	
Total social opportunity costs (year 1 and 2) <sup>a</sup>	0		2,862		−2,002		0		1,312		−295	
Panel B: Benefits (see Table 2)	€ per child Y1 + Y2 <sup>b</sup>		€ per child Y1 + Y2 <sup>b</sup>		€ per child Y1 + Y2 <sup>b</sup>		€ per child Y1 + Y2 <sup>b</sup>		€ per child Y1 + Y2 <sup>b</sup>		€ per child Y1 + Y2 <sup>b</sup>	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
QALYs child	0	(−1304; 1304)	NA		NA		0	(−1304; 1304)	NA		NA	
Medical resource use <sup>c</sup>	20	(−180; 191)	NA		NA		20	(−180; 191)	NA		NA	
HR absenteeism <sup>c</sup>	NA		−16	(−61; 26)	NA		NA		26	(−19; 61)	NA	
Other school absenteeism <sup>c</sup>	NA		4	(−5; 2)	NA		NA		3	(−7; 11)	NA	
Total benefits (total year 1 and 2)	20	(−1113; 1123)	−12	(−66; 28)	0	(0; 0)	20	(−1113; 1123)	29	(−26; 72)	0	(0; 0)
Panel C: Social return on investment	€ per child Y1 + Y2		€ per child Y1 + Y2		€ per child Y1 + Y2		€ per child Y1 + Y2		€ per child Y1 + Y2		€ per child Y1 + Y2	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
Ratio of benefits to investments <sup>d</sup>	NA		−0.00	(−1.00; 0.01)	NA		NA		0.02	(−0.02; 0.06)	NA	
Net monetary benefit <sup>e</sup>	20	(−1113; 1123)	−2873	(−5723; −2834)	2002	(NA)	20	(−1113; 1123)	−1283	(−2595; −1240)	295	(NA)
Net monetary benefit per child per day <sup>f</sup>	0.06	(−3.48; 3.51)	−8.98	(−17.89; −8.86)	6.26	(NA)	0.06	(−3.48; 3.51)	−4.01	(−8.11; −3.87)	0.92	(NA)

<sup>a</sup>Net investments = investments minus delivery-related offsets (HPSF: household expenses on lunches for children, and the value of the extended school day for parental productivity. HPSF & PAS: forgone household expenses regarding the fee for the lunch break).

<sup>b</sup>Benefits of HPSF or PAS = mean value at control schools \* rate ratio (repeated for lower and upper bound of the confidence interval). Discounted with an annual discount rate of 2.5% to account for differential timing of investments and benefits.

<sup>c</sup>Because medical resource use and school absenteeism represent a cost, they are represented as a negative benefit.

<sup>d</sup>Ratio of total of benefits and net investments.

<sup>e</sup>Incremental net monetary benefit = incremental benefits - incremental net investments.

<sup>f</sup>For a total of 160 schooldays per year (total of 320 days for two years).

CI, confidence interval; HPSF, Healthy Primary School of the Future; HR, health-related; IQR, interquartile range; PAS, Physical Activity School; QALYs, quality-adjusted life years; SE, standard error.

generated a benefit of €8/child/2 years [95% CI: €−1,085–1,057] when considering the financial outcomes in the child (Table 2). The incremental net benefit of HPSF was estimated at €−851/child/2 years (SROI ratio of 0.01). The net investment costs for PAS (€1017/child/2 years), generated a benefit of €49/child/2 years [95% CI: €−1,041–1,097]. The incremental net benefit of PAS was estimated at €−968/child/2 years (SROI ratio of 0.05). See Appendix 6 for the results when not adjusting for covariates. A breakdown of results by sector shows that most investment were incurred by the education sector, while offsets were received by the household and leisure sector, and most benefits belonged to the healthcare sector (HPSF: 100%, PAS: 40%) (Table 3).

The results of the scenario and sensitivity analyses were comparable to the base-case (SROI between zero and one), except for excluding children who were in grade 7 at baseline, and for the complete case analysis (Appendix 7). Repeating the analysis without children in grade 7 resulted in extra benefit for both HPSF and PAS (SROI HPSF: 1.70 vs. 0.01; PAS: 0.70 vs. 0.05). Additionally, including spillovers on caregiver's HRQOL and productivity increased the SROI (SROI HPSF: 0.05 vs. 0.01, PAS: 0.70 vs. 0.05). The complete case analysis showed comparable results with regard to the direction of the regression estimates (Appendix 5). However, due to the number of missing data and the missing data mechanism (not completely at random) the complete case analysis resulted in inefficient and (probably) biased point estimates of the benefits (SROI HPSF: −1.80 vs. 0.01, PAS: 0.60 vs. 0.05).

## DISCUSSION

The objective of the current study was to examine the short-term return on investment created by HPSF and PAS after 2 years of intervention. HPSF and PAS led to outcomes within the healthcare sector (favorable changes in health behaviors and body mass index [both significant], and medical resource use [not significant]), education sector (favorable changes on perceived social behaviors at school and school satisfaction, and absenteeism from school [later not significant]), and household & leisure sector (perceived engagement with the community). The benefits (HPSF: €0.05 per child/day, PAS: €0.31/child/day), did not outweigh the net investment costs of HPSF and PAS (HPSF: €2.69/child/day, PAS: €3.18/child/day). For every euro invested, HPSF and PAS generated a benefit of €0.01 [95% CI: €−1.3; €1.2] and €0.05 [95% CI: €−1.0; €1.1], respectively. In the paper of Bartelink et al. (2019) it was shown that HPSF resulted in more favorable effects on children's BMI scores compared to PAS (6). The authors suggested that HPSF may be more effective in targeting health behaviors, since HPSF simultaneously addressed nutrition and physical activity, and the activities at HPSF led to additional health-promoting changes in the school (5). In contrast, the SROI calculation revealed that PAS led to more financial benefits than HPSF, which was mainly due to the favorable effects of PAS on absenteeism from school (not statistically significant). The results, however, do not suggest that PAS had a more favorable SROI as compared to HPSF, because HPSF led to more favorable results on the non-monetized outcomes (see SROI story). The findings on

financial benefits need to be interpreted with caution. Benefits were not statistically significant and therefore uncertain, but a trend toward favorable outcomes was observed. The SROI of HPSF and PAS increased substantially after including spillover effects, which was driven by the monetization of the relative small effects on caregivers' HRQOL (WTP for a QALY), as well as by the favorable effects on caregiver productivity. In the sensitivity analysis, it can also be seen that the SROI was sensitive to the QALY gains. Most short-term cost-effectiveness studies on childhood lifestyle interventions examined cost-effectiveness by the ratio of costs and health outcomes, such as body mass index improvements, cases of overweight prevented, or units of waist circumference prevented (20). WTP thresholds are not available for these outcomes, and interpreting their cost-effectiveness results therefore remains difficult. In contrast to these studies, we combined a qualitative and quantitative approach for examining the health- and non-health outcomes of HPSF and PAS. By using the SROI framework we were able to integrate the outcomes for multiple sectors (21, 22). If we would have examined the interventions from a healthcare perspective alone, a substantial part of the outcomes would have been ignored (HPSF: 49% of financial benefits, PAS: 59% of financial benefits). Jones et al. (2011) examined the SROI of the Food for Life programme, and also considered both health-related and non-health outcomes for local suppliers, school catering services, schools, parents, and local authorities (23). Financial proxies were defined by stakeholders, such as using the costs of a trip to the farm for valuing the knowledge of children about the origin of foods, which resulted in a SROI ratio of 4.4. Defining monetary values for non-financial outcomes is challenging as methods for obtaining proxies are not standardized. In the current study, we used standard cost prices only and refrained from defining financial proxies ourselves. This could have resulted in a conservative estimate of the SROI of HPSF and PAS. Due to the non-response on the parental questionnaire and the dynamic cohort design, our study suffered from missing data on covariates and longitudinal outcomes, which required multiple imputation.

Decisions on school-based lifestyle interventions should not be based on only the intervention's short-term return on investment. Follow-up assessments, as well as modeling to extrapolate short-term results beyond the trial period, are required to examine the full merits of school-based lifestyle interventions. Long-term information is, however, not always available for decision-making, because follow-up assessments are dependent on previous intervention implementation. To ensure successful intervention implementation and continuation it is crucial to have support from all stakeholders. The SROI framework allowed for comprehensively assessing the distribution of investments and outcomes over stakeholder groups. The results of the current study showed that the short-term benefits did not outweigh the investments of the HPSF initiative, but outcomes were generated for multiple sectors. The majority of investments were incurred by the education sector, while outcomes were received by the healthcare, household & leisure, and education sector. This information can be used as input for continuation decisions and investment strategies on the HPSF initiative by, for example, exploring alternative



modes of intervention delivery (e.g., changing the organization of activities so that fewer pedagogical employees are needed), and examining whether a redistribution of investments over, amongst others, schools, parents, and the government is desired. The SROI framework can therefore serve as a tool in obtaining stakeholder support, foster intervention implementation and continuation, and facilitate follow-up research and decision-making on school-based lifestyle interventions. In accordance to others, we recommend that further research should focus on the valuation of outcomes in different sectors (18, 22, 24), and on the methods for valuing outcomes across different sectors (18) to further develop the methodology and enhance the implementation of the SROI methodology (17, 25). Future research is also needed to examine if SROI evaluations adequately meet the information needs of different stakeholders and optimally support the various decision-making processes on school-based lifestyle interventions.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study were collected as part of the ‘Healthy Primary School of the Future’ quasi-experimental study. Data collection took place until 2019 to study the effects after 4 years of exposure. Data will become available from the authors upon reasonable request, following article publication on the 4-year effects and potential other comparative studies in the Netherlands.

## ETHICS STATEMENT

The need for ethical approval has been waived by the Medical Ethics Committee Zuyderland in Heerlen (MEC 14-N-142). All participants were required to complete an informed consent form

in accordance with the Declaration of Helsinki, signed by both parents/caregivers, and by the children in case they are 12 years or older. The study protocol has been registered in the database ClinicalTrials.gov (NCT02800616).

## AUTHOR CONTRIBUTIONS

MO and MJ designed the current study. MO, NB, and MW contributed to the data acquisition. MO and BW performed the statistical analyses. MO wrote the manuscript with input from all authors. All authors read and approved the final manuscript.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2020.00401/full#supplementary-material>

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

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# Preferences of Physical Education Profiles Among Polish Adolescents

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The purpose of this study was to examine the association of the preferred profiles of physical education (PE) classes with gender and school level among Polish adolescents. In the cross-sectional survey study, 1,340 Polish students (including 50% of girls) attending middle and high schools, aged between 13 and 19 years, participated. The participants selected one of four preferred profiles of PE classes. The majority ( $n = 845$ , 63%) of students participated in PE for “fun–pleasure–entertainment,” whereas only one third of students ( $n = 419$ , 31%) preferred “exercise–sweat–fitness” as a profile of PE classes. The preference for “fun–pleasure–entertainment” decreased about 41% for boys and 31% for high school students. A preference for “exercise–sweat–fitness” increased about 56% for men and 31% for high school students. Teachers should comply with students’ preferences related to PE profiles, organizing PE classes in more fun-related forms for girls and in more exercise-related forms for boys. The proportions of these two preferred profiles of PE classes should turn across adolescence, increasing exercise-related forms and decreasing those fun-related ones.

**Keywords:** adolescents, gender, physical education preferences, physical activity, school level

## INTRODUCTION

Physical education (PE) underwent a deep transformation with the transition from a traditional sports skill orientation to a broader emphasis on health-related fitness and lifelong physical activity (PA) (1). Given the growing concerns over the PA levels of many young people and the possible health consequences, it is not surprising that the PE concept is not limited to “curriculum orientations” and teachers’ educational goals, but it includes the view of students and the broader sociocultural context (2, 3). Previous studies have suggested that issues connected with the objectives of PE were well-established in theory (4–9). However, in rapidly transforming modern societies, the educational system is also undergoing significant changes; thus, there is a strong need to replicate previous research and monitor developments in this area. In light of the above, the present study is an attempt to focus on the preferences in PE classes among adolescents.

Most of the published data from different countries reported that PA decreases with an increase of age in youth (10, 11). For instance, the longitudinal prospective 10-year study by Kimm et al. (12) showed that between the ages 9–10 and 16–17 years, median habitual leisure time PA declined by 100% in African American girls ( $n = 1,213$ ) and 64% in white girls ( $n = 1,166$ ). In another longitudinal study by Telama and Yang (13), a decline in PA between the ages of 9 and 27 was shown in Finland, and a remarkable decline in PA level was observed after the age of 12. In a review study by Hallal et al. (14), it was found that inactivity rises with age and is increased in high-income countries. Caspersen et al. (15) also showed that PA of moderate to vigorous intensity declined consistently from age 12 in the United States, with one of the most dramatic declines appearing to occur between 13 and 18 years of age.

Youth PA behavior is influenced by biological, psychosocial, and environmental factors. Gender is identified among them as a significant correlate of PA. The vast majority of studies have consistently indicated that boys are more active than girls (11, 13, 14, 16, 17). Gender differences in various types of PA patterns (e.g., low, moderate, and vigorous) were also noticed. Some researchers point out that boys participate more in vigorous activities, while girls prefer moderate-to-low activities. Interestingly, with increasing age, boys prefer moderate- or low-activity patterns, while girls continue to participate in moderate-to-low activities (10).

One of the reasons for this gender difference may be that regular participation in sports and exercises is heavily influenced by observation of others who model these behaviors and by social reinforcement. The main emphasis is being put on parental role modeling, rules around sedentary and active pursuits, and parental support for PA (18), as well as the strong pressure from the media concerning female aesthetic models (19). On the other hand, it is often said that the school reproduces male culture and values, thus instilling a series of gender stereotypes among students, and that there are fewer opportunities for girls to participate in sports or regular exercise in some countries (20, 21).

Participating in organized PA at school and in the community is associated with greater physical effort and reduced sedentary time among both boys and girls (22). Unfortunately, PE that is currently taught in Polish schools increasingly fails to engage young people and, thus, fails to prepare them to become active creators and consumers of the varied forms of PA available outside of school. Recent research into the PA of youth in Poland has shown that only 74% of the students participated in all or almost all PE classes in the school year, while 11% took part in half or fewer of the total classes. The students' participation decreased as they got older, and the participation level was lower among the girls than the boys. Approximately 70% of the students were exempted from PE classes on written parental request, while 43% were excused on their own request. A doctor's certificate was obtained by 33% of the students, usually for a period shorter than 1 month, and 4.5% were exempted longer than 3 months. To sum up, for over 20–40% of the students, the number of PE classes in which they participated was significantly lower than the number planned by the legislator (23). Similar data were obtained in a nationwide survey carried out in the school years 2009–2010 and 2011–2012, in which, on average, the abstentions exceeded 15, 23, and 30% of students for specific levels of education (primary, middle, and high schools), respectively (24).

Low PA and PE classes' participation may largely be a function of a lack of motivation to exercise among inactive children and adolescents. Thus, teachers should aim, among other objectives, to boost adolescents' motives for the maintenance of participation in PA. Among the reasons driving adolescents to perform and to maintain physical or sportive activities, intrinsic motivation plays an important role. Intrinsic motivation refers to participation in an activity for inherent satisfaction and represents the most autonomous form of motivation (25, 26). It positively predicts the importance of students' engagement in PE, and this finally and positively predicts the intention of the student

to continue doing PA (27–29). It is in accordance with the thesis that human behavior is undermined by the fulfillment of needs, self-actualization, and full realization of one's own potential, hence leading to the satisfaction with tasks at hand (30, 31).

Crum (32) distinguishes four profiles of PE classes: (1) fun–pleasure–entertainment; (2) exercise–sweat–fitness; (3) control–order–discipline; and (4) relevant learning concerning movement and sport. The PE profiles were originally intended to diagnose the quality of PE teacher education (PETE). In the current study, these PE profiles were used to examine students' preferences to be provided with an answer to the important question of which of the profiles is the strongest trigger of PE attendance and the main source of their motivation.

Although the conception and curriculum of PE should include an individual context from the students' perspective, little research was focused on the opinion of adolescent students about the preferences for the profiles of PE classes. This study examines the associations of the preferred profile of PE classes with gender and school level of students attending middle and high schools.

## METHODS

### Participants

In this cross-sectional survey study, a sample of 1,340 adolescent students attending public schools in the Silesian region in the south of Poland participated. The study sample included 667 middle school students (50% of the total sample) and 673 high school students (50%), aged between 13 and 19 years. There were 675 girls (50%) and 665 boys (50%) among the participants. **Table 1** shows the demographic characteristics of the sample.

### Measure

The survey asked a single question: "Which version of physical education presented below is closest to the one you would like to pursue at your school?" The students answered by selecting one of four preferred profiles of PE classes, developed by Crum (32): (1) PE as fun, pleasure, and entertainment; (2) PE as exercise, sweat, and fitness; (3) PE as control, order, and discipline; and (4) PE as relevant learning concerning movement and sport. The answers were coded 0 = *No choice* and 1 = *Choice*. Further, three close questions were added at the end of the survey, regarding such demographic variables as gender (female or male), type of school (middle or high), and grade (first, second, or third). The students answered each question by selecting one of the options.

### Procedure

The cross-sectional survey study was conducted between September 2010 and January 2011 in three voivodeships around the Silesia region (Poland): Lower Silesia, Upper Silesia, and Opole Voivodeship. The paper-and-pencil survey was administered during school time with the consent of the teachers. The research was approved by the Bioethics Committee of the Opole Medical Chamber (no. 151/2007) and conducted according to the principles of the Declaration of Helsinki. Prior to the study, written informed consent was obtained from parents of students below 16 years of age. The students were informed that the research is anonymous and voluntary and



**TABLE 1** | Demographic characteristics of the sample.

	Girls				Boys				Total	
	Middle school		High school		Middle school		High school		n	%
	n	%	n	%	n	%	n	%		
Type	334	24.92	341	25.45	333	24.85	332	24.78	1340	100.00
Grade										
First	111	8.28	109	8.13	111	8.28	111	8.28	442	32.98
Second	111	8.28	110	8.21	111	8.28	112	8.36	444	33.14
Third	112	8.36	122	9.10	111	8.28	109	8.13	454	33.88

that they could withdraw from the examination at any time, without giving a reason. Data collection consisted initially of 1,355 surveys. However, 10 surveys were excluded from further analysis because of more than 10% of missing data, and five individuals refused participation in the survey. The response rate was 99%.

## Statistical Analysis

A series of Pearson's  $\chi^2$  independence tests were performed separately to examine the relationship of the preferred PE profile with gender and school level. The null hypothesis is that the values included in rows and columns in the contingency table are equal. The alternative hypothesis (when  $p < 0.05$ ) indicates an association between the variables. Further, binary logistic regression was conducted to discover predictors of the preferred PE profiles among such independent variables as gender (female and male) and school level (middle and high). In the univariate model of regression, gender, and school level were tested separately. Conversely, in the multivariate model, both gender and school levels were considered simultaneously as predictors. The Wald test was used to test the null hypothesis that a set of parameters is equal to zero. All statistical analyses were performed using STATISTICA 13.1 software.

## RESULTS

Preferences of the profiles of PE classes are shown in **Table 2**. Among the four profiles of PE classes, the majority of students have chosen the first ( $n = 845$ , 63%) and second ( $n = 419$ , 31%). The two other profiles of PE classes were not too common among students since only 3% ( $n = 40$ ) has selected the fourth and 2.7% ( $n = 36$ ) preferred the third. **Table 2** contains the results of Pearson's  $\chi^2$ -test for the association between gender and school level of students and their preferences for the profiles of PE classes. Preference for the first profile of PE classes prevailed among girls, whereas boys more often chose the second profile of PE classes, as is shown in **Figures 1A,B**, respectively. Similar tendencies were found between students of distinct levels of schools. Students of middle school more often selected the first profile of PE classes, whereas more students of high schools have chosen the second profile, as is shown in **Figures 1C,D**,

**TABLE 2** | Contingency table and results of Pearson's  $\chi^2$ -test for the association between the four profiles of physical education, gender, and school level.

Profiles of PE classes	Gender		School level			
	Female	Male	$\chi(1)^2$	Middle	High	$\chi(1)^2$
	<i>n (%)</i>	<i>n (%)</i>		<i>n (%)</i>	<i>n (%)</i>	
1. Fun			20.86***			11.07***
No	209 (15.6)	286 (21.3)		217 (16.2)	278 (20.7)	
Yes	466 (34.8)	379 (28.3)		450 (33.6)	395 (29.5)	
2. Exercise			14.28***			5.31*
No	496 (37.0)	425 (31.7)		478 (35.7)	443 (33.1)	
Yes	179 (13.4)	240 (17.9)		189 (14.1)	230 (17.1)	
3. Control			5.81*			9.08**
No	664 (49.5)	640 (47.8)		658 (49.1)	646 (48.2)	
Yes	11 (0.8)	25 (1.9)		9 (0.7)	27 (2.0)	
4. Learning			0.14			0.08
No	656 (49.0)	644 (48.0)		648 (48.4)	652 (48.6)	
Yes	19 (1.4)	21 (1.6)		19 (1.4)	21 (1.6)	

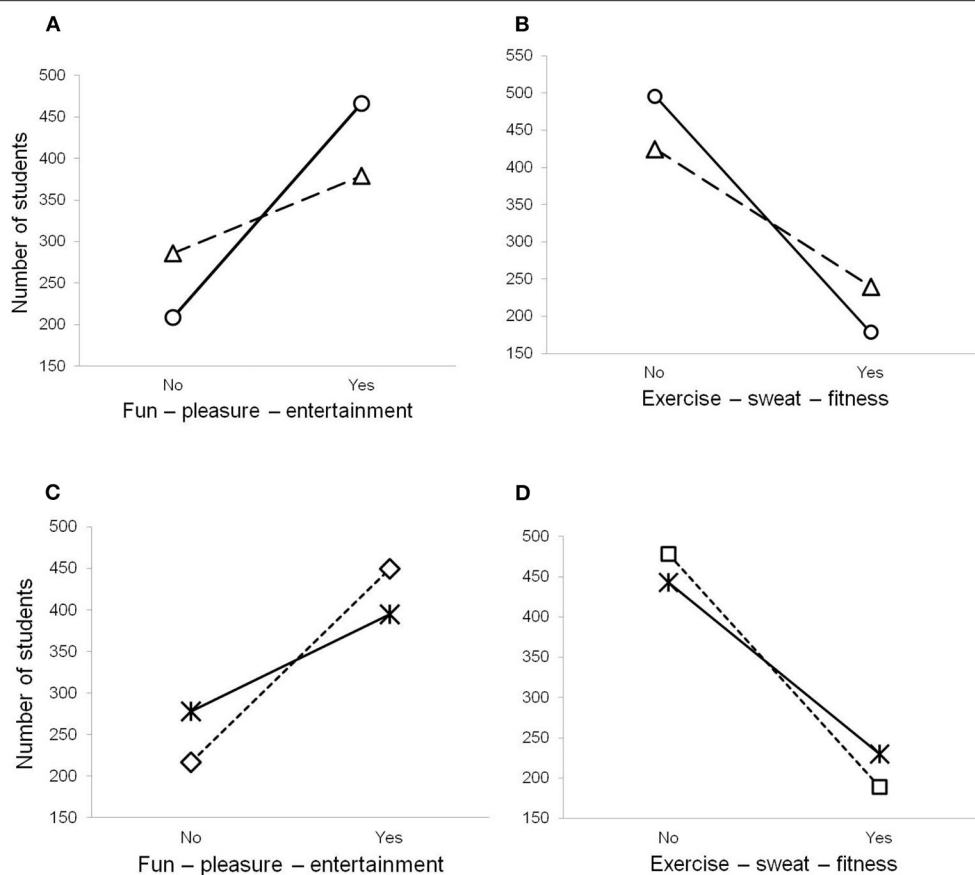
\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

respectively. More boys (when compared to girls) and high school students (in comparison to middle school students) have selected the third profile of PE classes. There was neither a significant association between the fourth profile of PE classes and gender nor with school level. The interaction effect is shown in **Figure 1**.

Results of the logistic regression analyses predicting preference for the profiles of PE classes among students are shown in **Table 3**. Preference for the first profile of PE classes may be predicted among female and middle school students, whereas preference for the second and third profiles may be predicted among male and high school students.

## DISCUSSION

The findings indicate that students' preferences for the profiles of PE classes are mainly related to the first (63%) and second (31%) profiles. It means that the basic, desirable forms of the



**FIGURE 1 |** Interaction plots **(A)** between the first profile of PE classes (fun–pleasure–entertainment) and gender (female marked as a *circle* and male marked as a *triangle*); **(B)** between the second profile of PE classes (exercise–sweat–fitness) and gender (female marked as a *circle* and male marked as a *triangle*); **(C)** between the first profile of PE classes (fun–pleasure–entertainment) and school level (middle marked as a *square* and high marked as a *cross*); and **(D)** between the second profile of PE classes (exercise–sweat–fitness) and school level (middle marked as a *square* and high marked as a *cross*).

**TABLE 3 |** Results of the logistic regression analysis predicting preferences for the profiles of PE classes among students ( $N = 1,340$ ).

Predictors of profiles of PE classes	Univariate model							Multivariate model						
	<i>B</i>	<i>SE B</i>	<i>OR</i>	95% <i>CI</i>		Wald's	<i>p</i>	<i>B</i>	<i>SE B</i>	<i>OR</i>	95% <i>CI</i>		Wald's	<i>p</i>
				<i>LL</i>	<i>UL</i>	$\chi^2$					<i>LL</i>	<i>UL</i>	$\chi^2$	
<b>1. Fun</b>														
Gender (male)	−0.52	0.11	0.59	0.47	0.74	20.72	0.00001	−0.53	0.11	0.59	0.47	0.74	21.06	0.00000
School level (high)	−0.38	0.11	0.69	0.55	0.86	11.03	0.001	−0.39	0.11	0.68	0.54	0.85	11.39	0.001
<b>2. Exercise</b>														
Gender (male)	0.45	0.12	1.56	1.24	1.98	14.19	0.0002	0.45	0.12	1.57	1.24	1.98	14.34	0.0002
School level (high)	0.27	0.12	1.31	1.04	1.66	5.31	0.02	0.28	0.12	1.32	1.05	1.67	5.45	0.02
<b>3. Control</b>														
Gender (male)	0.86	0.37	2.36	1.15	4.83	5.49	0.02	0.87	0.37	2.39	1.16	4.90	5.61	0.02
School level (high)	1.12	0.37	3.06	1.42	6.55	8.25	0.004	1.13	0.39	3.08	1.44	6.62	8.36	0.004
<b>4. Learning</b>														
Gender (male)	0.12	0.32	1.13	0.60	2.11	0.14	0.71	0.12	0.32	1.13	0.60	2.11	0.14	0.71
School level (high)	0.09	0.32	1.10	0.58	2.08	0.08	0.77	0.09	0.32	1.10	0.58	2.08	0.09	0.77

LL, lower limit; UL, upper limit.

activities during PE lessons are fun, leisure, entertainment, and intention to develop their physical fitness and locomotor skills. This is in line with previous research showing that positive emotions (happiness and joy) are significantly more highly evaluated than other emotions (negative and ambiguous) throughout PE sessions and that intrinsically motivated people do PA for pleasure, fun, or other self-determined reasons (25, 26, 33).

The results suggested that the preferable profile for girls and younger students from middle school was that of fun, pleasure, and entertainment, while boys and older adolescents from high school were predominantly in favor of exercise, sweat, and fitness. Previous research on gender differences in the context of PE activity support these results, as boys' more intensive PA and preferences toward vigorous activities contrasted with girls' predilection for moderate-to-low activities and lower level of activity in general (10, 11, 13, 14, 16, 17). The data also showed that the preferable profile of PE classes changes with age from the first to the second profile. Adolescence is a transitional developmental period between childhood and adulthood that is characterized by more biological, psychological, and social role changes than any other stage of life except infancy (34–36). Given the magnitude of such changes, it is not surprising that there are also significant changes in the preferred forms of physical activity and the motives and values underlying engagement in PE classes. Given the magnitude of such changes (37), it is not surprising that there are also significant changes in the preferred forms of physical activity and the motives and values underlying engagement in PE classes.

Logistic regression analysis showed that the preference for the first profile of PE classes was predicted by female gender and middle school level, whereas prediction of the occurrence of the second and third profiles concerned male gender and high school students. In other words, girls and younger students most frequently tended to choose fun, pleasure, and entertainment, whereas the group of boys and older youth preferred exercise, sweat, and fitness, as well as control, order, and discipline. A nationwide survey carried out in Polish schools showed that 14% of students expressed lack of willingness to participate in PE lessons. Consequently, from primary school to higher education, the proportion of the reluctance to attendance tended to increase: from 6% between the fourth and sixth grades of primary school, through 14% in middle school level, to 19% in high school. As one of the main reasons for the avoidance of PE classes, respondents mentioned an unattractive method of conducting classes by the teachers (31% of the total number of students) (24).

## Limitation of the Study

Despite the importance of the results of the present study, the findings must be viewed within the context of its limitations and interpreted with caution. One important limitation is the cross-sectional nature of the study, which does not allow any causal relationship of the preferred profiles of PE classes with gender and school level among adolescents. Further longitudinal research is needed to replicate the present findings. The research was performed almost a decade ago. Likely, the current and future replication of the study could have different results. The changes in PE preferences and culture may be related to

generational changes. Moreover, there are other correlatives such as biological, psychosocial, and environmental factors that can affect students' preferences. Therefore, future studies need to investigate more factors related to the PE preferences. Finally, given that this research is based only on students' self-report survey, future research could combine self-report measured with a more objective qualitative method (e.g., observation).

## Conclusions

Particular Polish schools and teachers have some autonomy in developing the curriculum of physical education. Teachers' preference for selected sports disciplines may significantly affect the content of school PE. It seems necessary to also take into account students' preferences in PE practice. Students expect that PE classes will be fun and focused on recreation and entertainment. This choice dominates in both middle and high schools. Students expect physical education classes to be implemented as fun, recreation, and entertainment. This choice dominates in both types of schools. The PE curriculum close to the students' expectations may have a positive impact on the attitude toward PE participation by increasing the perceived attractiveness of PE and in engaging in physical activity and triggering greater creativity.

It appears that better understanding of students' preferences is one of the means to decrease the level of reluctance in attendance in PE classes as well as to boost the effectiveness of realizing the most important PE objectives. Organizing PE classes in more fun-related forms for girls and in more exercise-related forms for boys and using the knowledge about the changing proportions of two preferred profiles of PE classes over age in practice by increasing the exercise-related forms and decreasing the fun-related ones could provide useful guidance for teachers.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Bioethical Commission of the Opole Medical Chamber, 45-054 Opole, Poland. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent from the participants of this study over the age of 16 was not required according to national legislation and institutional requirements.

## AUTHOR CONTRIBUTIONS

CK, BZ-W, and AR contributed to the study conception and design, data collection and interpretation, and manuscript preparation and review. AR contributed to the statistical analysis and visualizing and writing the results. All authors contributed to the article and approved the submitted version.

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

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# Self-Efficacy and Depression in Boxers: A Mediation Model

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**Background:** Depression has become one of the most common problems faced by athletes. In many mental health problems, its production and development mechanisms and influencing factors have received full attention from researchers, whereas boxers' depression has received limited attention. This study explored the relationship between boxers' self-efficacy and depression, as well as the effect of self-control as a mediating factor.

**Methods:** This study used the athlete self-efficacy scale (ASES), the self-control scale (SCS), and the Center for Epidemiologic Studies depression scale (CES-D). Using a large number of randomly selected samples, a total of  $N=231$  boxers (age:  $M=20.28$ ,  $SD=2.60$ , ages around 18 to 32; the total number of years of exercise:  $M=6.07$  years,  $SD=2.90$ , years around 1 to 15; 144 male) of Chinese national athletes participated the study.

**Results:** Self-efficacy and self-control were negatively correlated with depression; self-efficacy was positively correlated with self-control. In addition, self-control played a partial mediation role between self-efficacy and depression among boxers.

**Conclusion:** Above all, an important way to improve and prevent the depression of Chinese boxers maybe enhance their level of self-efficacy and self-control.

**Keywords:** self-efficacy, self-control, depression, mediating effect, boxers

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## INTRODUCTION

The mental health of elite athletes is increasingly becoming the focus of attention both in sports psychology and sports medicine (1–4). However, few studies have examined elite athletes' coping strategies for mental health problems such as depression. Such research is vital: depression is a widespread social problem affecting both the general population and athletes (5–7). While the exact prevalence of depression among elite athletes is still unclear (2, 3) and often underestimated (8), the extent to which depressive symptoms occur among them is currently considered comparable (9, 10) or higher (11) to that among the general population. Previous studies have also found that athletes engaged in team sports have lower levels of depression than those who participate in individual sports (12).

Scholars in sport psychology have called for research that 'gives a voice' to marginalized groups (13, 14), which would arguably include boxers. Boxing is a combat sport that places two individuals

in intense one-on-one physical and mental competition, who not only need to rapidly lose weight before the game to maintain the best competitive state, but also face the risk of concussion during competition and training. Research has also found that rapid weight loss and concussion are associated with depression among samples of boxers (15, 16). However, these findings which showed a link between depression and sport-related concussion, did not suggest any relationship between depression, self-control, and self-report methods among boxers.

Neurobiological and psychosocial models at this stage give evidence for the relationship between brain injury and depression. On the one hand, the neurobiological model of depression has provided compelling and parsimonious accounts of depression (17, 18). For example, individuals with clinical depression have been found to exhibit structural and morphologic changes of the brain's mood centers involving the hippocampus (19), amygdala, and prefrontal brain regions (20), which may be affected after concussion. In addition, it pointed out the effect of the apolipoprotein E4 allele (which has been shown to predispose to Alzheimer's disease) which is associated with chronic traumatic brain injury in boxing (21). That is, in boxers who had been knocked out many times in their boxing career, those with the E4 allele had considerably higher dementia symptoms than others. In other words, the E4 allele influenced whether an individual was relatively sensitive or insensitive to the dementia-causing effects of repeated mild brain injury (22). On the other hand, the psychosocial and cognitive model of depression provided a framework for identifying and understanding factors that maintain an episode of depression (23). In addition, some aspects of self-control and self-efficacy, such as the lack of an active rehabilitation, removal from sport, isolation, and lack of social support in dealing with concussion may influence mood in athletes with concussion (24, 25). Therefore, this study attempts to better understand the factors affecting depression in athletes who engage in individual sports by exploring the influencing factors and mechanisms of depression among boxers. Therefore, investigating the influential factors and mechanisms of boxers' depression is particularly important to prevent and reduce such depression in boxers and promote their healthy development.

Moving away from medical models that focus on treatment to more preventative and contextual approaches to health care, understanding a broader range of psycho-social outcomes associated with health care prevention is paramount. In this case, that self-control plays a mediating role between self-efficacy and depression in boxers is highly relevant both to social cognitive theory (SCT) and to broader psycho-social considerations of health.

Albert Bandura's (26, 27) SCT theory represents one of the most studied theories in this field, with applications in contexts as diverse as education, healthcare, and indeed sport and exercise. It is positioned as a theory of human behavior with integrative principles of broad applicability (28). Within SCT, self-efficacy, which represents a person's beliefs in their capabilities to perform given behaviors (29), is considered to be the focal determinant of task-oriented behavior (30) and drives healthy behavior (27). Previous studies have shown that not only is self-efficacy an

important component of sports-success functioning (31, 32), it also has a positive protective effect on athletes' mental health (33, 34). Therefore, this study is based on SCT, to more clearly demonstrate the importance of self-control and self-efficacy in preventing and reducing depression in boxers.

Extensive studies have found self-efficacy (35), self-control (36), and self-esteem (37) to be important factors affecting depression. Self-efficacy refers to an individual's belief in his or her organization and ability to perform the necessary actions to achieve a particular goal (38, 39). Research suggest that low self-efficacy leads to depression (29, 40) and that it can be an important protective factor for individual mental health. This kind of hypothesis is confirmed by recent studies, which find self-efficacy to be a significant negative predictor of depression (41–43) and an important factor affecting depression (44, 45). Individuals with high self-efficacy believe that they can effectively control potential external threats, and their positive responses can help them maintain their mental health. However, while some studies have confirmed that self-efficacy would negatively predict depression overall (46–48), no research has specifically examined the relationship between boxers' self-efficacy and depression. The purpose of the current study was to, therefore, proposed that self-efficacy among boxers would negatively predict depression (Hypothesis 1).

Self-control is an individual's ability to influence, regulate, and control one's own psychological, behavioral, and physiological processes (49). Some previous research has found that depression can be seen as a set of related problems in self-control (50). Therefore, self-control can also be used as a strategy to prevent or alleviate depression (51). Research over the past few decades has shown that self-control training can successfully reduce depression levels (52). Previous studies have found self-control to be a key factor affecting depression, and specific research has indicated that it is a negative predictor of the same (53, 54). Studies have shown that individuals with lower levels of self-control are more likely to suffer from depression than those with higher levels (55, 56); the latter is more willing to work at adopting strategies to deal with their problems and have a higher sense of control to fight against pressure. Those lacking the ability to regulate and effectively control their behavior are more likely to be depressed at some point in their life. Thus, it is still unclear whether there is a psychological mechanism affecting self-control and depression among boxers. Based on the above evidence, we hypothesized that self-control would negatively predict depression among boxers (Hypothesis 2).

Self-efficacy signals one's emotions over self-control; individuals will only act positively if they feel they have the ability to complete an activity (57). Self-control requires an individual to have the resources to control themselves, and self-efficacy is a positive emotion that can complement this ability. Bandura believes in the interaction between self-control and self-efficacy (58). Some studies showed that self-efficacy can positively predict self-control (59–61). However, other researchers have found that, under certain circumstances, individual self-control can significantly negatively predict self-efficacy (62, 63). Thus, there may be different relationships

between self-efficacy and self-control among different groups. Therefore, research should explore the influence of boxers' self-efficacy on self-control.

Many existing studies demonstrated that self-control is closely related to self-efficacy and depression, acting as a mediating variable worth considering, and that it mediated the relationship between other psychological characteristics and depression in different groups (64–66). This study, thus, was to investigate whether self-efficacy has a positive effect on boxers' self-control and whether there is a mediating effect on the relationship between self-efficacy and depression. This study speculates that, among boxers, there is a positive correlation between self-efficacy and self-control, and that self-control mediates the effects of self-efficacy on depression (Hypothesis 3).

## The Current Study

The aim of the current study was to investigate the effect of boxers' self-efficacy, self-control, and depression. The hypothesis is that boxers' self-efficacy would be significantly negatively related to depression, and boxers' self-efficacy is significantly positively predictive of self-control; secondly, boxers' self-control would significantly negatively predict depression; finally, boxers' self-control has a significant mediating effect between self-efficacy and depression. Therefore, this study explored the effect of self-efficacy on the depression of boxers and its internal mechanism from the perspective of the protective mechanism of self-efficacy on individual mental health. How does boxers' self-efficacy affect depression? (The mediating role of self-control in it). We aimed to provide sport psychologists with new perspectives and helpful suggestions for the intervention and treatment of boxers' depression. Thus, we simulated a mediation model to examine whether boxers' self-control mediates the relationship between self-efficacy and depression. **Figure 1** illustrates the conceptual model applied.

## METHODS

### Sample

The sample comprised of boxers from China, individuals and teams. This study adopted cluster sampling and selected boxers from China in different cities as participants to complete a survey questionnaire. In a cross-sectional study, a total of 250 questionnaires were distributed, and a total of 231 valid questionnaires were returned, a response rate of 92%. Among

the participants,  $N = 144$  were male (62%),  $N = 87$  were female (38%). Their average age was  $M = 20.28$  years ( $SD = 2.60$ , ages around 18 to 32).

## Procedure

All participants were invited to complete an anonymous online survey, which took approximately 20 min to complete. Participants were approached by the researchers, with the support of the participating sporting codes, consistent with the approved research ethics procedures. The first page of the survey included informed consent information, including the voluntary nature of participation. This first page of the survey stated that consent was inferred based on the provision of data. Participants were reminded of any missing items prior to progressing to the next page, resulting in no missing outcome data. Participants were provided with individual access to a tablet or phone to complete the survey. Data collection occurred locally, at each of the participant clubs/teams.

## Measures

### Self-Efficacy Scale for Athletes

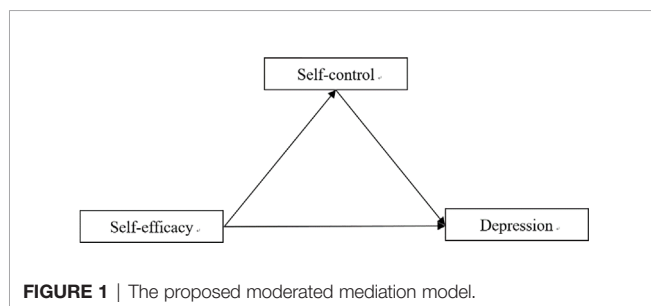
The self-efficacy scale for athletes consists of 15 items (67), such as "I can keep my mind clear and focused during the competition". Items for the self-efficacy scale ranged from 1 = *never been like this* to 5 = *always so*. A confirmatory factor analysis confirmed the one-dimensionality of the scale (CFA):  $\chi^2 = 97.75$ ,  $df = 70$ ,  $\chi^2/df = 1.40$ , RMSEA = 0.042, IFI = 0.983, NFI = 0.943, CFI = 0.983. The factor loadings of the items ranged from a = 0.44 to a = 0.68. The internal consistency of the questionnaire was good ( $\alpha = 0.92$ ).

### The Center for Epidemiologic Studies Depression (CES-D) Scale

The CES-D scale contains 20 items (68). The questionnaire included 20 items; one example was "I feel depressed." This item had to be answered on a scale of 1 (rarely or none of the time) to 4 (most or all the time), with higher scores indicating more depressive symptoms. A confirmatory factor analysis confirmed the one-dimensionality of the scale (CFA):  $\chi^2 = 3.21$ ,  $df = 2$ ,  $\chi^2/df = 1.61$ , RMSEA = 0.051, IFI = 0.993, NFI = 0.982, CFI = 0.993. The factor loadings of the items ranged from a = 0.35 to a = 0.71. The internal consistency of the questionnaire was satisfactory ( $\alpha = 0.70$ ).

### Self-Control Questionnaire

Self-control was measured by a 19-item (49), five-point Likert scale questionnaire, ranging from "1 = not at all" to "5 = very much", which reflects the five higher-order domains of impulsive control, work or study performance, healthy habit, moderation entertainment and resist the temptation; higher scores indicate a better self-control (item example: "I am good at resisting temptation"). A confirmatory factor analysis confirmed the one-dimensionality of the scale (CFA):  $\chi^2 = 6.19$ ,  $df = 3$ ,  $\chi^2/df = 2.06$ , RMSEA = 0.068, IFI = 0.989, NFI = 0.979, CFI = 0.989. The factor loadings of the items ranged from a = 0.47 to a = 0.78. The internal consistency of the questionnaire was well-qualified ( $\alpha = 0.83$ ).



**FIGURE 1** | The proposed moderated mediation model.

## Data Analysis

This study used SPSS 22.0 for statistical analysis and Amos 24.0 for establishing the structural model.

Firstly, we used initial correlational analysis to examine the relationships between self-efficacy, self-control, and depression. Descriptive statistics and means (*M*) and standard deviations (*SD*) were tested via IBM SPSS Statistics version 22. Then, following the two-step procedure recommended by Gerbing and Anderson (69), this study tested the measurement mediation model before construction (70). We first used a measurement model that contained three potential variables: self-efficacy, self-control, and depression, to test whether each latent variable could be well-represented by its indicators. We next determined whether the results from the measurement model were satisfactory; the structural model could be tested using the maximum likelihood (ML) estimation in the AMOS 24.0 program. To control the inflation of measurement errors generated by multiple items for the latent variable, we created several parcels using the item parceling assignment method (71), and specially created two-item parcels for self-efficacy, five-item parcels for self-control, and four-item parcels for depression.

To assess the adequacy of the model fit, we used the following six goodness-of-fit indices (72): 1) chi-square statistics between 1 and 3; 2) a standardized root mean square residual (SRMR) of 0.06 or less; 3) a root-mean-square error of approximation (RMSEA) of 0.08 or less; 4) a goodness-of-fit index (GFI) of 0.90 or higher; 5) a Tucker-Lewis index (TLI) of 0.90 or higher; and 6) a comparative fit index (CFI) of 0.90 or higher.

## RESULT

### Preliminary Analysis

Preliminary analyses for the study variables were presented in **Table 1**. Firstly, boxers' self-efficacy was negatively correlated with depression, and boxers' self-control negatively correlated with depression. Moreover, boxer's self-efficacy was positively correlated with self-control. Therefore, in this study, the significant correlations between the variables provided a basis for subsequent testing of mediating effects.

### Overall Model Analysis

According to the testing procedure of mediating effects (Preacher et al., 2006). Firstly, the fitness indicators of the SEM direct effect analysis results were as follows: ( $\chi^2 = 8$ ,  $df=15.52$ ,  $\chi^2/df = 1.940$ ,  $p < 0.05$ ), CFI (0.983), the TLI (0.967), and the GFI (0.977) > 0.90, and the RMSEA (0.067) < 0.06. Self-efficacy was negatively

related to depression ( $\beta = -0.24$ ,  $p < 0.001$ ). Then, the SEM tested whether there was a mediating effect of self-control between self-efficacy and depression in boxers. The chi-square value was significant ( $\chi^2 = 38$ ,  $df=55.73$ ,  $\chi^2/df = 1.467$ ,  $p < 0.05$ ) with its sensitivity to the large sample size, other goodness-of-fit indices demonstrated satisfactory results for this study, with the CFI (0.978), the TLI (0.969), and the GFI (0.957) > 0.90, the RMSEA (0.045) < 0.06, and the SRMR (0.047) < 0.06. The variance in depression explained by this model was 35%. All of the observed variables were significantly loaded on the latent constructs in the expected directions, which suggested that the selected indicators reasonably represented the underlying constructs in a statistically reliable manner.

As shown in **Figure 2**, self-efficacy was negatively related to depression ( $\beta = -0.14$ ,  $p < 0.001$ ), and self-control was negatively related to depression ( $\beta = -0.54$ ,  $p < 0.001$ ). Moreover, self-efficacy was positively related to self-control ( $\beta = 0.35$ ,  $p < 0.001$ ), and age was positively related to self-control ( $\beta = 0.19$ ,  $p < 0.001$ ). Taken together, self-control had a partial mediating effect on the relationship between self-efficacy and depression.

## DISCUSSION

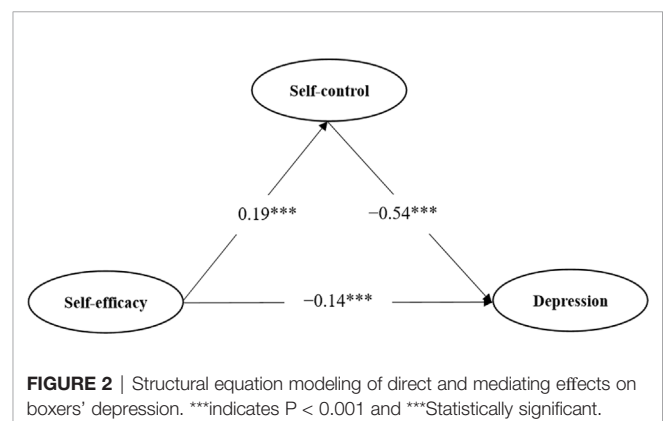
This study discussed the relationship between boxers' self-efficacy and depression and its internal mechanisms of action. Correlation analysis stated that there is a significant negative correlation between boxers' self-efficacy, self-control, and depression, and there is a significant positive correlation between self-efficacy and self-control. In addition, boxers' self-control has a significant mediating effect between self-efficacy and depression.

This study aims to understand whether self-efficacy and self-control can predict depression among boxers. We determined self-efficacy to be significantly and negatively associated with depression, a finding that supports Hypothesis 1 and is consistent with previous findings (41–43). Our results also suggested that boxers' self-efficacy would negatively predict depression; again, this finding was consistent with those of previous studies (45–48). Social cognitive theory argues that a lack of self-efficacy might lead to feelings of depression through a discrepancy in aspirations and perceived skills

**TABLE 1** | Descriptive statistics for study variables ( $N=231$ ).

	<i>M</i>	<i>SD</i>	1	2	3
1. Self-efficacy	3.34	0.65	–		
2. Self-control	3.44	0.51	0.23***	–	
3. Depression	2.10	0.30	-0.21**	-0.41***	–

\*indicates  $P < 0.05$ , \*\*indicates  $P < 0.01$ , and \*\*\*indicates  $P < 0.001$ .





(73). The results of this study to a certain extent support the views of social cognitive theory, that self-efficacy influences depression in boxers. So, self-efficacy is so important for boxers, it is a psychological indicator to predict the depression of boxers. In addition, some studies that rely on longitudinal study methods also show a significant negative correlation between self-efficacy and depression (44, 74), while others demonstrate that reduced levels of individual self-efficacy lead to psychological maladaptation, including depression (75, 76). Thus, improving boxers' self-efficacy could not only enhance the probability of winning competitions, but also contribute to boxers' mental health.

Our results also suggested that self-control is significantly and negatively associated with depression among boxers, we found that this supports Hypothesis 2 and is in accordance with prior studies (53, 54). A self-control model of depression found that self-control therapy showed a significantly greater reduction in depression (26). The results of this study to a certain extent support the views of a self-control model of depression, that improving boxers' self-control helps reduce their risk of depression. High levels of self-control are vital for the healthy development of an individual's physical and mental health (49). In addition, a large number of studies have found that people who report depressive symptoms are more likely to be impulsive and have a lower level of self-control than those without such symptoms (77–79). In sporting contexts, self-control is a key factor influencing athletic performance (80). Overall, for boxers, improving self-control levels not only helps improve athletic performance but also has a positive effect on reducing the risk of depression. Conversely, if boxers have a low level of self-control, their risk of depression increases.

Finally, this study found that boxers' self-control plays a significant mediating role between self-efficacy and depression; this finding supports Hypothesis 3 and is in line with previous research (64–66). Bandura's (81) model of self-control with the addition of attributional considerations is proposed as a heuristic model for the analysis of the phenomena of depression. The results of this study support this model. The results show that boxers' self-control plays a partial mediating role in the relationship between self-efficacy and depression. Boxers' self-efficacy not only has a direct impact on depression, but also indirectly through self-control. Therefore, no matter where boxers are in competition and life, if the level of self-efficacy and self-control is high, the risk of depression is reduced. Thus, future research should focus on improving boxers' self-efficacy and self-control to prevent depression during high-pressure training or competitions.

In summary, the results of this study are not only applicable to boxers but can also be promoted among other athletes. This new conceptual framework can be a valuable and novel perspective for the future research of depression in applied fields such as sport, providing possible targets for intervention, and forming a basis for further research. In addition, boxing is a confrontation sport that increases physical fitness and is loved by different age groups for the role the sport can play in helping to raise awareness of mental health generally.

## CONCLUSION

To sum up, we used the self-efficacy scale for athletes, the self-control questionnaire, and the Center for Epidemiologic Studies depression scale to collect data from 231 Chinese national boxers. Based on SCT, this study clearly demonstrated the importance of self-control and self-efficacy in preventing and reducing depression in boxers. Therefore, for the mental health education of boxers, on the one hand, it is necessary to continuously improve their self-control levels, and at the same time, improve their self-efficacy through behavioral training which will be more conducive to reducing the depression of boxers. Future studies could replay the same experimental procedures in these contexts to provide more substantial findings and consider using specific questionnaires on personality profiles.

## LIMITATIONS

This research has certain theoretical and practical significance, but there are some limitations. Firstly, this study uses a cross-sectional study design, making it difficult to make accurate causal inferences. On the other hand, the survey instruments have not been validated for use in boxers. The findings of this study can be tested in the future through experimental research and tracking design. Secondly, only the mediating effect of self-control between boxers' self-efficacy and depression is considered, but in reality, there are still other mediator variables, such as self-esteem and personality, which are subject to further research.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding authors.

## ETHICS STATEMENT

The study was approved by the Research Ethics Committee of Southwest University, Chongqing, China. Written, informed consent was obtained from all the participants.

## AUTHOR CONTRIBUTIONS

XC, NQ, CC, DW, GZ, and LZ conceived the study, interpreted the data, drafted and revised the work, approved the final version of the manuscript to be published, and agreed to be accountable for all aspects of the work.

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# Physical Activity Recommendations for Segments of School Days in Adolescents: Support for Health Behavior in Secondary Schools

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School physical activity (PA) is an indispensable part of daily PA, the foundation for developing lifelong PA and fitness, and an easy way to gain physical and health literacy. School PA is equally important for understanding the continuity of physical and mental health, even in broader psychosocial aspects. Regarding long-term outcomes, significant attention has been paid to the determination of daily and weekly recommendations for adolescent PA. However, comprehensive approaches suggesting recommendations for PA in segments of the school day are rare. This study aimed to (a) provide a rationale for PA recommendations in segments of school days and incorporate it into generally accepted PA recommendations, and (b) promote radical changes in the educational process toward a healthy school lifestyle through PA recommendations in segments of school days. The results of research conducted in 98 secondary schools in the Czech Republic and 104 secondary schools in Poland from 2009 to 2017 were used in this study. In total, 3,860 boys and 5,237 girls from the Czech Republic and 3,052 boys and 3,329 girls from Poland, all aged 15–19, participated. We recommended at least 2,000 steps (or 10 min of moderate-to-vigorous PA) for the before school segment and at least 6,000 steps (or 30 min of moderate-to-vigorous PA) for the after-school segment. For the time spent at school, we further recommended at least 500 steps/h (alternatively, at least 3,000 steps/school time), 20 min of moderate-to-vigorous PA ( $\geq 3$  METs or 60% HRmax), and at least one HRsubmax/max response to significant stress during PA to mitigate educational stress and high levels of sedentary behavior in schools. PA should account for at least 25% of school time, even on days with no scheduled physical education lessons. We propose using PA recommendations in segments of school days to achieve positive changes in the educational process and school lifestyle. Acceptance of PA recommendations in segments of school days theories on physical education could help refine and concretize demands for changes in PA and lifestyle in secondary schools. In practice, it could support the creation of innovative and comprehensive school PA programs. Future research should focus on obtaining evidence in support for adolescent PA by applying PA recommendations in segments of school days.

**Keywords:** physical education, steps, physical literacy, school lifestyle, comprehensive school physical activity program



## INTRODUCTION

The state of health in European populations is alarming, most notably with cardiovascular diseases being responsible for 45% (3.9 million) of all deaths in Europe annually (1). Though progressive improvement has been observed in some European countries, the situation in Central and Eastern Europe remains relatively unchanged. As children age, rates of overweight and obesity rise (2), cardiovascular fitness declines (3), incorrect body posture increases (4), and mental health disorders increase, especially among girls (5). There is also a decline in physical activity (PA) as children age (6, 7), particularly for intense PA (8), along with decreasing interest in physical education (PE) (9). Indeed, by 2012, only 35 of 131 European studies reported that adolescents met daily PA recommendations (10) and in Central-Eastern European countries, high levels of sedentary behaviors have been recorded (11). Schools bear some responsibility for this situation, as they should significantly contribute to health maintenance, developing physical and mental fitness, and promote healthy lifestyles for adolescents.

The school environment is the ideal “practical lab” to investigate the effects of education on adolescent health. In particular, schools play a crucial role in promoting PA, as well as the adoption of lifelong PA habits (12); this is especially true for combating sedentary behavior in and out of school (13), and identifying and supporting adolescents with low physical fitness (14). Numerous school reforms and emerging alternative education systems seek positive changes in adolescent health (15), including the implementation of PA recommendations in different segments of school days; we defined segments of school days as the time before, during, and after school that is set aside for PA on days that adolescents attend school. However, there is legitimate criticism of the limited evidence-base for current PA recommendations (16). The question arises whether universal PA recommendations in segments of school days can be formulated to transcend differences in geographical, urban, socioeconomic, and, in particular, educational conditions.

Thus, this study aimed to:

- (1) Through the synthesis of previous research results, provide a rationale for PA recommendations in segments of school days and incorporate it into generally accepted PA recommendations.
- (2) Promote a comprehensive approach to change educational processes toward a healthy school lifestyle for adolescents through PA recommendations in segments of school days.

## MATERIALS AND METHODS

### Methodological Basis

This study's methodological basis is rooted in analyzing investigations of school health promotion models (17), together with recommendations for PA for children and adolescents (18, 19), school PA, and PE (20, 21). This study is based on a synthesis of previous research published in this area. Specifically, it draws on research findings from studies conducted in secondary schools in the Czech Republic and Poland (22–29), where

the methodology of individual research is clearly presented; therefore, it is not repeated in this comprehensive study.

### Participants and Procedure

From 2009 to 2017, we conducted surveys on PA and inactivity among adolescents between the ages of 15 and 19 in 98 secondary schools in the Czech Republic (3,860 boys and 5,237 girls) and 104 secondary schools in Poland (3,052 boys and 3,329 girls). Subsets of school participants had an average age 16–17 years with BMI ranging from 20 to 22 kg·m<sup>-2</sup> and only 5–10% of adolescents did not give informed consent to the research. All participants received individual feedback on the research results and the average results were discussed at the end of the research. This study presents the results directly related to school PA from a range of measures: the International Physical Activity Questionnaire–Long Form [IPAQ-LF; (30)], weekly PA monitoring using pedometers, and daily PA monitoring using accelerometers. The IPAQ-LF was completed by 1,632 boys and 2,537 girls to estimate perceived PA in selected domains; evaluating the school PA domain was the focus of this study [see (31–34)]. In the Czech version of the IPAQ-LF the Pearson's correlation coefficient, as an indicator of concurrent validity between weekly PA (METs-min) and weekly step count (steps/week), was  $r = 0.283$ . The internal consistency reliability coefficient Cronbach's alpha was  $\alpha = 0.845$ . There were 810 boys and 1,293 girls who participated in weekly PA monitoring using Digi-Walker SW-700 pedometers [Yamax Co., Yasama Corp., Tokyo, Japan; see (22, 33, 34)], and 1,136 boys and 2,256 girls who participated in monitoring daily school PA using ActiTrainer accelerometers (Pensacola, FL, USA; <http://www.theactigraph.com/products/actitrainer>). Accelerometer data were processed using cutoff points for children (35), and the epoch was set at 15s [see (22, 23, 26)]. We set the threshold for the moderate-to-vigorous PA (MVPA) in accordance with the recommendations of Norton et al. (36). All surveys were centrally managed and conducted by stable research teams in both countries.

We respect the specifics of contemporary education in Central-Eastern European countries, particularly the frequent, and not always system-based, educational reforms resulting from extensive political changes. In these countries, the educational system tends to prefer imparting cognitive knowledge to students; consequently, the relationship between sports and PE tends to be separated, and PE lessons are typically sex-segregated.

Data collection, recording, and evaluation were performed using the respective Czech and Polish versions of the International Database for Research and Educational Support (Indares; [www.indares.com](http://www.indares.com)).

### Statistical Analysis

Statistical analyses were conducted using SPSS 22 (IBM Corp., Armonk, NY) and Statistica 13 (StatSoft Inc., Prague, Czech Republic). For statistical processing, we used descriptive characteristics and cross-tables to identify differences in meeting PA recommendations for boys and girls. A Kruskal-Wallis analysis of variance (ANOVA) was applied for IPAQ-LF results, and one or two-way ANOVAs with Scheffé *post-hoc* analyses were used for the analysis of data obtained from monitoring PA with

pedometers and accelerometers. The practical significance of the results was assessed by partial eta-squared ( $\eta_p^2$ ) and Cohen's  $w$  effect size coefficients, defined as follows: small  $0.01 \leq \eta_p^2 < 0.06$  ( $0.10 \leq w < 0.29$ ), medium  $0.06 \leq \eta_p^2 < 0.14$  ( $0.3 \leq w < 0.50$ ), and large  $\eta_p^2 \geq 0.14$  ( $w \geq 0.50$ ). Statistical significance was set at  $p < 0.05$ .

## Ethics Statement

The study was approved by the Ethics Committee of Human Research of the Faculty of Physical Culture, Palacký University, in Olomouc (no. 24/2012) and the Jerzy Kukuczka Academy of Physical Education, in Katowice (no. 2/2008). All participants, their parents, and school administrators provided written informed consent. Prior to the study, the participants received detailed information on data confidentiality and security in Indares, as well as on data processing and publishing. Participants could withdraw from PA monitoring at any time during the study.

## RESULTS

### General Recommendations for Adolescents PA

Extraordinarily long-term attention has been devoted to PA recommendations for adolescents (37). However, it remains unclear to what extent global recommendations have mitigated deteriorating PA, and in what areas of a physically active lifestyle their promotion has been most effective and beneficial (16). Continental and regional variability in lifestyle is a significant inhibitor of globally recognized PA recommendations (38)—especially regarding children and adolescents—due to societal differences in the role of education, different educational systems, and curricula differences. This most likely explains why school PA recommendations are less frequently published, compared to general recommendations for PA for children and adolescents.

Recommendations published in the Healthy People Initiative and Physical Activity Guidelines for Americans (39) have had the greatest impact worldwide. There is an almost unanimous consensus that children and adolescents should engage in at least 60 min of PA daily (40–45), including MVPA focused on strengthening skeletal and muscular systems at least three times a week. Based on a study by Pate et al. (21), most of the 60 min of PA per day should be MVPA, and school PA should itself include at least 30 min of MVPA. According to our IPAQ-LF estimates, mean daily school PA is 62 min (268 METs-min/daily school time), 37 min of which are MVPA (185 METs-min/daily school time). Another equally important recommendation is that government institutions should ensure that schools provide PE programs in line with national standards of 225 min of PE per week in secondary schools for grades 9–12 (42).

Easy-to-understand PA indicators, such as minutes of PA or steps per day (or in particular segments of a day), are important for most adolescents. Regarding adults and the elderly, the universality of 10,000 steps per day is discussed worldwide and, despite many criticisms, its positive aspects have prevailed (46). The situation is more complicated for adolescents, due

to their higher diversity of PA, especially in school and after-school activities. Despite frequent objections, recommendations of 10,000–11,700 steps per day for adolescents (47), or a simplified proposal for children and adolescents (of both sexes) of  $\geq 11,500$  steps per day (48), has been widely accepted in many countries.

In our study, we found that Czech adolescent boys and girls reached an average of  $11,354 \pm 3,606$  and  $10,799 \pm 3,047$  steps per day, respectively, while Polish adolescent boys and girls averaged  $10,799 \pm 3,692$  and  $10,130 \pm 3,121$  steps per day, respectively. Based on these findings, and previous studies in Central Europe (25, 31), we recommend 11,000 steps per day and 60 min of MVPA every day for both boys and girls. These results related to daily PA are also the starting point for creating PA recommendations in segments of school days.

### Recommendations for PA Before and After School

#### PA Before School

##### Background

The most significant type of PA before school for most adolescents is active transport (AT) to school. Declines in rates of AT to school have been observed in developed countries (49) and Central Europe (50). Although intervention studies have so far failed to increase AT to school significantly (51), it is desirable to keep investigating possibilities for promoting AT, particularly in less developed countries (e.g., Central and Eastern Europe), to avoid repeating the well-known causes of AT decline in more economically developed countries.

Before school PA is the most efficient use of available time and significantly contributes to increasing overall daily PA, mainly through AT (52). The distance from home to school is a crucial factor for AT among secondary school students (53). Approximately 0.84 miles was determined to be an acceptable distance for walking to school among Portuguese adolescents (54). Meanwhile, the US Healthy People 2020 plan advocates increasing the number of 5- to 15-years-olds who walk at least one mile to school (or cycle if the distance exceeds two miles).

##### Research findings

According to our pedometer-derived data, boys averaged  $1,686 \pm 910$  steps (1,754 steps/h) and girls averaged  $1,870 \pm 972$  steps (1,628 steps/h) in the before-school segment. Similar results were found from accelerometer monitoring, with boys averaging  $1,465 \pm 867$  steps ( $1,451 \pm 889$  steps/h) and girls averaging  $1,566 \pm 899$  steps ( $1,379 \pm 1,001$  steps/h). The average time for before-school PA was  $37.2 \pm 18.2$  min for boys (MVPA  $\geq 3$  METs  $9.5 \pm 6.9$  min and  $9.6 \pm 7.7$  min/h;  $\geq 60\%$  HRmax  $7.6 \pm 15.8$  min and  $6.7 \pm 10.5$  min/h) and  $40.2 \pm 19.0$  min for girls (MVPA  $\geq 3$  METs  $8.9 \pm 6.7$  min and  $7.9 \pm 6.5$  min/h;  $\geq 60\%$  HRmax  $11.1 \pm 14.9$  min and  $9.8 \pm 11.3$  min/h). Compared with other school-day segments, we also found the highest mean HR/min (boys:  $96 \pm 15$ ; girls:  $105 \pm 15$ ) during the before-school segment. Based on these findings, our proposed recommendations for PA in the before-school segment are at least 2,000 steps or 10 min of MVPA, mainly through AT with cycling or brisk walking.

### Rationale

The proposed number of 2,000 steps before school was met by 29.3% of boys and 38.1% of girls, as measured by pedometers, and by 22% of boys and 25.4% of girls, as measured by accelerometers. The recommended 10 min of MVPA  $\geq 3$  METs was met by 37.2% of boys and 27.1% of girls, while 23% of boys and 39.6% of girls met the recommended 10 min of MVPA  $\geq 60\%$  HRmax. Observed sex differences highlighted the importance of multi-factor assessments of MVPA. Effective use of before-school time for PA was also confirmed by the ratio of PA time to total segment time; PA accounted for 58.1% of the before-school time for boys and 55.1% for girls.

### PA After School

#### Background

After school PA is the most important part of daily PA on a school day (55); however, it is also the part most affected by educational and institutional environments (comprising sports and other leisure-time PA institutions), together with social and economic context. Despite their positive effects (56), previous after-school interventions to increase PA in children have scarcely yielded significant outcomes (57), and there is little evidence regarding which after-school settings increase PA among adolescents the most (58). Nonetheless, after-school programs have high potential (56) and, in coordination with school- and community-based sports clubs and institutions, they are indispensable for providing organized PA for children and adolescents.

#### Research findings

The PA of boys and girls, measured by pedometers, averaged  $5,794 \pm 3,389$  steps (1,754 steps/h) and  $6,188 \pm 3,351$  steps (1,628 steps/h), respectively, in the after-school segment. Furthermore, boys' and girls' PA as measured by accelerometers averaged  $5,411 \pm 3,513$  steps ( $811 \pm 494$  steps/h) and  $5,459 \pm 3,122$  steps ( $829 \pm 454$  steps/h), respectively. The average time of after-school PA was  $153.7 \pm 72.9$  min for boys ( $22.8 \pm 9.2$  min/h; MVPA  $\geq 3$  METs  $33.6 \pm 26.4$  min and  $5.1 \pm 3.9$  min/h; MVPA  $\geq 60\%$  HRmax  $37.0 \pm 52.5$  min and  $5.5 \pm 7.7$  min/h) and  $156.2 \pm 65.3$  min for girls ( $23.4 \pm 7.7$  min/h; MVPA  $\geq 3$  METs  $30.0 \pm 22.4$  min and  $4.6 \pm 3.4$  min/h;  $\geq 60\%$  HRmax  $35.0 \pm 48.2$  and  $5.4 \pm 7.5$  min/h). Mean HR/min was  $90.5 \pm 13.4$  for boys and  $93.8 \pm 13.4$  for girls. Based on these findings, our proposed recommendations for PA in the after-school segment are at least 6,000 steps or 30 min of MVPA, provided by AT from school and various organized and unorganized PA.

### Rationale

The proposed number of 6,000 steps in the after-school segment was met by 41.5% of boys and 47.2% of girls, as measured by pedometers, and met by 33.4% of boys and 36.1% of girls, as measured by accelerometers. The recommended 30 min of MVPA  $\geq 3$  METs was met by 43.8% of boys and 40.4% of girls. Furthermore, PA accounted for 38.0 and 39.0% of the after-school time in boys and girls, respectively.

## School PA Recommendations

### General School PA Recommendations in Summary and in Main Time Segments

#### Background

Most recommendations in national PA promotion programs are based on or complement the most widespread recommendations of Healthy People 2010, Healthy People 2020, and the 2008 Physical Activity Guidelines for Americans. They are formulated as calls for action (39, 59), such as:

- Increase the number of public and private schools that require daily PE for all students.
- Increase the number of adolescents who participate in daily PE.
- Increase the number of adolescents who are physically active for at least half of the PE allocated time.
- Encourage adolescents to participate in age-appropriate PA that is pleasant and diverse/varied.
- Increase the number of regular recess periods in schools.

In the context of educational systems' historical development (e.g., discretionary lessons, online PE, and lessons according to sports preferences), the recommendation and implementation of 225 min of PE per week still prevail in national educational curricula, despite the emergence of alternative approaches (60). It is also recommended that "schools should ensure that all children and adolescents participate in a minimum of 30 min of MVPA during the school day; this includes time spent being active in PE lessons," [(60), p. 1,220] which is frequently promoted and generally accepted by educational institutions.

Based on PA monitoring of Czech and Polish adolescents, the following in-school PA recommendations were previously proposed: 3,000 steps/school time, 20 min of MVPA/school time ( $\geq 3$  METs), 20 min of MVPA/school time ( $\geq 60\%$  HRmax), and 25% PA/school time (22, 26). PA recommendations in segments of school days also began to be used based on the results of adolescents' weekly PA estimates from the IPAQ-LF questionnaire (Part 1—Job/school-related physical activity; 23). Despite questionnaire limitations (28), our school PA recommendations complement general PA recommendations as follows:  $\geq 20$  min of vigorous PA at school ( $\approx 360$  METs-min) at least three times per week;  $\geq 30$  min of moderate PA at school ( $\approx 600$  MET-min) at least five times per week;  $\geq 30$  min of walking at school ( $\approx 500$  MET-min) at least five times per week; and (the most challenging recommendation)  $\geq 60$  min of any MVPA at least five times per week and  $\geq 20$  min of vigorous PA at least three times per week ( $\approx 1260$  MET-min).

Despite extensive prior research on children's PA during recesses (61), little is known regarding the type of PA, its intensity, or benefits of PA-oriented recess and intervention programs to improve educational processes and increase overall daily PA in adolescents (62, 63). It is clear that appropriately inserting PA-oriented recess periods is a health-enhancing and cost-effective way to increase school PA (64). However, suitable indoor and outdoor school facilities are needed to facilitate PA during recess, thus addressing the prevalence of being overweight, obesity, and low levels of PA among secondary school students (62). It is



important not to shorten recess; instead, the duration of the last lesson should be reduced (26).

Encouragingly, almost all countries recommend that PE be designated as a core subject (12). In most countries that recommend a minimum duration of PE time, the ratio of PE to overall school time is higher in primary than secondary education. Additionally, PE in secondary education represents 6–8% of total school time in Europe, ranging from 14% in France to 3–4% in Spain, Malta, and Turkey (15). On school days with physical education lessons (PEL), boys and girls not only achieve higher school PA but also higher overall PA (65). Regardless of lesson goals or content, at least 50% of each PEL should involve MVPA (60, 66). Moreover, students should be pushed to reach a significant physiological stress response nearing submaximal to maximal HR at least twice during each PEL, again independent of its focus (22).

### Research findings

In our pedometer monitoring of school PA, boys averaged  $3,653 \pm 2,353$  steps ( $580 \pm 361$  steps/h) and girls averaged  $3,330 \pm 1,969$  steps ( $533 \pm 309$  steps/h). According to accelerometer monitoring, boys averaged  $2,867 \pm 1,849$  steps ( $478 \pm 296$  steps/h) in school, while girls averaged  $2,630 \pm 1,659$  steps ( $432 \pm 243$  steps/h). The mean time of PA (regardless of type) was  $115.7 \pm 47.2$  min for boys (MVPA  $\geq 3$  METs  $15.3 \pm 14.0$  min; MVPA  $\geq 60\%$  HRmax  $19.2 \pm 33.5$  min) and  $100.0 \pm 43.4$  min for girls (MVPA  $\geq 3$  METs  $12.0 \pm 11.3$  min; MVPA  $\geq 60\%$  HRmax  $21.1 \pm 35.4$  min). Mean HR/minute during school was  $92.3 \pm 12.3$  in boys and  $95.8 \pm 11.4$  in girls. **Table 1** presents additional characteristics of school PA according to adolescent participation in PELs. As school PA with PELs was statistically significantly higher in both boys ( $>2,000$  steps/school time and  $>14$  min MVPA) and girls ( $>1,500$  steps/school time and  $>11$  min MVPA), compared to school PA without PELs, careful consideration should be given to the implementation of PA recommendations.

On average, boys reached  $1,229 \pm 1,298$  steps ( $278 \pm 285$  steps/h) and girls reached  $1,094 \pm 1,135$  steps ( $242 \pm 243$  steps/h) during non-PE school lessons. From the first lesson (1L) to the sixth lesson (6L) in school schedules (six lessons is a common school day in vocational schools in the Czech Republic and Poland), boys averaged  $174 \pm 465$  steps in 1L,  $182 \pm 428$  steps in 2L,  $151 \pm 392$  steps in 3L,  $133 \pm 217$  steps in 4L,  $170 \pm 281$  steps in 5L, and  $271 \pm 429$  steps in 6L, while girls averaged  $131 \pm 307$  steps in 1L,  $118 \pm 240$  steps in 2L,  $132 \pm 322$  steps in 3L,  $119 \pm 225$  steps in 4L,  $157 \pm 315$  steps in 5L, and  $238 \pm 412$  steps in 6L. Aggregated across all lessons during school time (excluding PELs), boys averaged  $1,216 \pm 1,325$  steps ( $267 \pm 283$  steps/h) and girls averaged  $1,088 \pm 1,132$  steps ( $236 \pm 237$  steps/h). Further, it is concerning that we observed HR  $\geq 85\%$  HRmax during lessons in 9.9% of boys and 13.0% of girls.

According to the pedometer monitoring of PELs, boys averaged  $2,554 \pm 1,108$  steps/45 min, and girls averaged  $1,839 \pm 828$  steps/45 min. Boys and girls monitored by accelerometer averaged  $1,894 \pm 1,144$  steps ( $1,604 \pm 784$  steps/45 min) and  $1,585 \pm 843$  steps ( $1,308 \pm 624$  steps/45 min), respectively. The average PA time in PELs was  $35.0 \pm 7.2$  min/45 min for boys

(MVPA  $\geq 3$  METs  $11.3 \pm 7.2/45$  min; MVPA  $\geq 60\%$  HRmax  $20.1 \pm 14.6/45$  min) and  $33.3 \pm 7.02$  min for girls (MVPA  $\geq 3$  METs  $8.1 \pm 5.5/45$  min; MVPA  $\geq 60\%$  HRmax  $18.3 \pm 13.4/45$  min). Based on these findings, our proposed PA recommendations for in-school segments are for students to reach at least 3,000 steps (averaging at least 500 steps/h, lesson, and recess) and at least 20 min of MVPA during school. Furthermore, it should be ensured that there is at least one significant physiological response to vigorous PA intensity (at submaximal to maximal HR). School PA should account for at least 25% of total school time, and 50% of their recess should be devoted to PA. Recess should last for at least 25% of the total time of lessons. In each PEL, students should strive to achieve at least 2,000 steps/45 min and at least 20 min of MVPA/45 min, with more than 50% of PEL time devoted to PA, and at least two physiological responses at submaximal to maximal HR.

### Rationale for PA during total time spent in school

The proposed recommendation of 3,000 steps during school time was met by 50.4% of boys and 49.8% of girls. Similarly, 49.1% of boys and 46.6% of girls met the recommendation of 500 steps per hour. The ratios of boys' and girls' step count in school to their total daily step counts on weekdays are shown in **Figure 1**.

The recommendation of 3,000 steps in school, based on accelerometry derived PA monitoring, was met by 37.9% of boys and 32.6% of girls. Further, 38.1% of boys and 31.7% of girls met the recommendation of 500 steps/h. The recommended 20 min of MVPA  $\geq 3$  METs was met by 29.1% of boys and 19.1% of girls, while the MVPA recommendation  $\geq 60\%$  HRmax was met by 27.2% of boys and 30.1% of girls. PA accounted for 32.4% and 27.8% of overall school time for boys and girls, respectively. Additionally, according to responses to the IPAQ-LF, school PA comprised 28.8% of overall 5-days PA in boys and 27.1% in girls.

Among the pedometer-measured sample, the proposed 3,000 steps in school were met by 85.0% of boys and 79.7% of girls on days with PELs, compared to 37.5 and 39.6%, respectively, on days without PELs. The equivalent values in the accelerometer-measured sample were 77.1% of boys and 68.3% of girls on PEL days, compared to 26.1 and 21.6%, respectively, on non-PEL days. In the pedometer-measured sample, the recommendation of 500 steps/h was met by 81.8% of boys and 77.6% of girls on PEL days, compared to 37.0 and 36.0%, respectively, on non-PEL days. The equivalent values in the accelerometer-measured sample were 80.2% of boys and 64.4% of girls on PEL days, compared to 25.5 and 21.5%, respectively, on non-PEL days. The recommended 20 min of MVPA at school was met by 41.3% of boys and 58.7% of girls on PEL days, compared to 19.5 and 11.7%, respectively, on non-PEL days.

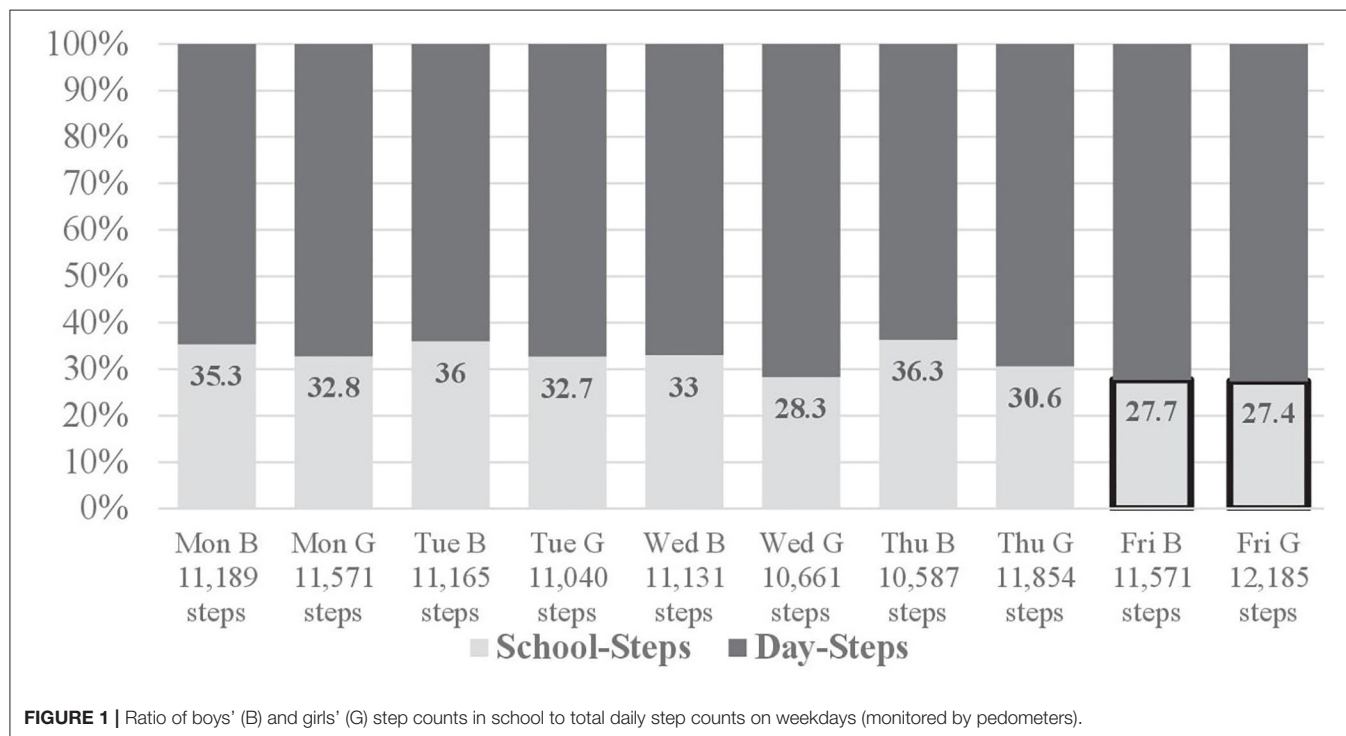
In total, on school days without PELs, 65.0% of boys and 44.5% of girls met the recommendation that PA should represent 25% of school time. However, 93.9% of boys and 91.0% of girls met this recommendation on PEL days. These values comprise all forms of PA. It is important to note that low-intensity PA and short bouts of MVPA have significant health benefits in the school environment (67).



**TABLE 1** | School physical activity on days with and without a physical education lesson.

Characteristics of school physical activity (measuring instrument)	<i>n</i>	School time				<i>F</i>	<i>p</i>	$\eta_p^2$
		Boys		Girls				
		with PEL <i>M</i> (SD)	without PEL <i>M</i> (SD)	with PEL <i>M</i> (SD)	without PEL <i>M</i> (SD)			
Steps (pedometer)	2,103	5,538 (2,507)	2,950 (1,853)	4,496 (1,850)	2,930 (1,846)	154.93 <sup>a,b</sup>	<0.001	0.181
Steps/h (pedometer)	2,103	857 (388)	477 (290)	714 (296)	471 (289)	140.86 <sup>a,b</sup>	<0.001	0.168
Steps (accelerometer)	3,329	4,418 (1,832)	2,402 (1,582)	4,019 (1,753)	2,200 (1,386)	314.98 <sup>a,b</sup>	<0.001	0.218
Steps/h (accelerometer)	3,329	730 (281)	402 (256)	640 (252)	368 (201)	333.88 <sup>a,b</sup>	<0.001	0.228
PA-min (accelerometer)	3,329	145.8 (44.8)	106.7 (44.1)	134.5 (39.6)	89.3 (38.7)	265.31 <sup>a,b</sup>	<0.001	0.190
PA-min/h (accelerometer)	3,329	24.2 (6.7)	18.4 (6.6)	21.5 (5.5)	15.1 (5.7)	280.44 <sup>a,b</sup>	<0.001	0.199
MVPA-min (accelerometer)	3,329	26.2 (15.4)	12.0 (11.8)	20.8 (12.7)	9.4 (9.3)	273.40 <sup>a,b</sup>	<0.001	0.195
MVPA-min/h (accelerometer)	3,329	4.3 (2.4)	2.0 (1.9)	3.3 (2.0)	1.5 (1.4)	285.19 <sup>a,b</sup>	<0.001	0.202

PEL, physical education lesson; *M*, Mean; *SD*, Standard deviation; *F*, value of ANOVA; *p*, level of significance;  $\eta_p^2$ , effect size coefficient; <sup>a</sup>significant difference between boys with and without PELs; <sup>b</sup>significant difference between girls with and without PELs.

**FIGURE 1** | Ratio of boys' (B) and girls' (G) step counts in school to total daily step counts on weekdays (monitored by pedometers).

School PA recommendations apply regardless of the type of school or the presence of PELs in the daily program. Therefore, demands will be higher on days with PELs and in schools oriented toward practical lessons.

#### Rationale for PA during recesses

Boys were physically active for  $54.6 \pm 16.1\%$  of recess time, compared to  $50.1 \pm 14.5\%$  for girls. However, MVPA  $\geq 3$  METs accounted for only  $6.2 \pm 6.3\%$  of total recess time for boys and

$4.8 \pm 4.9\%$  for girls, and MVPA  $\geq 60\%$  HRmax accounted for  $8.5 \pm 11.6\%$  of total recess time for boys and  $8.9 \pm 6.4\%$  for girls. Both the intensity and duration of PA during recesses were found to be low, with boys averaging only  $1,056 \pm 524$  steps per hour and girls averaging  $1,023 \pm 485$  steps per hour in a total of 60 min of recess each day. These results confirm that longer cumulative recess time increases school PA in boys and girls but cannot replace participation in PELs (22).

### **Rationale for PA in physical education lessons**

PA in PELs represented  $77.8 \pm 16.1\%$  of total PEL time in boys; however, MVPA  $\geq 3$  METs accounted for only  $25.2 \pm 16.1\%$  and MVPA  $\geq 60\%$  HRmax for only  $44.7 \pm 32.4\%$  of total PEL time. In girls, PA represented  $74.0 \pm 15.5\%$  of total PEL time; however, MVPA  $\geq 3$  METs accounted for only  $18.0 \pm 12.2\%$  and MVPA  $\geq 60\%$  HRmax for only  $40.6 \pm 29.7\%$  of total PEL time. In many cases, PELs play a significant role in meeting general PA recommendations, and further improvement is needed to promote adherence to lifelong PA.

### **Model of PA Recommendations for Segments of the School Day**

**Figure 2** depicts a simplified guide for adhering to minimum PA recommendations in the main segments of a school day, emphasizing a substitution approach under specific conditions. It includes the following indicators: number of steps, MVPA minutes, each segment's share of total PA (TPA), and submaximal and maximal HR (HRmax).

## **DISCUSSION**

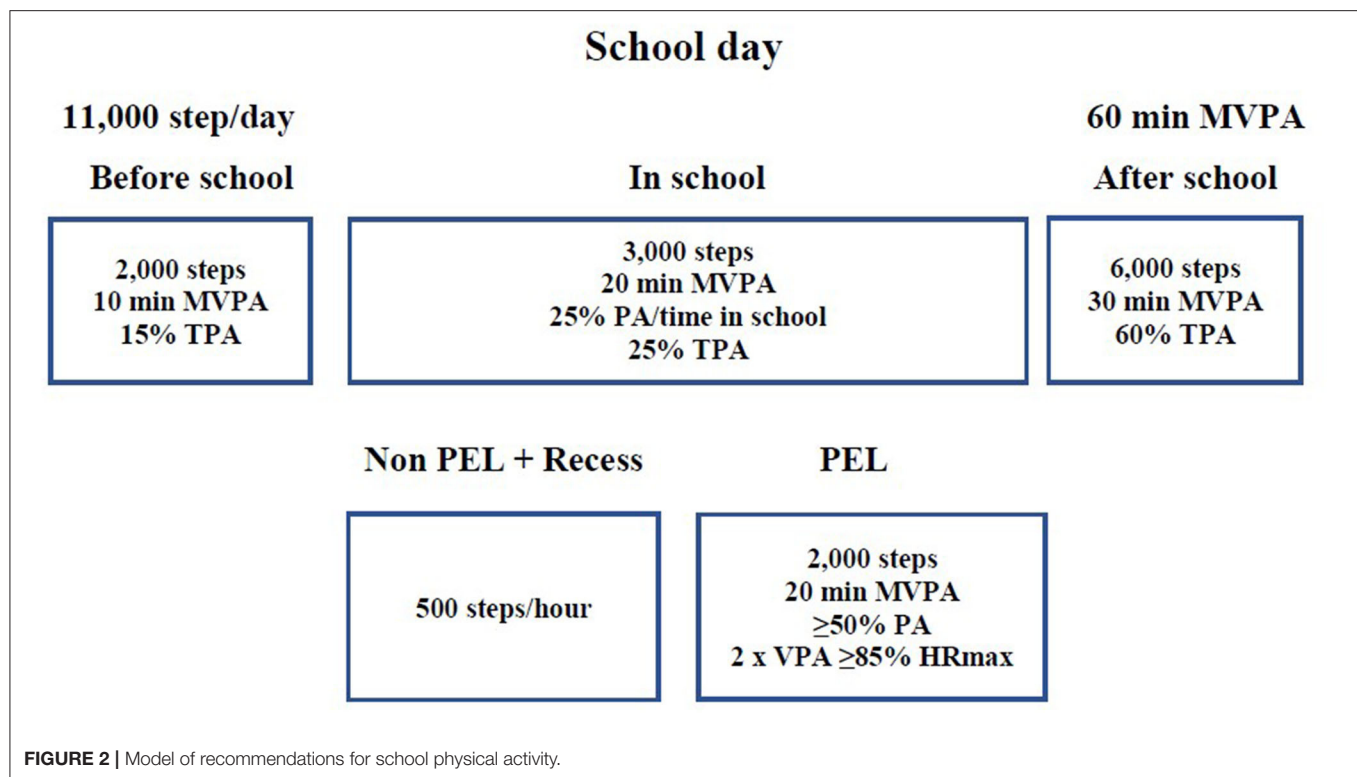
PA recommendations in segments of school days should be evidence-based with respect to PA, which will likely lead to simplification of universal indicators primarily due to health and educational differences, alongside political, socioeconomic, and demographic differences. Universal PA recommendations in segments of school days should be an enduring guideline, especially to motivate at-risk adolescents and support health and physical literacy. It should also link the school schedule with a normal lifestyle, even for weekends and school holidays. To emphasize increasing adolescents' PA through applying a comprehensive multi-sector strategy (60), PA recommendations in segments of school days need a multi-sector basis and multi-factor indicators (e.g., time, intensity, frequency, and volume of PA) to enable alternative approaches to its use. Thus, the proposed PA recommendations in segments of school days Model is based on existing evidence-based findings on school PA in Central European countries (22, 26). There remains a lack of high-quality intervention studies on school PA in these countries, compared to Western European countries (68). Amidst significant educational reforms in Central Europe, the issue of PE has received insufficient attention, with the sole possible exception of Hungary (69). Therefore, given their common historical roots, our suggested recommendations for the Czech Republic and Poland are also potentially applicable to Slovakia, Hungary, and other Eastern European countries.

The model of PA recommendations in segments of school days could support the formation of evidence-based strategies for developing school PA, as well as facilitating and improving means to track the impact of such strategies on health and educational outcomes, in line with the guiding principles and priorities of (18) PA strategy. Proposed recommendations for school PA should support positive changes in the organization of educational processes in secondary schools. Enforcing the 500 steps per hour recommendation is especially important because it could promote more efficient use of classroom-based PA and better mitigate educational stress. Integrating PA into non-PE lessons may increase students' overall PA, improve their attention and working time, and positively influence academic outcomes (70, 71). The identified association between the number of steps per hour and self-reported stress levels in periods of physical inactivity, highlight the need to compensate for educational workloads through PA and the importance of integrating PA into classroom-based lessons.

School recess can make a significant contribution to meeting the 500 steps per hour recommendation. In our research, recess accounted for only 15% of total school time each day. The recommended 10-min recess periods with one longer 20-min recess, excluding any other PA- or health-oriented breaks or lunch breaks, should represent at least 20% of the total in-school time. In earlier research, 41% of boys met the recommended 500 steps per hour when given a longer total recess time ( $\geq 60$  min), compared with 26% of boys with a shorter recess time ( $< 60$  min); the equivalent values for girls were 42 and 23%, respectively (53). These findings emphasize the importance of increasing total recess time; however, they also show that longer recess time cannot replace students' participation in PELs, given the documented mean steps in the latter. It is encouraging that we found positive associations between meeting the PA recommendations and a lower incidence of depressive symptoms and academic stress in adolescents (27, 72).

Pedometer-measured steps in PELs (boys: 2,554 steps/45 min; girls 1,839 steps/45 min) corresponded to unpublished results we collected during teacher-student training. Within these "training lessons," boys ( $n = 1,858$ ) averaged  $2,311 \pm 871$  steps/45 min and girls ( $n = 2,234$ ) averaged  $1,852 \pm 717$  steps/45 min. Similar results in PELs were found by Culpepper and Killion (73), in which boys averaged  $2,454 \pm 838$  steps/45 min, and girls averaged  $1,820 \pm 750$  steps/45 min.

We know that a substantial percentage of recommended children and adolescent PA can be provided through a comprehensive school PA program (74, 75). Thus, PA recommendations in segments of school days should become an integral part of these programs, to encourage changes toward a healthy school lifestyle, facilitate the adoption of (necessary) healthy work habits, and raise awareness of how mental stress can be mitigated through adequate PA. Implementing PA recommendations in segments of school days into comprehensive school PA programs could also provide a good basis for finding complementary forms of PE. Support for comprehensive school PA program development should form part of national PA policies or promotion plans, although many countries still fail to optimize their use (42).



PA recommendations in segments of school days should be an integral part of comprehensive school PA programs, as it can assure a significant part of daily recommended PA (70). PA recommendations in segments of school days also have potential economic benefits (76). Application of PA recommendations to the main segments of the school day can support the determination of the economic and social effects of adolescents at schools' health. School PA has significant social potential, and therefore the prevalence of PA recommendations in segments of school day could support the social health of adolescents within the school. It is confirmed that adolescents meeting the PA recommendations are also more likely to have better subjective well-being than others (27). Future research should focus on obtaining evidence in support of adolescent PA by applying PA recommendations in segments of school days to schools. Furthermore, it should focus on exploring the positive and negative aspects of PA recommendations in segments of school days enforcement in comprehensive school PA programs, not only among adolescents but also among teachers and school administrators.

## Strengths and Limitations

To the best of our knowledge, this was the first study dealing with the comprehensive promotion of school PA recommendations for specific segments of school days. This study's strength lies in its long-term comprehensive analysis of evidence and experience-based findings on school PA across different types of secondary schools in the Czech Republic and Poland, with a large sample of adolescents. Additionally, it combines

subjective PA estimates with PA monitoring by pedometers and accelerometers, yielding a uniform dataset processed and analyzed through the web application Indares.com. It was essential, to the greatest possible extent, to keep natural and customary conditions in all stages of our research conducted in schools.

However, our PA recommendations are limited in application to Central Europe and countries with similar geographic, socioeconomic, and educational conditions. As we do not have enough evidence to determine prospective PA recommendations based on the current compliance rate, the starting point for determining the presented PA recommendations in this study was to meet the recommendations for 30–50% of participants. The setting of minimum recommendations was mainly based on the level and trends of PA, but also on the experience with the presentation of results in schools in direct contact with participants. Our school PA results on days with PELs were influenced by the goals and content of PELs, which were solely determined by PE teachers (without our input). The major limitation was that the suggested recommendations for PA in segments of school days were determined based only on the status of, and trends in, adolescent PA and the practical experience gained by implementing research results into school practice. Future research should focus on the verification of proposed PA recommendations in segments of school days in different educational systems. Furthermore, to establish under which circumstances PA recommendations in particular segments of the day may support and increase adolescents' daily PA.

## CONCLUSIONS

The results of the trends in PA of Czech and Polish adolescents enabled the study to propose a comprehensive model of recommendations for adolescent PA in individual segments of the school day. The implementation of these partial PA recommendations in school practice can support increased PA in some adolescent groups and positive changes in the school lifestyle. As part of the acquisition of physical literacy, these simplified PA recommendations should also be placed in the context of the risks of unilateral PA, the development of motor skills and physical fitness. These findings will need further investigation in the context of traditional daily and weekly PA recommendations. It will also be very important in school practice to respect the rapid development and popularity of technologies used in PA monitoring to adopt recommendations for adolescent PA in segments of the school day. Recommendations on adolescents PA in school day segments should also become a part of the design and innovation of school PA programs.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Human Research

of the Faculty of Physical Culture, Palacký University, in Olomouc (no. 24/2012) and the Jerzy Kukuczka Academy of Physical Education, in Katowice (no. 2/2008). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

## AUTHOR CONTRIBUTIONS

KF, DG, and JM collected data, secured funding, drafted, and conceptualized the manuscript. AM and TC reviewed and edited the study. All authors contributed to the article and approved the submitted version.

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# Psychosocial Consequences of Female Infertility in Iran: A Meta-Analysis

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**Background:** Although not a life-threatening condition, infertility does influence various aspects of life. Based on a meta-analysis of the relevant literature, the aim of this study is to identify the psychosocial consequences of infertility in Iranian women.

**Methods:** Comprehensive Portal of Human Sciences, Magiran, Scientific Information Database, Noormags, MEDLIB, ScienceDirect, Google Scholar, Medline, and ProQuest were the databases searched from inception (1999) to 2018. To maximize the comprehensiveness of the search, the reference lists of all the relevant papers identified were manually examined. The evaluation of the content was based on PRISMA guidelines, and Comprehensive Meta-Analysis software was used for data analysis.

**Results:** Based on the analysis of 124 quantitative papers, the psychosocial consequences of infertility in women in Iran can be classified into 14 categories: psychological well-being (effect size = 3.10), adaptation to infertility (effect size = 2.71), quality of life (effect size = 1.83), depression (effect size = 1.80), anxiety (effect size = 1.72), marital relationships (effect size = 1.37), personality disorders (effect size = 1.37), violence (effect size = 1.31), social support (effect size = 0.90), self-efficacy (effect size = 0.90), coping strategies (effect size = 0.84), irrational thoughts (effect size = 0.77), somatization disorders (effect size = 0.65), and sexual dysfunction (effect size = 0.55).

**Conclusion:** Considering the wide-ranging psychosocial consequences of infertility in women, it is necessary for treatment to account for psychological factors.

**Keywords:** infertility, psychosocial consequences, Iran, review, meta-analysis

## INTRODUCTION

Infertility is characterized by the failure to achieve a clinical pregnancy despite 12 months of regular and unprotected sexual intercourse (1). The global prevalence of infertility is ~9–12.5% (2, 3). According to studies conducted in Iran, the total mean of infertility and the rate of primary infertility prevalence are 13.2% (4) and 17.3% (5), respectively; these figures are higher than the global average. Although not a life-threatening condition, infertility has intense psychosocial consequences. Infertility diagnosis and the subsequent treatment process usually impose excruciating stress on couples. Several studies have reported that couples with infertility

are prone to experiencing depression (6), anxiety (7), sexual intercourse problems, marital problem (8, 9), decrease in self-confidence (10), and low levels of psychological well-being (11, 12) and quality of life (13).

Although infertility has an emotional impact on both partners, studies have shown that it imposes greater pressure on women, as demonstrated by the fact that 50% of infertile women considered this the biggest problem in their lives (14). In a previous study, many women with infertility stated that they could not imagine a life without children, while this was not the case with men (15). Further, it is mainly women who are subjected to fertility treatments, which serves to increase their psychological burden.

The stress and anxiety in women with infertility arises from issues such as missing out on the experience of motherhood, negative self-concept, and inability to continue the family line. Moreover, societal pressures are responsible for the extensive psychological consequences in women with infertility (16). In many cultures, infertility is perceived as something to be ashamed of (17). Specifically, owing to cultural and social factors as well as religious beliefs, having children is much more crucial in Asian compared to Western countries (18). In many traditional cultures, the male partners of women who are unable to bear children often remarry. In Iran, infertility can be considered a legal basis of divorce; that is, it is permitted upon the request of either partner (19).

Since infertility is an unexpected stress in the lives of couples, they are usually not equipped with the necessary information and appropriate coping strategies. Therefore, it is of paramount importance that psychological factors be taken into account during the treatment of infertility. Accordingly, the aim of this meta-analysis of studies concerning the psychological consequences of infertility in women is to provide experts with the data required to design therapy programs to preclude and decrease the negative effects of infertility in women. In this regard, this study seeks to answer the following question: What does the literature reveal about the psychological consequences of infertility in Iranian women?

## MATERIALS AND METHODS

This study was conducted according to PRISMA guidelines. To investigate the entirety of the body of published research concerning the psychological consequences of infertility in women in Iran, the databases searched included Comprehensive Portal of Human Sciences, Magiran, Scientific Information Database, Noormags, MEDLIB, ScienceDirect, Google Scholar, Medline, and ProQuest. To maximize the comprehensiveness of the search, the reference lists for all the relevant papers were manually examined.

### Search Strategy

The search strategy was based on the PICOS model, as follows: P—infertile Iranian women, I—psychological interventions or assessment were done about psychosocial consequences of female's infertility, C—fertile Iranian people, O—psychosocial consequences of infertility, S—randomized control trial studies, pretest and posttest, quasi-experimental, and descriptive studies.

To identify papers in the aforementioned electronic databases, the keywords used were “infertility,” “women's infertility,” “primary infertility,” “secondary infertility,” “quality of life,” “well-being,” “mood disorder,” “anxiety disorder,” “sexual dysfunction,” “psychological distress,” and combinations of these words.

## Inclusion and Exclusion Criteria

For studies to be included in this meta-analysis, they had to meet certain inclusion and exclusion criteria. The inclusion criteria were studies that (19) were published from inception (1999) to 2018, (20) investigated the psychological consequences of infertility, (21) reported sufficient data to measure effect sizes, (22) were in the form of full papers, published either online or accessible in library archives, and (23) had Iranian authors, although the text could be in either Persian or English. The exclusion criteria were studies that (19) did not provide full-text access, (20) did not report information necessary to measure effect sizes, and (21) were duplicate articles based on reviewing titles and abstracts.

## Statistical Analysis

In this study, we employed Hedges' effect size to quantitatively evaluate the results. To elaborate, we first drew a funnel plot to identify publication bias. Following the sensitivity analysis and exclusion of studies with publication bias, we determined the effect size of every psychosocial consequence of infertility in women in Iran as well as the effect size using fixed and random models. Further, to investigate the heterogeneity of the effect sizes in the initial studies, that is, those that did not make it to the final analysis stage despite originally meeting certain criteria, we employed Cochran's Q and the chi-I index. Comprehensive Meta-Analysis software (CMA; Biostat, Inc.) was used for data analysis.

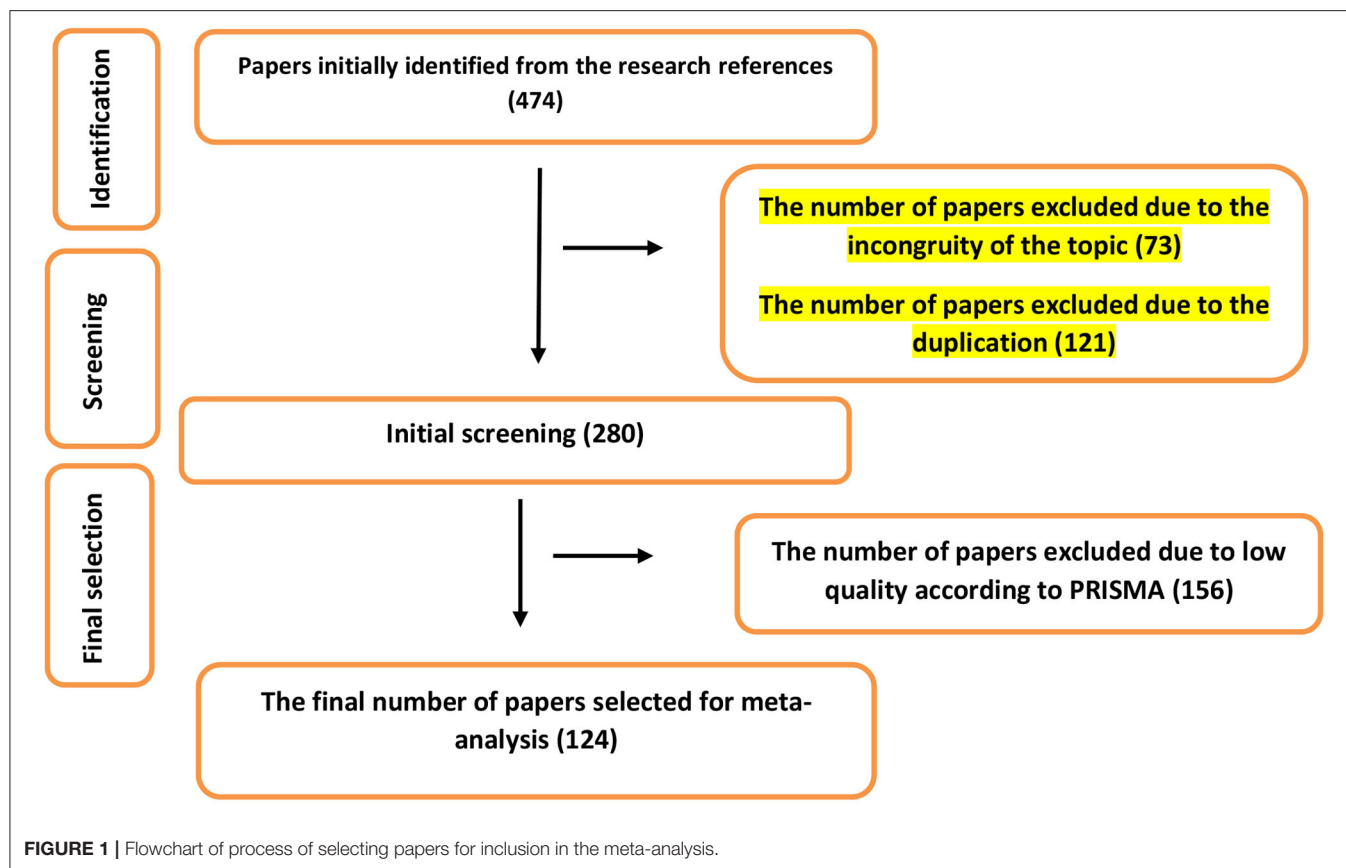
## RESULTS

Out of the 474 papers initially identified in the electronic databases, 73 and 121 were excluded in the first stage owing to the incongruity of their topics and duplication. As a result, a total of 346 papers were selected for the next stage. In this stage, the authors investigated the texts of the papers. A total of 156 papers that had a low quality based on PRISMA principles were excluded from the list. At this point, 124 papers were selected for the meta-analytic process (**Figure 1**). Details on the studies are presented in **Table 1**.

A total of 292 effect sizes from the studies that initially entered the meta-analysis were measured. The reason for the number of effect sizes being greater than the number of included studies was the fact that every study contained numerous variables related to the psychosocial consequences of infertility. Since one of the main assumptions of our meta-analysis was the absence of publication bias, we first employed a graphic method (funnel plot) to identify publication bias and eliminate those studies.

By observing the funnel plot (**Figure 2**), it can be seen that the points are not distributed symmetrically around the plot, owing to the uncommon and deviated values of the effect sizes. Further elimination of three effect sizes led to a symmetrical shape in the funnel plot (**Figure 2**). Finally, from the 124 papers determined





to be appropriate for meta-analysis, a total of 243 effect sizes regarding the psychosocial consequences of infertility in women were identified.

**Table 2** presents the number of papers for each psychosocial consequence, and their mean effect sizes, according to Hedges' effect size index. Based on the results presented in **Table 1**, it is evident that the maximum effect size—3.10—relates to psychological well-being. Therefore, it can be deduced that the most significant psychosocial consequence of infertility among women is the psychological well-being variable and its related factors. In addition, the minimum Hedges' effect size—0.55—relates to sexual dysfunction. Thus, sexual dysfunction is the least significant psychosocial consequence of infertility in women.

**Table 3** illustrates the combined effect of the fixed and random models in Iranian studies on the psychosocial consequences of female infertility after sensitivity analysis. The means of the combined effect sizes for the psychosocial consequences of female infertility in fixed and random models were 0.58 and 1.03, respectively, both of which were statistically significant ( $P \leq 0.00$ ).

To specify the final meta-analysis model, a set of heterogeneity tests had to be conducted to ensure the presence of moderating variables. To examine the heterogeneity of the effect sizes in the studies, the Egger's test, Cochran's Q and Chi-I indices were employed. Egger's regression intercept tests revealed no evidence of publication bias ( $\rho = 0.24$ ). The value obtained for the Q index (for 243 effect sizes) was 2,777.90, with a 242 degree

of freedom, which was statistically significant ( $P \leq 0.00$ ) and indicated an actual difference between the effect sizes of the initial studies. Furthermore, the Chi-I results indicated that 91.28% of the variance present in the initial study results was real and could be obtained using moderating variables. Based on the criteria laid down by Bornstein, Hedges, Higgins, and Rothstein (142), a high heterogeneity is indicated in the initial studies. Based on the two heterogeneity indices, it was determined that the moderating variables played significant roles in the importance of the psychosocial consequences in women with infertility. Therefore, the random model was selected for meta-analysis, 1.03 was considered to be the combined effect size.

## DISCUSSION

In this study, we performed a meta-analysis of Iranian studies on the psychological consequences of infertility in women. The aim was to synthesize the findings available in the literature, along with facilitating more precise future conclusions and presenting the possibility of devising plans to preclude, or at least decrease, such consequences.

As the results indicate, well-being is the psychological aspect most significantly impacted by infertility in women, with 19 significant effect sizes and a Hedges' effect size of 3.10. This is noteworthy, since existing studies have placed more emphasis on negative emotional factors than positive emotional factors. According to the definition provided by the World Health

**TABLE 1** | Summary of studies included in review.

Psychosocial consequences	ID	References	Sample size	Age (Y)	Study type	Statistics	<i>d</i>	Sig
Sexual dysfunction	1	(24)	120	24–38	Descriptive	T	0.27	0.00
	2	(25)	250	NA	Cross-sectional	T	2.16	0.00
	3	(26)	296	17–50	Cross-sectional	M-SD	0.44	0.00
	4	(27)	220	NA	Cross-sectional	M-SD	0.00	0.98
	5	(28)	32	NA	Field trial	M-SD	0.45	0.00
	6	(29)	100	NA	Descriptive	M-SD	0.52	0.01
	7	(30)	200	20–45	Descriptive	M-SD	0.16	0.40
	8	(31)	604	18–42	Cross-sectional	M-SD	0.45	0.00
	9	(32)	200	NA	Descriptive	T	0.98	0.00
						T	0.44	0.00
						T	0.53	0.00
						T	0.02	0.88
	10	(33)	200	22–45	Descriptive	T	0.08	0.23
	11	(34)	600	18–45	Descriptive	M-SD	0.10	0.37
12	(35)	90	21–48	Descriptive	T	0.62	0.00	
13	(36)	600	NA	Descriptive	M-SD	0.06	0.59	
14	(37)	180	18–40	Descriptive	T	0.97	0.00	
14 appropriate article for meta-analysis							M = 0.55	
Depression	1	(11)	22	23–37	Semi-Experimental	M-SD	0.03	0.92
	2	(38)	200	NA	Descriptive	T	0.85	0.00
	3	(39)	30	20–40	Semi-Experimental	M-SD	0.20	0.53
	4	(40)	45	NA	Semi-Experimental	M-SD	1.89	0.00
						M-SD	0.52	0.00
	5	(41)	43	18–40	Descriptive	M-SD	1.74	0.00
	6	(42)	70	NA	Prospective	M-SD	0.13	0.41
	7	(43)	30	NA	Semi-Experimental	M-SD	1.57	0.00
	8	(44)	30	19–42	Semi-Experimental	M-SD	1.69	0.00
	9	(45)	30	NA	Semi-Experimental	M-SD	0.90	0.00
	10	(46)	80	NA	Descriptive	T	0.22	0.00
	11	(47)	40	NA	Semi-Experimental	T	1.23	0.00
	12	(48)	30	21–37	RTC	M-SD	0.56	0.13
						M-SD	0.51	0.16
	13	(49)	61	20–40	RTC	T	3.97	0.00
	14	(50)	23-42	70	Descriptive	M-SD	0.50	0.00
	15	(51)	90	NA	Descriptive	M-SD	0.90	0.00
	16	(52)	40	NA	Semi-Experimental	M-SD	3.62	0.00
						M-SD	3.15	0.00
	17	(53)	294	NA	Descriptive	M-SD	0.41	0.00
	18	(54)	31	20–35	RTC	M-SD	1.45	0.00
	19	(55)	40	24–40	Semi-Experimental	M-SD	3.53	0.00
						M-SD	5.75	0.00
	20	(56)	40	NA	Semi-Experimental	M-SD	2.05	0.00
					M-SD	2.42	0.00	
21	(57)	89	NA	RTC	M-SD	1.75	0.00	
22	(36)	600	NA	Descriptive	M-SD	0.42	0.00	
23	(58)	174	NA	Descriptive	T	0.73	0.00	
24	(59)	300	17–45	Descriptive	M-SD	0.60	0.00	

(Continued)

TABLE 1 | Continued

Psychosocial consequences	ID	References	Sample size	Age (Y)	Study type	Statistics	<i>d</i>	Sig
24 appropriate article for meta-analysis							<i>M</i> = 1.80	
Marital satisfaction	1	(60)	282	NA	Descriptive	R	0.40	0.00
						R	0.87	0.00
						R	0.62	0.00
	2	(61)	90	25–44	Descriptive	R	1.85	0.00
	3	(62)	24	NA	Semi-Experimental	M-SD	1.84	0.00
	4	(63)	40	NA	Semi-Experimental	M-SD	3.29	0.00
	5	(64)	139	20–50	Descriptive	M-SD	1.54	0.00
	6	(65)	32	25–40	Semi-Experimental	M-SD	1.32	0.00
	7	(66)	36	NA	RTC	T	0.70	0.05
	8	(67)	40	22–47	Semi-Experimental	M-SD	2.35	0.00
						M-SD	1.88	0.00
	9	(68)	30	NA	Semi-Experimental	M-SD	1.21	0.00
	10	(69)	72	NA	RTC	M-SD	1.94	0.00
						M-SD	2.39	0.00
	11	(70)	64	NA	Semi-Experimental	M-SD	0.93	0.00
						M-SD	1.73	0.00
	12	(71)	20	NA	Semi-Experimental	M-SD	0.34	0.43
	13	(72)	220	NA	Descriptive	T	0.47	0.00
						T	0.61	0.00
	14	(73)	100	18–43	Descriptive	R	0.79	0.00
						R	0.22	0.1.
	15	(74)	100	NA	Descriptive	T	0.92	0.00
						T	0.90	0.00
	16	(75) •	40	NA	Semi-Experimental	M-SD	14.0	0.00
	17	(76)	220	NA	Descriptive	M-SD	0.06	0.64
	18	(22)	520	NA	Descriptive	M-SD	0.22	0.07
						M-SD	0.23	0.05
						M-SD	0.39	0.00
	19	(46)	80	NA	Descriptive	T	0.08	0.54
	20	(77)	30	NA	Semi-Experimental	M-SD	0.63	0.08
	21	(78)	24	NA	Semi-Experimental	M-SD	3.48	0.00
	22	(79)	186	NA	Descriptive	M-SD	1.10	0.00
	23	(80)	80	NA	Descriptive	M-SD	0.27	0.01
	24	(78)	130	18–37	Descriptive	T	0.36	0.04
	25	(81)	130	20–40	Descriptive	R	0.74	0.00
	26	(82)	100	NA	RTC	M-SD	0.49	0.00
	27	(83)	24	25–35	Semi-Experimental	M-SD	0.73	0.08
						M-SD	0.83	0.04
	28	(84)	440	NA	Descriptive	T	0.35	0.01
	29	(85)	60	NA	Semi-Experimental	M-SD	0.71	0.05
	30	(86)	198	NA	Descriptive	M-SD	0.14	0.50
30 appropriate article for meta-analysis							<i>M</i> = 1.37	
Anxiety	1	(40)	45	NA	Semi-Experimental	M-SD	3.77	0.00
	2	(87)	30	NA	Semi-Experimental	M-SD	1.62	0.00
	3	(20)	30	25–40	Semi-Experimental	M-SD	1.39	0.00
	4	(41)	43	18–40	Descriptive	M-SD	2.04	0.00
	5	(64)	139	20–50	Descriptive	M-SD	1.54	0.00
	6	(88)	30	20–35	Descriptive	T	0.80	0.00

(Continued)

TABLE 1 | Continued

Psychosocial consequences	ID	References	Sample size	Age (Y)	Study type	Statistics	<i>d</i>	Sig
	7	(89)	108	18–40	RTC	M-SD	0.57	0.00
						M-SD	0.47	0.01
	8	(43)	30	NA	Semi-Experimental	M-SD	1.92	0.00
						M-SD	1.99	0.00
	9	(42)	70	NA	Prospective	M-SD	0.02	0.97
	10	(90)	50	20–45	RTC	M-SD	0.97	0.00
	11	(91)	100	25–35	RTC	T	0.26	0.18
	12	(46)	80	NA	Descriptive	T	0.20	0.01
	13	(49)	61	20–40	RTC	T	2.37	0.00
						T	2.76	0.00
	14	(50)	23–42	70	Descriptive	M-SD	0.95	0.00
	15	(92)	65	20–49	Semi-Experimental	T	0.37	0.00
	16	(54)	31	20–35	RTC	M-SD	2.37	0.00
						M-SD	2.76	0.00
	17	(93)	24	NA	RTC	M-SD	2.04	0.00
	18	(94)	22	22–37	Semi-Experimental	M-SD	2.69	0.00
	19	(95)	130	18–37	Descriptive	T	0.83	0.00
	20	(55)	40	24–40	Semi-Experimental	M-SD	1.48	0.00
						M-SD	2.72	0.00
	21	(96)	60	20–45	RTC	T	0.59	0.02
	22	(97)	76	18–35	Semi-Experimental	T	0.09	0.70
	23	(98)	30	20–40	RTC	M-SD	2.92	0.00
	24	(57)	89	NA	RTC	M-SD	0.72	0.00
						M-SD	1.93	0.00
	25	(59)	300	17–45	Descriptive	M-SD	0.13	0.23
	26	(99)	60	NA	Semi-Experimental	T	0.84	0.00
	27	(100)	80	20–44	Descriptive	T	1.52	0.00
	28	(101)	110	20–40	RTC	M-SD	1.31	0.00
28 appropriate article for meta-analysis							M = 1.72	
Physical complaints	1	(41)	43	18–40	Descriptive	M-SD	0.49	0.02
	2	(42)	70	NA	Prospective	M-SD	0.00	0.01
	3	(50)	23–42	70	Descriptive	M-SD	3.05	0.00
	4	(95)	130	18–37	Descriptive	T	0.34	0.05
	5	(18)	150	17–45	Descriptive	M-SD	0.00	0.94
	6	(102)	240	NA	Descriptive	M-SD	0.95	0.00
	7	(59)	300	17–45	Descriptive	M-SD	0.01	0.89
	8	(103)	100	25–45	Descriptive	T	0.39	0.00
8 appropriate article for meta-analysis							M = 0.65	
Social support	1	(62)	24	NA	Semi-Experimental	M-SD	1.68	0.00
	2	(65) •	32	25–40	Semi-Experimental	M-SD	8.08	0.00
	3	(42)	70	NA	Prospective	M-SD	0.02	0.92
	4	(104)	90	NA	Descriptive	M-SD	0.55	0.03
	5	(105)	80	24–45	Semi-Experimental	T	0.51	0.02
	6	(106)	40	NA	Descriptive	T	0.56	0.07
	7	(72)	220	NA	Descriptive	T	0.04	0.72
	8	(107)	200	19–59	Descriptive	R	0.98	0.00
	9	(77)	30	NA	Semi-Experimental	M-SD	0.63	0.08
	10	(50)	23–42	70	Descriptive	M-SD	3.05	0.00

(Continued)



TABLE 1 | Continued

Psychosocial consequences	ID	References	Sample size	Age (Y)	Study type	Statistics	<i>d</i>	Sig
	11	(95)	130	18–37	Descriptive	T	0.30	0.08
	12	(53)	294	NA	Descriptive	M-SD	0.85	0.00
	13	(108)	280	NA	Descriptive	M-SD	0.98	0.00
	14	(109)	150	NA	Descriptive	R	0.02	0.90
	15	(18)	150	17–45	Descriptive	M-SD	3.05	0.00
	16	(102)	240	NA	Descriptive	M-SD	1.07	0.00
	17	(85)	60	NA	Semi-Experimental	M-SD	0.35	0.35
	18	(103)	100	25–45	Descriptive	T	0.77	0.00
<b>18 appropriate article for meta-analysis</b>							<b>M = 0.90</b>	
Coping strategies	1	(110)	400	NA	Descriptive	M-SD	0.81	0.00
	2	(111)	266		Descriptive	T	0.10	0.43
	3	(112)	160	20–40	Descriptive	M-SD	0.37	0.01
	4	(105)	80	24–45	Semi-Experimental	T	0.18	0.41
	5	(75)	40	NA	Semi-Experimental	M-SD	2.81	0.00
	6	(113)	40	NA	Semi-Experimental	M-SD	1.26	0.00
	7	(114)	200	NA	Descriptive	M-SD	0.30	0.13
						M-SD	0.10	0.60
<b>7 appropriate article for meta-analysis</b>							<b>M = 0.84</b>	
Adjustment	1	(68)	30	NA	Semi-Experimental	M-SD	1.21	0.00
	2	(70)	64	NA	Semi-Experimental	M-SD	1.35	0.00
						M-SD	2.07	0.00
	3	(115)	92	20–35	RTC	M-SD	2.73	0.00
	4	(78)	24	NA	Semi-Experimental	M-SD	3.48	0.00
<b>4 appropriate article for meta-analysis</b>							<b>M = 2.71</b>	
Violence	1	(38)	200	NA	Descriptive	T	2.27	0.00
	2	(116)	32	NA	Semi-Experimental	M-SD	2.74	0.00
	3	(32)	200	NA	Descriptive	T	0.98	0.00
						T	0.43	0.00
						T	0.53	0.00
						T	0.02	0.98
	4	(117)	200	NA	Descriptive	T	0.86	0.00
						T	0.48	0.00
						T	0.53	0.00
						T	0.01	0.92
	5	(18)	150	17–45	Descriptive	M-SD	0.15	0.19
	6	(102)	240	NA	Descriptive	M-SD	0.96	0.00
	7	(59)	300	17–45	Descriptive	M-SD	0.16	0.14
	8	(103)	100	25–45	Descriptive	T	0.41	0.00
<b>8 appropriate article for meta-analysis</b>							<b>M = 1.31</b>	
Quality of life	1	(118)	60	20–40	RTC	M-SD	2.51	0.00
	2	(119)	11	18–23	Semi-Experimental	M-SD	1.83	0.00
	3	(66)	36	NA	RTC	T	0.69	0.05
	4	(120)	200	15–49	Descriptive	T	0.45	0.00
	5	(121)	190	20–45	Descriptive	R	1.55	0.00
	6	(122)	450	15–49	Descriptive	M-SD	0.32	0.00

(Continued)

TABLE 1 | Continued

Psychosocial consequences	ID	References	Sample size	Age (Y)	Study type	Statistics	<i>d</i>	Sig
	7	(21)	276	NA	Descriptive	T	0.04	0.69
	8	(123)	190	20–45	Descriptive	R	0.5	0.00
	9	(124)	29	NA	RTC	M-SD	1.71	0.00
	10	(125)	45	NA	RTC	M-SD	1.59	0.00
						M-SD	1.48	0.00
	11	(51)	90	NA	Descriptive	M-SD	1.91	0.00
	12	(79)	186	NA	Descriptive	M-SD	0.30	0.00
	13	(126)	40	25–45	Semi-Experimental	M-SD	0.40	0.20
						M-SD	2.84	0.00
						M-SD	0.92	0.00
						M-SD	0.70	0.03
						M-SD	1.19	0.00
						M-SD	1.14	0.00
						M-SD	1.44	0.00
	14	(33)	200	22–45	Descriptive	M-SD	0.03	0.79
	15	(127)	24	25–35	Semi-Experimental	M-SD	2.11	0.00
						M-SD	2.65	0.00
	16	(23)	120	NA	Descriptive	M-SD	2.14	0.00
	17	(128)	79	20–40	Descriptive	M-SD	0.64	0.00
17 appropriate article for meta-analysis							M = 1.83	
Irrational beliefs	1	(22)	260	18–45	Descriptive	M-SD	0.24	0.05
	2	(93)	24	NA	RTC	M-SD	1.77	0.00
	3	(129)	100	NA	Descriptive	M-SD	0.16	0.09
	4	(108)	280	NA	Descriptive	M-SD	0.98	0.00
	5	(85)	60	NA	Semi-Experimental	M-SD	0.71	0.05
5 appropriate article for meta-analysis							M = 0.77	
Self-efficacy	1	(130)	53	NA	Descriptive	M-SD	0.12	0.53
	2	(131)	104	20–45	RTC	T	2.11	0.00
	3	(132)	200		Descriptive	M-SD	0.49	0.00
3 appropriate article for meta-analysis							M = 0.90	
Personality disorders	1	(133)	92	NA	Descriptive	T	0.10	0.59
	2	(59)	300	17–45	Descriptive	M-SD	0.28	0.01
	3	(134)	14	NA	Semi-Experimental	T	3.73	0.00
3 appropriate article for meta-analysis							M = 1.37	
Well-being	1	(135)	45	NA	Semi-Experimental	M-SD	1.49	0.00
						M-SD	1.54	0.00
	2	(63)	40	NA	Semi-Experimental	M-SD	1.50	0.00
	3	(71)	20	NA	Semi-Experimental	M-SD	4.06	0.00
						M-SD	4.87	0.00
	4	(104)	90	NA	Descriptive	M-SD	1.25	0.00
	5	(136)	197	NA	Descriptive	M-SD	3.58	0.00
	6	(137)	30	NA	Semi-Experimental	T	1.13	0.00
	7	(138) •	16	NA	Semi-Experimental	M-SD	6.88	0.00
	8	(139)	22	NA	Semi-Experimental	M-SD	1.51	0.00
	9	(75)	40	NA	Semi-Experimental	M-SD	2.82	0.00

(Continued)

TABLE 1 | Continued

Psychosocial consequences	ID	References	Sample size	Age (Y)	Study type	Statistics	<i>d</i>	Sig
	10	(125)	45	NA	RTC	M-SD	2.35	0.00
						M-SD	1.82	0.00
	11	(140)	24	NA	RTC	M-SD	2.03	0.00
	12	(80)	80	NA	Descriptive	M-SD	0.77	0.01
	13	(94)	22	22–37	Semi-Experimental	M-SD	3.04	0.00
	14	(54)	31	20–35	RTC	M-SD	2.06	0.00
	15	(141)	24		Semi-Experimental	M-SD	3.21	0.00
						M-SD	3.83	0.00
15 appropriate article for meta-analysis							<i>M</i> = 3.10	

•The research, which had distribution bias, was subsequently discarded.

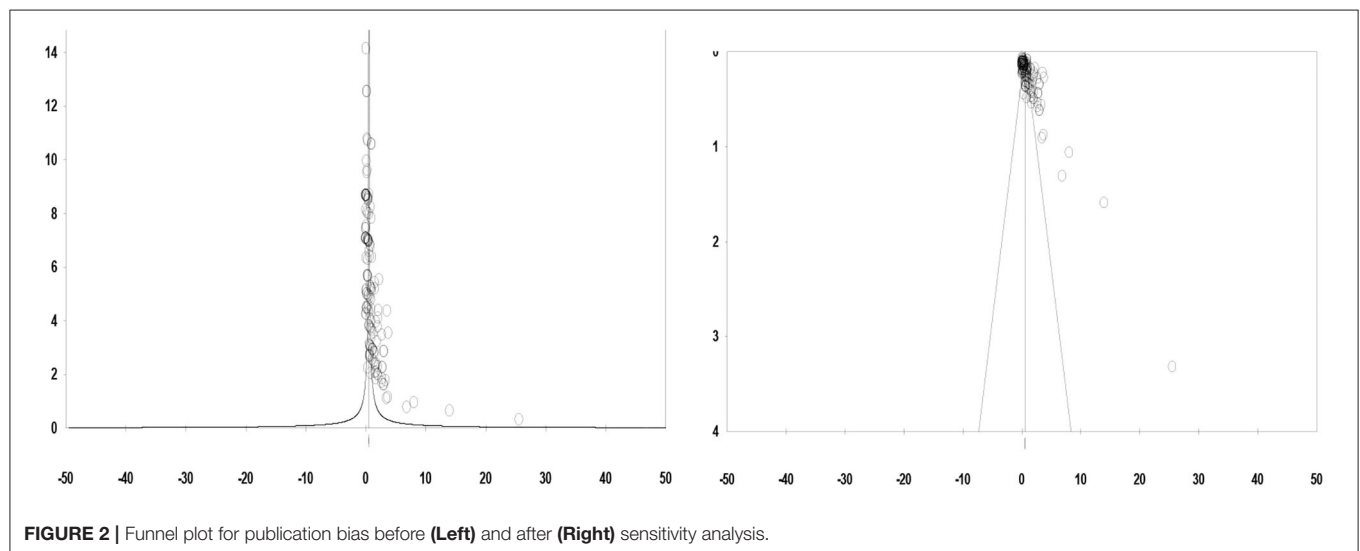


FIGURE 2 | Funnel plot for publication bias before (Left) and after (Right) sensitivity analysis.

Organization, health is a state characterized by more than just the absence of disease. Therefore, a comprehensive definition of health should also include positive criteria such as welfare and physical, psychological, and social well-being (143). Infertility can decrease well-being by introducing stress in the personal, social, and marital domains. Indeed, when faced with the possibility of infertility, the situation is one of ambiguity: while the desire to bear a child lingers, its fulfillment is unlikely. While this is enough to impose great stress on couples, the side effects of assisted reproductive technology and the possibility of the treatment failing lower the well-being of women with infertility even further.

Adaptation to infertility emerged as the second most significant psychological consequence of infertility in women, with 12 significant effect sizes and a Hedges' effect size of 2.71. Adaptation to infertility refers to the cognitive and behavioral solutions individuals with infertility employ to cope with the crisis (144). The level of adaptation in couples with infertility is influenced by social and personal factors. Research has revealed that factors such as couples' attachment level, relationship quality, personal beliefs, and social support can influence adaptation to infertility (107). Owing to cultural and

social reasons as well as religious beliefs, having children is very important for women in Islamic countries, and families generally expect married women to conceive within the first few months of marriage. As previously mentioned, in many traditional cultures, there is a high possibility of the male partners of women with infertility getting remarried (145). This can impose more psychological stress on women, decreasing their adaptation to infertility.

The third psychological aspect affected by infertility is quality of life, with 25 significant effect sizes and a Hedges' effect size of 1.83. In general, infertility and its treatment have negative effects on the quality of life. The severity of these effects is such that researchers have assigned it a distinct definition: fertility quality of life (146). In the context of 21st-century diseases that have a negative effect on quality of life, infertility is ranked third after cancer and cardiovascular diseases (147). Quality of life in women with infertility is related to factors such as economic status, income, and residential region (urban or rural) (148).

The results indicate that depression is the fourth psychological consequence of infertility in women, with 29 significant effect sizes and a Hedges' effect size of 1.80. At ~30.5%, the prevalence of depression in couples with infertility is higher than in the

general public. Depression in individuals with infertility is related to a number of factors including gender (being female), duration of infertility, success/failure of previous treatments, and the cause of infertility (i.e., which of the partners is experiencing infertility) (149). In this regard, it is noteworthy that in the intervals between treatments, monthly variations in hopefulness or disappointment induce extensive psychological pressure in individuals with infertility. This pressure is more complex in women compared to men, mainly because women have a yearning for motherhood because of its link to their identity and meaning of life and are generally capable of making great sacrifices for the sake of childbearing. Aside from these psychological factors, having children is considered a source of power in women, in the context of not only the family but also of society. Therefore, when infertility deprives women of this source of power, it is natural that they experience pain and face problems at the familial and societal levels.

The fifth psychological consequence of infertility in women is anxiety, with 33 significant effect sizes and a Hedges' effect size of 1.72. The psychological, social, and financial challenges of infertility and its treatment can intensely influence the lives

of couples. In the ranking of the worst possible events in a woman's life, infertility was positioned fourth, following death of parents and betrayal by the partner (150). A study in Iran revealed that the prevalence of anxiety in individuals with infertility is 33%, which is significantly higher than in the general population. Further, women have been reported to be 2.26 times more likely than men to report symptoms of anxiety (151).

Marital satisfaction is the sixth psychological consequence of infertility in women, with 41 significant effect sizes and a Hedges' effect size of 1.37. The stress of infertility affects marital adaptation, marital quality, and marriage stability. Marital quality and satisfaction in couples with infertility is significant, since it facilitates the continuation of infertility treatments and increases their chances of success. It is worth mentioning that the quality of a marital relationship is a major predictor of psychological health in women with infertility, and plays a crucial role in reducing their anxiety and depression levels (152).

The seventh psychological consequence of infertility in women relates to personality disorders, with seven significant effect sizes and a Hedges' effect size of 1.37. An individual's personality is influenced by infertility and its consequences, because people face problems differently and according to their personality traits. One of the factors that influence infertility and its consequences is the personality of individuals, because people with different personality traits face problem differently. Several studies have reported a high prevalence of personality disorders in women with infertility (59).

The eighth psychological consequence of infertility is violence, with 14 significant effect sizes and a Hedges' effect size of 1.31. According to the United Nations' Declaration on the Elimination of Violence Against Women in 1993, violence against women is defined as "any act of gender-based violence that results in physical, sexual, or mental harm or suffering to women, including threats of such acts, coercion, or arbitrary deprivation of liberty, whether occurring in public or private life" (153). Infertility is the main reason for violence against women. In a study conducted on 400 women with infertility in Iran, 61.8% had experienced domestic violence owing to infertility (145). Moreover, violence against women with infertility is associated with their partner's unemployment and insufficient education, as well as the forced nature of the marriage (154).

Social support is the ninth most influential psychocognitive consequence of infertility in women, with 18 significant effect sizes and a Hedges' effect size of 0.90. Social support is defined as a person's receipt of information, financial aid, health recommendations, and emotional support from individuals in their social network, including partners, relatives, and friends.

**TABLE 2 |** Effect sizes of psychosocial consequences of infertility in women in Iran.

Psychosocial outcomes	Hedges' g	Hedges' g and 95% CI					
		-3.00	-2.00	1.00	0.00	1.00	2.00 3.00
Sexual dysfunction	0.55						
Depression	1.80						
Marital satisfaction	1.37						
Anxiety	1.72						
Physical complaints	0.65						
Social support	0.90						
Coping strategies	0.84						
Adjustment	2.71						
Violence	1.31						
Quality of life	1.83						
Irrational beliefs	0.77						
Self-efficacy	0.90						
Personality disorders	1.37						
Well-being	3.10						
Fixed overall	0.50						
Random overall	0.83						

CI, confidence interval.

**TABLE 3 |** Hedges' effect sizes of fixed and random models related to psychosocial consequences of infertility.

Model	Number of effect sizes	Hedges' effect sizes (g)	Standard error	95% CI		Z-value	P
				Lower limit	Upper limit		
After sensitivity analysis	Fixed	243	0.58	0.01	0.55 0.60	48.41	0.00
	Random	243	1.03	0.04	0.95 1.12	23.81	0.00



The results of a qualitative study indicated that the four most necessary support categories in couples with infertility are social, financial, spiritual, and informational (155).

Self-efficacy ranks 10th in the list of psychological consequences of infertility in women, with five significant effect sizes and a Hedges' effect size of 0.90. Self-efficacy stems from the difference between how an individual perceives him/herself (self-concept) and the ideal-self. A small difference between these two leads to high self-efficacy, while larger differences result in low self-efficacy (156). Studies have shown that failure in performing "duties," such as reproduction and fertility, decreases self-confidence. Therefore, having low self-efficacy decreases the level of psychological health and self-efficacy in women with infertility (157).

The use of inefficient coping strategies ranks 11th among the psychocognitive consequences of infertility in women, with eight significant effect sizes and a Hedges' effect size of 0.84. Coping strategies refer to mindful behaviors and cognitive attempts to manage current or expected stressors and negative events. These strategies are often categorized into two main groups, namely, problem-focused and emotion-focused. While problem-focused strategies employ behaviors such as acting and planning, emotion-focused strategies include expressing emotions and changing expectations (158). The results of Jafarzadeh et al.'s (159) study demonstrated that the cause of infertility is the main factor women without children consider while choosing the strategy to employ. For instance, when the male partner is infertile, women employ problem-focused coping strategies, whereas when they themselves experience infertility, they generally employ emotion-focused coping strategies (159).

Irrational thoughts regarding either having or not having children are the 12th most important psychological consequence of infertility, with five significant effect sizes and a Hedges' effect size of 0.77. Irrational thoughts are the beliefs that individuals learn in life. However, they are not fundamentally realistic and usual. Studies have shown that irrational cognitions regarding childbearing being the essence of a happy life are the main predictors of quality of life in couples with infertility (22).

Physical complaints are the 13th most significant psychocognitive consequence of infertility in women, with 10 significant effect sizes and a Hedges' effect size of 0.65. Overall, women with infertility have poorer psychological health compared to those who can bear children. A study showed that among the subscales of the Symptom Checklist-90-Revised, the highest mean score among women with infertility was for somatization (50). Stressful events can have a prominent role in the somatization aspect (160). Infertility, reported to be the

most challenging event in a woman's life, results in a variety of physical complaints.

Finally, sexual dysfunction is the 14th psychological consequence of infertility, with 17 significant effect sizes and a Hedges' effect size of 0.55. Negative psychological and physiological consequences of the diagnosis and treatment of infertility can influence sexual functioning and lead to sexual dysfunction. Pregnancy, in the minds of many individuals, is the result solely of sexual intercourse and an indication of intimacy. Therefore, when pregnancy does not occur, it can discourage individuals from having sexual intercourse. On the contrary, in the process of infertility treatment, physicians generally prescribe a certain schedule for couples to have sexual intercourse. When physicians recommend a strict regimen regarding the timing of sexual intercourse and dictate details, it changes from an enjoyable act to a mechanical one (161). As reported, the prevalence of sexual dysfunction in couples with infertility is as high as 87.1% (162).

The act of fertilization and delivering a healthy child is considered the main event in the life of every couple. However, there is a significant factor that obstructs such joy: infertility. Although both men and women can experience infertility, social (and occasionally religious) pressures imposed on women often result in them carrying the burden of infertility, in turn experiencing psychological and physical problems. Further, therapeutic protocols must be adjusted to decrease, if not eliminate, these consequences.

## DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article/supplementary material.

## AUTHOR CONTRIBUTIONS

HZ, HA, and HK contributed conception and design of the study. HZ and HA organized the database. HZ and HK performed the statistical analysis. HZ wrote the first draft of the manuscript. HZ and HA wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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# What Encourages Physically Inactive People to Start Running? An Analysis of Motivations to Participate in Parkrun and City Trail in Poland

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The aim of this study was to investigate the motivations for beginner runners to take part in Parkrun Poznań and City Trail Poznań, Poland, taking into account their socio-demographical variables. A total of 165 (age: 36.33 ± 10.38) inexperienced runners participated in the diagnostic survey and completed the MOMS (Motivations of Marathoner Scale) questionnaire. The sample consisted of 82 men (49.7%) and 83 women (50.3%). The results showed that men were more likely to start running due to competition-related motivations, while the motivations of women were more often related to affiliation, psychological coping, life meaning, and self-esteem. As age increased, the level of motivation due to personal goal achievement, competition, and recognition scales decreased. The Affiliation Scale was especially important for singles who started running, in comparison with runners who were married or in a relationship. These factors should be taken into consideration by event managers and public health specialists. Promoting safe running among people who have no experience with this sport is as important as encouraging them to run. All runners stated that they would like to run a marathon in the future. Moreover, thanks to initiatives such as City Trail and Parkrun, Polish respondents feel motivated to lead an active lifestyle, with an average score of 4.98 on a 7-point Likert scale.

**Keywords:** motivation, marathon runners, running, beginner runners, lifestyle

## INTRODUCTION

There is worldwide concern about insufficient levels of physical activity among a large part of the population. Physical inactivity is the fourth leading risk factor for global mortality and has been estimated to cause 6% of deaths worldwide. Physical activity can reduce the risk of cardiovascular disease, overweight, obesity, falls, type 2 diabetes, stress, and depression. The most important benefits of regular physical activity include lower prevalence of many diseases, as well as a decrease in mortality. People of all ages can enjoy the numerous physical, psychological, emotional, and social benefits that physical activity brings (1–4). An inactive lifestyle is associated with higher

all-cause mortality, coronary artery disease, hypertension and stroke. It is also a primary cause of most chronic diseases, as the body rapidly adapts to insufficient physical activity which, if continued, results in substantially reduced quantity and quality of life. Regular physical activity can significantly improve mental health, self-confidence, healthy aging, and quality of life (5). Increasing levels of physical activity to meet current guidelines during adulthood is a public health priority. Researchers, sports events organizers and health promotion professionals are exploring the reasons why some people are physically active, whereas others are not (6). Motivation to participate in sport is highly complex, and is a key factor that influences individuals' initiation and maintenance of active behavior. Motivation affects sport participation and is a critical factor in exercise adherence.

Parkrun is an initiative that organizes free, weekly 5 km timed runs (every Saturday morning) (7). It has grown on an international scale and promotes sport for everyone, regardless of their running experience, results, age, gender or social status. It has the potential to increase physical activity and promote health, especially among social groups with low economic status (8). Parkrun runs are held on almost all continents and bring together hundreds of thousands of amateur runners. Over the last few years, this initiative has grown from a small-time trial in Bushy Park, London, to a global social movement. Parkrun is non-profit and is based on the involvement of sponsors. Organizers (usually volunteers and local community) strive to ensure that every city where there is a demand for it has the opportunity to engage in regular runs. Participation in Parkrun provides an inclusive leisure space for casual sociability, as well as facilitating a shared experience of exercising with others—especially with inexperienced runners (9).

Another example of social imitative behavior in the field of mass sport is City Trail Poland. City Trail is an initiative that was started in Poland in 2010. It was a response to a shortage of 5 km runs, in contrast to the growing number of marathons and half marathons. It is based on the assumption that runs are for everyone, including beginner runners and families with children. A beginner runner was defined as “an individual having had no prior running training and not being involved in regular sporting activities” (10). Runs are organized on a regular basis in the autumn and winter seasons in major Polish cities, and they attract up to 20,000 participants annually.

Variables such as age, gender, and educational level influence physical activity motivation, so it is important to take them into account when developing strategies to promote sport for all. The motivations of beginner and inexperienced runners have not yet been analyzed. The publications on motivation for running do not cover studies on this population group, apart from a number of analyses of the relationship between the motivation for long-distance running and socio-demographic characteristics, e.g., gender, age or place of residence. Ogles et al. (11) reported that the most important reasons (for female runners more than for male runners) were weight concern, self-esteem, affiliation, psychological coping and life meaning (12). Similarly, in the Polish context, Waśkiewicz et al. (13) found that men were more motivated by competition whereas women's motivation was more linked to weight concern, affiliation, psychological

coping, life meaning, and self-esteem. More recently, León-Guereño et al. (14), reported that Polish female athletes were more motivated by psychological coping while and men were by competition and personal goal achievement. Nikolaidis et al. (10) found that women who ran marathons were frequently focused on personal goal achievement. According to Summers et al. (15) women showed higher levels of addiction to running marathons than men (15). Malchrowicz-Moško and Poczta (16) added that women were more likely to run than men because they wanted to escape everyday life and due to the prevailing fashion. Netz and Raviv (17) pointed out that the age of athletes was a very important factor in determining motivations for physical activity. Nikolaidis et al. (18) studied age-related aspects of marathon participation and identified that competing with other runners was the most important aspect for the youngest athletes. Malchrowicz et al. (19) found that young runners were especially focused on sports results, while older people were more centered on social interaction with other participants in mass running events such as half-marathons. At the same time, children and adolescents' motivation for participating in mass running events was associated with their fun and enjoyment rather than social motives (20).

Previous studies have analyzed the motivations of experienced runners, but we still know little about what motivates beginners—e.g., Parkrun and City Trail participants. Understanding the reasons why people decide to engage in physical activity is extremely important from the point of view of health prevention, in order to effectively promote mass sport and healthy lifestyles and encourage people to participate in sporting events. There is little research on the motivation to start the adventure of running. “Judaism? Islam? Israel's new religion is marathon running” is an example of the kind of statements found in many articles today (21). However, before the decision to participate in a marathon is made, there needs to be a previous initial impetus to take up running, e.g., during Parkrun or City Trail events. Sometimes running becomes a means of fighting cultural restrictions, as is the case of women who have limited participation in mass runs, such as the first international marathon in Tehran—TehRun (21). It is important to understand the motives of runners with wide-ranging running and socio-cultural experience to encourage a greater number of people to take up this sport (22). In the Western world, middle- and upper-class individuals are the primary participants in distance running at the non-elite level (23). According to Stempel (24), the upper classes in the United States use sports such as running to create barriers between them and the lower classes. Care for one's body, health, and physical condition are distinctive features of the ideology of healthism in Western societies, which in some people's view, makes it possible to distinguish the more physically active middle classes from supposedly inactive and lazy lower classes (25, 26). In line with the principles of healthism, it is mainly members of the middle-class who run in Poland (27). However, in the existing publications about the social class determinants of sport, there are few analyses about running (only 22 have been identified). This is probably because running escapes simple divisions into elite and non-elite disciplines, as it is a multidimensional contemporary social phenomenon. Wilson (28) study reported that more

affluent people engage in sport more often than members of the lower socioeconomic classes. Parkrun or City Trail are accessible for everyone, regardless of socioeconomic class. Runners with a high social status will probably increase their distance of choice to participate in ultramarathons in the future, will travel to take part in popular or prestigious marathons, or will change the discipline they engage in, for example, by shifting to triathlon (29). It may be rather difficult to encourage some people to do physical exercise at all, let alone engaging in regular physical activity, such as persuading some members of the lower socioeconomic classes to take up running. That is why initiatives that promote mass sport on an open and accessible basis for everyone (such as Parkrun and City Trail) are so important. Given their contribution to better health status, they can have an indirect impact on lowering public health care costs.

The aim of this study was to investigate the motivations of beginner runners through MOMS scales' 9 motivational dimensions, in particular, of participants in Parkrun Poznań and City Trail Poznań, taking their socio-demographical variables into account. Within these variables, apart from previously analyzed sex, age, and education level, the influence of the family context was analyzed. As little research has been done on this variable (14), the intention is to find out the motivational aspects that lead beginners to start running, since this participation will result in an improvement in health. When talking about motivational processes within a sport context, the type of motivation that has been related with commitment and the beginning of an activity is the intrinsic motivation (30, 31), which is a concept that comes from self-determination theory (32, 33). It is associated with behaviors promoted by the pleasure and satisfaction derived from individual willingness to participate in an activity/sport, which leads to positive consequences such as psychological welfare, interest, enjoyment, and intention to persist (32, 34). Studying motivation of Parkrun participants is important because the initiative is aimed at everyone, including members of the lower socioeconomic classes. A particularly interesting issue is also that Parkrun meetings provide opportunities for social affiliation. Taking part in them may involve a strong sense of community with other beginner runners. City Trail is the only Polish initiative entailing regular runs for beginner runners, and Parkrun is the only international running initiative for novices adopted in Poland to date.

## MATERIALS AND METHODS

### Participants and Study Design

This is a descriptive, quantitative, cross sectional research; whose sample consisted of 165 Parkrun and City Trail participants, with a total of 82 men (49.7%) and 83 women (50.3%). The average age was 37 years ( $36.33 \pm 10.38$ ). Forty runners (24.2%) were younger than 30 years old; 66 runners (40%) were aged between 31 and 40; 45 runners (27.3%) were aged between 41 and 50; and 14 runners (8.5%) were over the age of 50. All of them provided written informed consent to participate in the research, and participants were treated ethically under the American Psychological Association ethics code.

Forty five participants (27.3%) started running at the instigation of other people (family, friends), and as many as 120

people (72.7%) made their own decision to start running. Eighty six people ran with family/friends (52.1%), and 79 people (47.9%) ran alone. All participants stated that they would like to run a marathon in the future.

A total of 105 people (63.6%) had a higher education level, whereas 60 people (36.4%) had a secondary education level. While 143 of the participants were professionally active (86.7%), 18 people were students (10.9%), 2 people were retired (1.2%), and 2 people were unemployed (1.2%).

Ninety one people (55.2%) had children and 74 people (44.8%) had no children. Whereas, 126 participants (76.4%) were married or in a relationship, 39 (23.6%) were single.

## Measurements

### Sociodemographic Status

Following previous studies Molina-García et al. (35), participants were asked about sex (male, female), age, motivation for leading an active lifestyle, education level (secondary education or higher education), own decision to participate vs. persuasion of other people (family, friends, etc.), people with children vs. people without children (yes or no), and married status (single, married, and divorced).

### Motivations of Marathoners'

The multidimensional MOMS scale (36), developed initially by Masters et al. (37) was used. Athletes' motivation was measured via 56 items or reasons for participating in a marathon, organized using a 7-point Likert-scale, with the highest score being 7 "very important reason," and the least valued motive rated 1 "not a reason." This scale shows 9 dimensions that the authors divided into four main broader groups of motives: (1) psychological motives, involving self-esteem (items: 11, 23, 29, 31, 32, 34, 53, 56), e.g., "To improve my self-esteem," psychological coping (items: 10, 15, 18, 28, 36, 38, 39, 47, 50), e.g., "To become less anxious," and life meaning (items: 13, 20, 25, 27, 41, 49, 55), e.g., "To add a sense of meaning to life." (2) Achievement-related motives, including personal goal achievement (items: 5, 9, 22, 35, 46, 51), e.g., "To improve my running speed" and competition (items: 2, 40, 43, 52), e.g., "To compete with others"; (3) social motives, showing recognition (items: 3, 6, 19, 45, 48, 54), e.g., "To earn the respect of peers" and affiliation motives (items: 7, 12, 16, 24, 30, 33), e.g., "To socialize with other runners"; and (4) physical health motives, including general health orientation (items: 8, 14, 17, 26, 37, 44), e.g., "To improve my health" and weight concern (items: 1, 4, 21, 42), e.g., "To help control my weight." (37).

## Procedure

A diagnostic survey method was used, including a standardized interviewing technique (the research instrument developed was an online interview questionnaire). The organizers of City Trail Poznań and Parkrun Poznań consented to conducting the study in March 2020. The research was carried out in accordance with the Declaration of Helsinki, and the study was treated in accordance with the guidelines of the Publication Manual of the American Psychological Association regarding consent and anonymity. As online surveys or questionnaires do not require the completion of a separate participant information



**TABLE 1** | Participants' motivations (on a 7-point Likert scale).

Motives	Total		Women		Men		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Health orientation	5.15 ± 1.37		5.21 ± 1.40		5.08 ± 1.35		−0.63	0.528	0.10
Weight concern	4.08 ± 1.87		4.03 ± 1.83		4.13 ± 1.92		0.35	0.730	0.05
Personal goal achievement	4.97 ± 1.55		4.81 ± 1.52		5.13 ± 1.58		1.33	0.186	0.21
Competition	3.18 ± 1.76		2.74 ± 1.54		3.64 ± 1.86		3.38	0.001	0.53
Recognition	2.41 ± 1.35		2.35 ± 1.34		2.46 ± 1.37		0.51	0.609	0.08
Affiliation	3.79 ± 1.92		4.13 ± 1.99		3.45 ± 1.79		−2.29	0.023	0.36
Psychological coping	4.26 ± 1.61		4.79 ± 1.47		3.73 ± 1.56		−4.47	0.000	0.70
Life meaning	3.77 ± 1.56		4.18 ± 1.43		3.35 ± 1.59		−3.54	0.001	0.55
Self-esteem	4.39 ± 1.55		4.76 ± 1.37		4.02 ± 1.64		−3.12	0.002	0.49

**TABLE 2** | Own decision to participate vs. persuasion of other people (family, friends, etc.).

Motives	Persuaded by other people ( <i>n</i> = 45)		Own decision ( <i>n</i> = 120)		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Health orientation	5.00	1.14	5.20	1.45	−0.81	0.419	0.15
Weight concern	3.77	1.67	4.20	1.93	−1.43	0.157	0.24
Personal goal achievement	5.10	1.52	4.92	1.57	0.65	0.514	0.11
Competition	3.24	1.73	3.16	1.78	0.24	0.810	0.04
Recognition	2.73	1.36	2.28	1.33	1.88	0.062	0.33
Affiliation	4.65	1.74	3.47	1.89	3.66	<b>0.000</b>	0.65
Psychological Coping	4.16	1.43	4.31	1.67	−0.53	0.594	0.10
Life Meaning	3.63	1.38	3.81	1.63	−0.66	0.513	0.12
Self- esteem	4.42	1.37	4.38	1.62	0.15	0.883	0.02

Notes: Bold values indicate statistically significant differences.

sheet or consent form, participation in the survey was deemed to constitute informed consent. Participants were informed about the significance of the study and were kindly requested to provide information. The survey was voluntary, anonymous, and confidential. In Poland, anonymous diagnostic surveys do not require approval by a bioethics committee. The survey was forwarded to City Trail and Parkrun participants by the events' organizers. The survey was created using Google Docs technology. People who had not previously engaged in running and had not led an active lifestyle according to the World Health Organization prior to participating in Parkrun and City Trail were asked to take part in the survey. This sample selection allowed us to study people who took up physical activity and running thanks to initiatives such as Parkrun and City Trail. Participants were informed that, according to the World Health Organization (38), meeting physical activity recommendations involves doing exercise for at least 150 min a week (moderate-intensity effort) or for at least 75 min a week (high-intensity effort).

## Data Analysis

The normality of distributions was assessed with a Shapiro-Wilk test and homogeneity of variance was checked using Levene's test. Intergroup comparisons were made using Student's *t*-test

for independent variables or (in the case of failure to meet the assumption of homogeneity of variance) using the Cochran-Cox test. Cohen's *d* was calculated to determine effect size for mean comparisons. Correlations between age expressed in years and motivation scale values were performed using Pearson's linear correlation coefficient. The probability values were considered significant at  $p < 0.05$ . Calculations were made in Statistical 10.0.

## RESULTS

**Table 1** showed the participants' motivations. The highest-rated motivations for running were related to health orientation (5.15) and personal goal achievement (4.97), and the lowest-rated motivations were recognition (2.41) and competition (3.18).

Furthermore, **Table 1** revealed that the motivations of novice runners differed by gender. Men were more likely to start running due to Competition-related motivations, whereas women were more often inclined to do so due to aspects related to Affiliation, Psychological Coping, Life Meaning, and Self-esteem. Health and Weight orientation and Personal goal achievement held similar importance for women and men.

**Table 2** showed the motivations of people who made an independent decision to start running and those that did so encouraged by other people. A statistically significant difference

**TABLE 3** | People with higher education vs. people with secondary education.

Motives	Secondary education (n = 60)		Higher education (n = 105)		t	p	d
	M	SD	M	SD			
Health orientation	5.16	1.47	5.13	1.32	0.13	0.897	0.02
Weight concern	3.83	1.78	4.23	1.91	-1.30	0.195	0.21
Personal goal achievement	4.78	1.70	5.08	1.46	-1.19	0.236	0.19
Competition	3.12	1.76	3.22	1.77	-0.35	0.725	0.06
Recognition	2.45	1.49	2.38	1.27	0.32	0.748	0.05
Affiliation	4.16	1.84	3.58	1.94	1.89	0.061	0.31
Psychological coping	4.49	1.62	4.13	1.59	1.38	0.169	0.22
Life meaning	4.12	1.60	3.56	1.51	2.21	<b>0.029</b>	0.35
Self-esteem	4.44	1.61	4.36	1.52	0.31	0.759	0.05

Notes: Bold values indicate statistically significant differences.

**TABLE 4** | People with children vs. people without children.

Motives	Do you have children? Yes (n = 91)		Do you have children? No (n = 74)		t	p	d
	M	SD	M	SD			
Health orientation	5.18	1.32	5.10	1.45	0.37	0.711	0.06
Weight concern	4.23	1.83	3.91	1.91	1.08	0.281	0.17
Personal goal achievement	4.85	1.54	5.12	1.56	-1.11	0.269	0.17
Competition	2.96	1.68	3.47	1.83	-1.87	0.064	0.29
Recognition	2.22	1.23	2.64	1.46	-1.99	<b>0.048</b>	0.31
Affiliation	3.62	1.85	4.00	2.00	-1.29	0.198	0.20
Psychological Coping	4.24	1.61	4.29	1.61	-0.20	0.840	0.03
Life Meaning	3.71	1.52	3.83	1.62	-0.51	0.612	0.08
Self-esteem	4.19	1.52	4.64	1.56	-1.84	0.068	0.29

Notes: Bold values indicate statistically significant differences.

was found on the Affiliation scale, as higher significance was seen among people who had been encouraged to run by other people ( $p = 0.000$ ).

The next step involved checking how motivations were shaped based on respondents' educational level (Table 3). The Life Meaning Scale was more important to people with secondary education ( $p = 0.029$ ).

It was then decided to check how participants' motivations were shaped depending on whether they had children or not (Table 4). The Recognition scale was of higher importance for people who did not have children ( $p = 0.048$ ).

An analysis was then carried out to see if the motivations were shaped depending on whether the runners were single or not (Table 5). The Affiliation scale was more important for singles who started running ( $p = 0.048$ ).

Pearson's  $r$  correlation was used to check whether motivations differed by age (Table 6). Statistically significant correlations were obtained for Personal goal achievement ( $r = -0.16$ ;  $p = 0.040$ ), Competition ( $r = -0.18$ ;  $p = 0.021$ ), and Recognition ( $r = -0.21$ ;  $p = 0.006$ ).

These were weak, negative correlations ( $r < 0.30$ ). As age increased, the motivation values on the scales decreased.

Respondents were also asked whether Parkrun and City Trail had encouraged them to lead an active lifestyle (Table 7).

## DISCUSSION

The aim of this study was to analyze the reasons that lead beginner athletes to take part in Parkrun and City Trail Poznań, taking into account their socio-demographical variables. Previous studies on Parkrun have focused on its potential benefits and its impact on runners' physical and mental health and well-being. Assessments of the impact that participation in Parkrun meetings had on runners' overall level of physical activity found an increase in activity after 6 months, but this effect became less visible after 12 months (39). The increase was most pronounced among people with low levels of physical activity, which became close to the recommended weekly level due to their participation in Parkrun (40). Although participation in Parkrun did not cause that the weekly level of activity of all participants to reach the recommended levels, it is worth considering that that even low physical activity levels bring significant physical and mental health benefits (41, 42). As for the impact of Parkrun runs on the participants' weight, qualitative and quantitative studies have shown that Parkrun participants reported a decrease in weight; for example, overweight people noticed a weight loss of nearly 2.5% after 1 year without controlling their diet (43). The results of our study on Parkrun and City Trail participants in Poznań City who had not previously run and did not lead an active lifestyle showed that these initiatives

**TABLE 5 |** Single people vs. married people/people in a relationship.

Motives	Married/in a relationship ( <i>n</i> = 126)		Single ( <i>n</i> = 39)		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Health orientation	5.24	1.38	4.83	1.33	1.65	0.100	0.31
Weight concern	4.12	1.87	3.97	1.89	0.42	0.678	0.08
Personal goal achievement	4.98	1.51	4.94	1.70	0.12	0.904	0.02
Competition	3.14	1.75	3.31	1.82	−0.52	0.601	−0.09
Recognition	2.32	1.31	2.67	1.46	−1.41	0.160	−0.25
Affiliation	3.63	1.94	4.32	1.78	−1.99	<b>0.048</b>	−0.37
Psychological Coping	4.18	1.64	4.54	1.46	−1.23	0.219	−0.23
Life Meaning	3.69	1.58	4.01	1.51	−1.12	0.262	−0.21
Self- esteem	4.33	1.57	4.60	1.50	−0.97	0.335	−0.18

Notes: Bold values indicate statistically significant differences.

**TABLE 6 |** Scale correlations with age.

MOMS scale	<i>r</i>	<i>p</i>
Health orientation	0.15	0.062
Weight concern	0.04	0.579
Personal goal achievement	−0.16	0.040
Competition	−0.18	0.021
Recognition	−0.21	0.006
Affiliation	−0.06	0.440
Psychological Coping	−0.03	0.669
Life Meaning	−0.08	0.328
Self- esteem	−0.15	0.063

encouraged them to lead an active lifestyle in accordance with WHO guidelines on an average level of 4.98 points on a 7-point Likert scale. This is a positive result from the point of view of health promotion.

A literature review showed that long-distance running can be a form of therapy, and people also run to improve their mental health (16). Parkrun has had a positive impact on mental health. Studies have indicated that depression, tension, isolation and anger decreased, while participants' self-esteem, mood and stress levels improved (44, 45). According to Stevinson et al. (46) happiness and stress reduction were maintained 1 year after starting Parkrun (47). In Australia, well-being improvement was limited to older runners. Women's personal well-being may benefit from Parkrun especially through improved mental health, and men's well-being may be enhanced by their being connected to a community. Grunseit et al. (33) underlined that Parkrun may facilitate social identity and continuation of healthy habits among athletes, and non-demanding, health-enhancing activity among non-athletes. Researchers have shown that, in the early stages, Parkrun participants mainly focus on health benefits, but later social contacts and the opportunity to help and volunteer grow in importance (46). According to Wiltshire and Stevinson (48), Parkrun offers a space for collective bodywork whereby participants simultaneously enact personal body projects while they also experience a sense of being, all of which comes together to ameliorate certain individualizing effects of health

“responsibilization.” Growing evidence suggests that social identities may have profound implications for physical activity participation. Previous studies about Parkrun have demonstrated that group identification was significantly associated with greater participation, exercise-specific satisfaction, group cohesion, and life satisfaction. Findings provide real-world evidence of the health-related benefits associated with forming strong social identities in exercise settings (49).

According to our study, the highest-rated motivations for beginner runners were related to health orientation and personal goal achievement, whereas the lowest-rated motivations were related to recognition and competition. Almost 75% of respondents made an independent decision to start running in Parkrun and City Trail. In contrast, a statistically significant (higher) difference was found on the Affiliation scale among those who had been encouraged by other people. The Affiliation scale was especially important for single participants who started running in comparison with married runners and participants who were in a relationship. As for family circumstances, the Recognition scale was of higher importance for people who did not have children. The Life meaning scale proved to be more important for people with secondary education level.

The greatest differences in motivations were recorded for gender and age analyses of beginner runners. While men were more likely to start running due to Competition-related motivations, women tended to do so due to aspects related to Affiliation, Psychological Coping, Life Meaning and Self-esteem, which is in line with previous research (10, 11, 13, 14). As far as age was concerned, statistically significant correlations were obtained for Personal goal achievement, Competition and Recognition. As age increased, the level of motivation on these scales decreased. According to marital status, affiliation dimension showed significant differences between engage people and single beginners, in contrast to the results obtained by León-Guereño et al. (14) who did not find any differences among married, engaged and single, in any of the 9 dimensions of MOMS in amateur marathon runners. On the other hand, recognition dimension was found to be statistically different between beginner runners who had children and those who had not, being this variable interesting for further analysis.

**TABLE 7 |** Motivation for leading an active lifestyle.

	Total		Items motivation for leading an active lifestyle in accordance with WHO recommendations													
			1		2		3		4		5		6		7	
	<i>M</i>	<i>SD</i>	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Motivation for leading an active lifestyle in accordance with WHO recommendations	4.99	1.72	10	6.06	5	3.03	18	10.91	22	13.33	36	21.82	37	22.42	37	22.42

The survey results are optimistic. They showed that nearly 75% of respondents made an independent decision to start running in Parkrun and City Trail, and participation in these events motivated them to lead an active lifestyle at a level of nearly 5 points on a 7-point Likert scale.

The key strength of this study is that it is focused on a sample comprised of inexperienced runners. Other than that, athletes' family context is taken into account, being this another innovative perspective of this research, thus analyzing runners' marital status and whether they have children or not. According to Goodsell et al. (50) athletes' motivations need to be understood beyond psychological aspects, and social factors need to be taken into consideration. However, the obtained results need to be viewed carefully, since the research was carried out within a specific social context and using a cross-sectional design that did not allow for any causal inferences. Another limitation involves the use of an online survey to collect the data. However, online studies have been reported to obtain very similar results to those administered manually with paper and pencil (51, 52). In the future, more characteristics of inexperienced runners should be investigated, such as age-related motivations by gender, athletes' health status, or the number of children in the family. Moreover, in the future beginner children should be checked and add our reference about children (53).

## CONCLUSIONS

In conclusion, this study shows that social-demographic variables such as gender, age, education, and marital and family status had an impact on the decision to start running, so these factors should be taken into account when promoting mass sport events aimed at enhancing people's health. Fostering safe running among people who have no previous experience is as important as

encouraging people to run. All participants stated that they would like to run a marathon in the future.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

Ethical approval was not provided for this study on human participants because as online surveys or questionnaires do not require the completion of a separate participant information sheet or consent form, participation in the survey was deemed to constitute informed consent. Participants were informed about the significance of the study and were kindly requested to provide information. The survey was voluntary, anonymous and confidential. In Poland, anonymous diagnostic surveys do not require approval by a bioethics committee. The survey was forwarded to City Trail and Parkrun participants by the events' organizers. Written informed consent was not provided because Ethical approval for this study and written informed consent from the participants of the study were not required in accordance with local legislation and national guidelines.

## AUTHOR CONTRIBUTIONS

EM-M contributed conception and design of the study and organized the database. EM-M and ZW performed the statistical analysis and wrote the first draft of the manuscript. EM-M, PL-G, MT-S, and PS-M wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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

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# Factors Associated With Health-Related Quality of Life of Parents Who Lost Their Only Child: A Cross-Sectional Study in Central China

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**Purpose:** The number of families who lost their only child was over one million in 2012 in China, and it is growing rapidly every year. Without their only child, they will inevitably worry about their health and life for their later years. It is important to explore the quality of life and influencing factors of the parents.

**Methods:** The cluster sampling method was adopted to select the participants in Wuhu city, Anhui province, central China. The generalized linear regression models were performed to analyze factors influencing EQ-VAS scores.

**Results:** The parents with different monthly income ( $P = 0.001$ ) and self-rated health status ( $P < 0.001$ ) had different EQ-VAS scores. Educational level, self-rated health status, number of chronic diseases, depression and having grandchildren were significantly associated with their EQ-VAS score.

**Conclusion:** The government should encourage public medical institutions to provide convenient health management and medical services to this vulnerable group. Priority treatment should be given to the parents who already have multiple diseases. The parents who were depressed should be given timely intervention. The government should give more financial subsidies to the parents who need to raise their grandchildren.

**Keywords:** quality of life, EQ-5D, bereavement, EQ-VAS, who lost their only child

## INTRODUCTION

Since the late 1970s, “the one-child policy” has been the norm in the People’s Republic of China, and millions of couples have been restricted in the number of children they can have. This has played a certain role in controlling the over-rapid growth of the population and promoting economic development, but it also brings about negative social phenomena.

The number of families who lost their only child was over one million in 2012, and 76,000 new families were estimated to join this group each year nationwide (1). The loss of a child in a family is “the most distressing and long-lasting of all grief.” For Chinese parents, it is especially unique, because China has a traditional culture of “raising children for their old age.” Without their only child, they will inevitably worry about their health and life for their later years (2).

The pursuit of the highest standard of health is the basic right of every person. When people get old, the probability of various diseases will increase greatly. Who will take care of their health in old age after losing their only child? According to the bio-psycho-social medical model, many psychological and social factors have a great impact on health, even determinant. After the bereavement event, in addition to suffering major psychological trauma, what kind of impact will it have on the quality of life (QoL)? The introduction of the concept of QoL as an outcome measure in healthcare that emerged in the 1970s, it is the perceived quality of an individual's daily life. This includes all physical, emotional and social aspects of the individual's life (3). Therefore, it is very necessary to investigate the quality of life of the parents who lost their only child, and how best to improve their quality of life.

Yin et al. (4) pointed out that the physical status of the parents who lost their only child was much worse than that of the control group, characterized by a higher rate of chronic diseases and more hospital visits (4). Wang et al. (5) proposed that the health-related quality of life among the parents who lost their only child is lower, the length of time that had passed after losing the only-child and the personal average monthly income are the main influencing factors (5). Wang et al. (6) found that improving the senior citizens' quality of sleep and economic level, conducting health education and psychological intervention, providing facilities for sports and scientific guidance, and strengthening the treatment of chronic diseases may improve their quality of life (6). Song et al. (7) found that health-related QoL was significantly lower in bereaved family members than in controls. Bereaved family members experienced more frequent episodes of depression and suicidal thoughts. Female sex, lower income, and spousal relationship were negatively correlated with health-related QoL (8). Nicol (8) found that the time after a bereavement is related to the quality of life (7).

There were a large number of studies on the quality of life of the elderly. But there were fewer studies on the health of the parents who lost their only child. There was a study on the status of the illness. There was a study about the quality of their lives, but the EQ-VAS scale was not used. And there were some important factors that were not considered, for instance, having grandchildren, social support status, depression, and so on. This study used the EQ-VAS scale and adopted the regression analysis model to explore the quality of life and influencing factors of the parents, and to provide evidence for improving their quality of life.

**Abbreviations:** EQ-VAS, the European quality of life visual analog scale; GDS, Geriatric Depression Scale; SSRS, Social Support Rate Scale; TB, Tuberculosis.

## MATERIALS AND METHODS

### Sampling

Data were collected from April to July 2018 in Wuhu city, Anhui province, China. The cluster sampling method was adopted to select the participants. The sampling process involved a systematic approach and a four-step scheme: (a) According to the administrative divisions of Wuhu city, it was divided into four districts: Jinghu, Yijiang, Sanshan, and Jiujiang. (b) A district was selected from the city, and it was Jinghu district. (c) All communities in the Jinghu district were selected. (d) To survey all the parents who lost their only child in these communities. The inclusion criteria were: (a) Being older than 49 (In consideration of the fact that the health bureau had brought the parents who lost their only child aged 49 or older into the systematic management, and the mothers who lost their only child aged 49 or older were no longer in the fertile period), (b) Having normal cognitive functions, and being willing and able to cooperate throughout the survey process. The exclusion criteria were: (a) The parents who lost their only child had refused to accept the government's or others' condolence or investigation, (b) Moving to another place.

Two professors from Zhejiang Chinese Medical University and 20 family planning officials in the local communities were recruited and trained as interviewers. All participants were clearly informed of the purposes of the study, and were asked to sign the consent form. All participants were assured of their rights to refuse to participate or to withdraw from the study at any time. Privacy and confidentiality of all the participants were assured. Each interview lasted for about 30 min. The criteria for determining a valid questionnaire was: The information of the three scales used were complete and accurate, and there were very few missing or no missing sociodemographic information or other data, and there were no mistakes, such as: age over 200, the participant filled in the options that were not set. Three hundred fifty participants were surveyed. There were 306 valid questionnaires, and the effective recovery rate was 87.4%.

### Measurements

#### EQ-VAS

The EuroQol visual analog scale (EQ-VAS) descriptive system was introduced by the EuroQol Group in 1990 (9). It is a 20-centimeter visual scale. Participants were asked to rate their own health for the day, with a score of 100 representing their “best health” and a score of 0 representing their “worst health” (10). It has the advantage of easy acceptance by the respondents, and is widely used in China (11–13). The EQ-VAS score of the parents who lost their only child was regarded as the dependent variable.

#### GDS

Geriatric Depression Scale (GDS) was developed by the U.S. Brink and Yesavage in 1982, which was the first depression scale designed specifically for older adults, has become widely used for depression assessment in many countries (14). It has 30



items in total. The simplified geriatric depression scale (GDS-15) is a 15-item simplified scale designed by Yesavage and Sheikh in 1986, which is based on the standard version of 30 items according to the characteristics of the older adults. It was used to evaluate the depression status of the respondents in the recent week, mainly to measure the older adults feeling down, withdrawal, irritability, reduced activity, pain, and other thoughts, and negative evaluation of the past, present, and future. A higher score on the scale signifies more serious depression, and a score greater than or equal to 8 means depressive symptoms (15). A simplified scale was used in the study. GDS-15 has good reliability and discriminant validity, which can be used to measure depressive symptoms of elderly people in urban and rural areas in China (16).

### SSRS

Shui-yuan Xiao, a Chinese scholar, developed the Social Support Rate Scale (SSRS), which has 10 items, and is divided into three dimensions: subjective support, objective support, and utilization of support. The total score consists of the sum of the scores of the three dimensions. A higher score means a higher level of social support. A total score of <20 signifies less social support, a total score of 20–30 signifies general social support, and a total score of more than 30 signifies satisfactory social support (17). This scale has high reliability and validity and has been widely used in China (17). The social support status was divided into two levels in this study: A score above 30 indicates good social support. Less than or equal to 30 indicates poor social support.

### Independent Variables

The categorical independent variables included: gender (1=male, 2=female), marital status (1=living with spouses, 2=not living with spouses), having grandchildren (1=yes, 2=no). Age (1<60, 2≥60), monthly income (1<3000, 2≥3000), social support (1=good, 2=poor), depression (1=healthy, 2=depressive). Number of chronic diseases was a continuous variable. Self-rated health status (1=good, 2=moderate, 3=bad) and educational level (1= middle school and below, 2= high school, 3= college and above) were regarded as continuous variables in the logistic regression model and generalized linear regression model.

The number of chronic diseases was surveyed by a multiple-choice question, “How many chronic diseases do you have?” Sixteen chronic diseases were listed for selection, including diabetes, hypertension, hyperlipidemia, cerebrovascular disease, a malignant tumor, coronary heart disease, Cerebral infarction (stroke), senile dementia, gynecology disease, chronic liver disease, osteoporosis, gout, asthma, arthritis, Tuberculosis (TB), hematopathy, chronic low back pain, cataract. A higher score signifies that participants have more chronic diseases.

### Quality Control

The ages of the respondents were confirmed using the household registration system. During the face-to-face investigation, the trained family planning cadres and the professors explained how to fill in the questionnaires and helped respondents complete them in their homes or community residents committee office.

The database was set up by EpiData3.1 software, and double input was conducted to ensure accuracy.

### Data Analysis

Data were analyzed using the SAS version 9.1 software. Sociodemographic variables of the participants were expressed in terms of frequencies. Considering the non-normal distribution of EQ-VAS scores, the rank sum test was adopted to compare the EQ-VAS scores of the parents who lost their only child with different socio-demographic characteristics. The generalized linear regression models was performed to analyze factors influencing EQ-VAS scores.

## RESULTS

### Characteristics of the Parents Who Lost Their Only Child

**Table 1** shows characteristics of the parents who lost their only child. The median age of the parents is 62, and the median monthly income is 2,650 yuan. 46.2% of the respondents were men, and 53.8% were women. 75.7% of the respondents had an education level below middle school. 66.6% of respondents lived with their spouses. 89.3% of respondents had no grandchildren.

### Comparison of EQ-VAS Scores Between Groups

The EQ-VAS score of the parent was 20~100, the median was 70, the interquartile range was 20, the average was 71, and the standard deviation was 15. **Table 2** shows EQ-VAS scores comparison of the parents who lost their only child with different basic characteristics. Rank sum test results were shown: The

**TABLE 1** | Characteristics of the parents who lost their only child.

Characteristics	<i>M</i>	<i>Q<sub>R</sub></i>
Age	62	15
Monthly income (yuan)	2,650	1,440
	<i>N</i>	%
Gender		
Male	138	46.2
Female	161	53.8
Educational level		
Middle school and below	227	75.7
High school	61	20.3
College and above	12	4.0
Marital status		
Living with spouses	195	66.6
Not living with spouses	98	33.4
Having grandchildren		
No	259	89.3
Yes	31	10.7

7 were missing gender, 11 were missing age, 6 were missing educational level, 13 were missing marital status, 11 were missing monthly income, 16 were missing having grandchildren.

**TABLE 2 |** The EQ-VAS score comparison of parents who lost their only child with different sociodemographic characteristics (*M* (*Q<sub>R</sub>*), score).

Characteristic	<i>N</i>	<i>M</i> ( <i>Q<sub>R</sub></i> )	<i>Z</i>	<i>P</i>
Age			−1.314	0.189
<60	118	70 (30)		
≥60	177	70 (20)		
Gender			−1.016	0.310
Male	138	70 (20)		
Female	161	70 (23)		
Educational level			2.241	0.326
Middle school and below	227	70 (20)		
High school	61	75 (20)		
College and above	12	80 (20)		
Marital status			−0.648	0.517
Living with spouses	195	70 (20)		
Not living with spouses	98	80 (20)		
Monthly income (yuan)			−3.261	0.001
<3,000	195	70 (20)		
≥3,000	100	80 (10)		
Having grandchildren			−0.207	0.836
No	259	75 (14)		
Yes	31	70 (19)		
Self-rated health status			72.256	<0.001
Good	99	80 (13)		
Moderate	119	70 (10)		
Poor	38	50 (20)		

7 were missing gender, 11 were missing age, 6 were missing educational level, 13 were missing marital status, 11 were missing monthly income, 16 were missing having grandchildren, 50 were missing self-rated health status.

parents with different monthly income ( $P = 0.001$ ) and self-rated health status ( $P < 0.001$ ) had different EQ-VAS scores. Those with a monthly income of 3,000 yuan or more had higher EQ-VAS scores than those with a monthly income of <3,000 yuan. The parents who assessed themselves as in good health and moderate health had higher EQ-VAS scores than those who assessed themselves as in poor health.

## Results of Generalized Linear Regression Analysis of EQ-VAS Score

Table 3 shows the results of generalized linear regression analysis of the factors affecting the EQ-VAS score of the parents who lost their only child. Educational level ( $P = 0.001$ ), self-rated health status ( $P < 0.001$ ), number of chronic diseases ( $P < 0.001$ ), depression ( $P = 0.001$ ), and having grandchildren ( $P = 0.001$ ) were significantly associated with the EQ-VAS score of the parents who lost their only child.

## DISCUSSION

This study used the EQ-VAS scale and adopted the generalized linear regression models to explore the quality of life and influencing factors of the parents who lost their only child,

coming from Wuhu city, Anhui province, located in central China. This study found that the parents with different monthly incomes and self-rated health statuses had different EQ-VAS scores. Educational level, self-rated health status, number of chronic diseases, depression and having grandchildren were significantly associated with their EQ-VAS score.

Huang-Hui Chen used the EQ-VAS scale to study the quality of life of the ordinary elderly in Nanjing, China. The EQ-VAS score of the elderly in Nanjing was  $77.22 \pm 11.12$  (18). The EQ-VAS score of the parents who lost their only child was  $71 \pm 15$ . The quality of life of the parents who lost their only child was lower than that of the ordinary elderly (19). Yan Li found that these parents had difficulties in health and the government should provide support (20). Qian-Lan Yin also found these parents had a higher rate of chronic diseases than parents who have a living child (4). The bereaved family members have lower health-related QoL and mental health than the general population (7, 21, 22). Therefore, the government should encourage public medical institutions to provide convenient health management and medical services to the vulnerable group.

This study found that as self-rated health deteriorated, EQ-VAS score decreased. This reflected a high consistency between self-rated health status and quality of life. This study found that as the number of diseases increased, the EQ-VAS score decreased. This suggests that an increase in the number of diseases leads to a decrease in the quality of life. Therefore, for the parents who already have multiple diseases, priority treatment should be given.

This study found that depression was significantly associated with the EQ-VAS score. As depression levels increased, quality of life declined. This study was consistent with Yan Li's findings. Yan Li found that the parents suffered from emotional or physical health problems, and their risks of heart disease and hypertension were high, due to suffering from depression for a long time (23, 24). This is because the quality of life evaluation includes the overall evaluation of the three dimensions of body, psychology, and society. Aggravation of depression can lead to a decrease in quality of life. In addition, physical health and mental health interact with each other. Poor mental health can cause physical health deterioration. Influencing the overall quality of life. Therefore, the parents who were depressed should be given timely intervention.

This study found that the parents with grandchildren had a higher EQ-VAS score. This may be because, in Chinese culture, offspring are parents' hope and future, as well as the driving force of life. Parents with grandchildren have better mental health, which in turn improves physical health. This study found that the more educated the parents are, the higher their EQ-VAS score. Therefore, the government should give more financial subsidies to the parents who need to raise their grandchildren.

This study had several strengths. First, this was the first quantitative research we are aware of about the quality of life among parents who lost their only child in a central China city. Second, the generalized linear regression analysis models were used to explore the influencing factors of quality of life among the parents. Third, it adds to a limited number of studies on quality of life and health among parents who lost their only child, who

**TABLE 3 |** Generalized linear regression analysis of the factors affecting EQ-VAS score of the parents who lost their only child.

Independent variables	Reference	$\beta$	S $\bar{x}$	P	OR (95%CI)
Gender					
Male	Female	-0.32	0.80	0.690	0.73 (0.15 ~ 3.50)
Age					
<60	≥60	1.33	0.85	0.116	3.77 (0.72 ~ 19.77)
Educational level		2.18	0.64	0.001	8.83 (2.53 ~ 30.85)
Marital status					
Living with spouses	Not living with spouses	-0.67	0.93	0.471	0.51(0.08 ~ 3.17)
Monthly income					
<3,000	≥3,000	-0.54	0.90	0.554	0.59 (0.10 ~ 3.45)
Self-rated health status		-9.40	0.68	<0.001	0.00 (0.00 ~ 0.00)
Number of chronic diseases		-1.86	0.41	<0.001	0.16 (0.07 ~ 0.35)
Social support					
Good	Poor	0.16	0.77	0.834	1.18(0.26 ~ 5.31)
Depression					
Healthy	Depressive	3.13	0.92	0.001	22.81(3.73 ~ 139.44)
Having grandchildren					
Yes	No	2.77	0.82	0.001	15.92(3.22 ~ 78.66)

were special vulnerable groups. This study also had the following limitations which should be acknowledged. First, this study did not analyze the data of the control group, so it is difficult to determine whether the same associated factors exist in the control group. Second, the parents were psychologically devastated by the events, and many were reluctant to be disturbed or investigated. This study only surveyed a city in Wuhu. The sample size we investigated was small, and it was difficult to represent the whole central China situation. Third, there were some possible factors that had not been investigated, such as: personality traits, the time of the event.

## CONCLUSIONS

The study quantitatively analyzed the health-related quality of life and its influencing factors among parents who lost their only child in central China city and provided some suggestions for improving the health related quality of life. Second, it can cause the government and society to pay attention to and care about the health-related quality of life of vulnerable parents. There are some topics worth further study in the future. First, we could investigate non-bereaved parents and compare the differences between the two groups. Second, we need to design specific solutions to improve the health related quality of life of parents who lost their only child.

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## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The Medical Ethics Committee of Zhejiang Chinese Medical University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

Z-QG and S-HS designed the present study. X-LW, DW, and C-MX assisted in the acquisition of subjects and data. L-JZ, Y-DC, and W-WS conducted the analysis and interpretation of data. CR and QZ prepared the manuscript. All authors contributed to and have approved the final manuscript.

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

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# Investigating the Mental Health Impacts of University Campus Green Space Through Perceived Sensory Dimensions and the Mediation Effects of Perceived Restorativeness on Restoration Experience

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**Introduction:** Green spaces support people mentally in their everyday life. Perceived restorativeness and Perceived Sensory Dimension (PSD) have been addressed as optimal environmental related characteristics with regards to psychological restoration. However, relatively little research has investigated how the perception of these characteristics, directly and indirectly, affects restoration experience, particularly in a sample of university students within the area of green outdoor campus landscapes.

**Methods:** This study hypothesizes these associations through application of partial least squares structural equation modeling (PLS-SEM), inputting data from a sample of university students in Malaysia. In the hypothesized model, we examine the degree of restoration that is enjoyed by subjects within landscapes through the effects of these characteristics. Indirect effects of perceived restorativeness via evaluation of mediation effects associated with perception of landscape characteristics and restoration experience are also investigated.

**Results:** Through validation of the measurement model, we find significant positive coefficient paths with adequate predictive abilities in the hypothesized model. Findings suggest the effect of PSD on perceived restorativeness leads to a better explanation of restoration experience. In addition, perceived landscape characteristics of PSD enhance restoration experience in alignment with perceived restorativeness characteristics.

**Conclusions:** Greater effects on restoration experience come through perceived restorativeness that is affected by PSD, which itself is capable of promoting favorable experiences of restorativeness in a green space and facilitating psychological restorative outcomes. The mechanistic effect of emotional regulation implies a distinct role of green spaces in maintaining good mental health and has relevance to public health models that promote independence and well-being through preventative approaches. The work

paves the way for further studies that examine which dimensions of PSD support perceived restorativeness and restoration experience more than others, and the wider psycho-social value of green spaces through the application of mediation effects and personal sensory dimensions in the development of mental health.

**Keywords:** restoration experience, mental health, perceived restorativeness, perceived sensory dimension (PSD), PLS-SEM analysis

## INTRODUCTION

Mental fatigue and stress-related mental disorders, depression, and anxiety are related to individual mental health and well-known risk factors for positive mental health (1–3). One in every four people suffer from mental disorders in their lifetime (1). Environmental health related researchers have suggested that green environments can reduce levels of stress related mental disorders and therefore enhance positive mental health (2, 4–12). For instance, Dzhambov et al. (6) have shown that green spaces afford restorative experiences and promote better mental health with higher mindfulness, lower rumination, and greater resilience to stress.

In human health and environmental relationships, the positive effect of green spaces on development of positive mental health is recognized as psychological restoration experience (13). Psychological restoration is the direct effect of contact with green spaces to promoting positive mental health outcomes (14). It refers to renewal of “directed attention capacities” that have depleted with sustained usage in daily life, “physiological changes from tension and stress toward relaxation,” and “positive mood change” (15). Examining the literature, a great deal of attention has been paid to restoration experiences in investigating mental health promotion of green spaces (1, 6, 12). The importance of green spaces in the development of better state of mental health involves “the promotion of subjective well-being,” “the prevention of mental disorders” and “the treatment and rehabilitation of people affected by psychiatric disorders” (1). A number of approaches used by researchers to measure the mental health benefits of green spaces involve multidimensional definitions of health outcomes, such as cognitive and emotional restoration (1), attention restoration (16), cognitive functioning (4), and emotional well-being (17, 18). According to the World Health Organization (WHO), health is not an absence of illness, it is a state of physical, mental and social well-being (3). Social and environmental stressors, sustained stress, mental fatigue and negative emotional states cause harmful diseases such as heart disease, type II diabetes and mental illness (1, 13), especially if people neglect recharge their psychophysiological and emotional resources. To cope effectively with everyday life demanding mental disorders, people therefore need to regularly restore the impaired resources from a negative state to their original state.

Topics related to mental health promotion of university students have also shown a light on the restorative potential of outdoor campus green spaces for students’ psychological restoration and in development of positive mental health (19,

20). Like other population groups, this subgroup encounters various types of social, academic and environmental stressors, and a lack of psychological restoration can cause depression and mental disorders during what is a sensitive life stage (19). For example, Adams et al. (21) showed that students’ poor mental health (depression, anxiety, negative affect) is associated to some extent with a decline in immunity system function and acute infectious illnesses including bronchitis, sinusitis, strep throat and ear infection. To enhance university students’ mental health, the importance of outdoor campus green space has been recognized as a potential restorative setting that contribute to their psychological restoration (20, 22), attention restoration (23) and mental fatigue restoration (16). As many studies have shown, in outdoor environments there are possibilities to enjoy a psychological restoration experience and mental health benefits. From this perspective, three sets of research objectives have been developed to show how a physical environment works as a prominent supportive and restorative setting contributing to restoration experience and support development of positive mental health:

(1) A growing body of research based on Attention Restoration Theory (ART), has explored whether the green environment is a restorative setting and to what extent landscape components works as a psychological health resource (24–26). Through this lens, the restorative effects of different types of green environments and the effect of various landscape components on human psychological systems were investigated. Results revealed that an environment with presence of landscape components (mainly greenery and water) is health promoting and provide stress-reducing effects and reduce mental fatigue.

(2) Another group of studies has focused on what perceived qualities of green spaces provide restoration experience. Based on ART, studies have described perceived restorativeness as an environmental condition for psychological restoration experience and better mental health condition (1, 2). The perceived restorativeness involves perception of characteristics of “being away” (freeing the mind from everyday life demanding tasks), “fascination” (effortless attention to pleasing objects like birds and flowers), “extent” (occupying the mind for a long period of time) and “compatibility” (a good match with inclinations, no struggle). Perceived restorativeness characteristics can improve mental health by providing relief from stress related mental disorders (1). For many years, scholars have addressed the questions around psychological restoration experience, cognitive restoration and mental fatigue recovery through examining the impact of these perceived restorativeness characteristics (16, 17, 24, 27).

Although perceived restorativeness is now associated with an extensive literature relating to restorative outcomes in natural environments, in recent decades a number of studies have indicated the possibility of Perceived Sensory Dimension (PSD) of green space for restoration experience and mental health promotion (3, 13, 28–31). PSD involves eight perceived qualities of “nature,” “culture,” “social,” “prospect,” “rich in species,” “refuge,” “space” and “serene.” Within this approach, landscape perception involves active interaction with green space and experience of characteristics such as self-growing lawns (nature), static and dynamic elements offering fascination with the course of time (culture), vistas and plane view (prospect), facilities available for gathering (social), spacious and free (space), diverse non-human life (rich in species), sensation of a safe environment (refuge) and natural sounds offering a sense of quietness and tranquility (serene). It has subsequently been proposed that perception of a green environment with these landscape characteristics offers psychological and emotional restoration from stress (28, 29) and support mental health strengths (13).

(3) The third group of studies went further, and investigated how the “external” environment (green space) is able to affect a human’s “internal” being state (18, 32). These scholars believe that the process of understanding how an environment impacts human health is more complex than simply examining what causes the outcome (18, 33). Such studies have focused on the underlying mechanistic factors—mediation effects—and analysis of multiple pathways to explain precisely how this process works. Literature on green space and human health has revealed many possible mediating variables in this relationship (6, 7, 34, 35). Developed from ART, perceived restorativeness is a psychological mechanism that makes it possible to achieve restoration experience in a green environment. For example, Marselle et al. (18) and Hipp et al. (32) examined the mediation effect of perceived restorativeness to explain how perceived naturalness and biodiversity are related to an individual’s emotional well-being and quality of life. They showed that an individual’s perception of the environment is linked to perceived restorativeness and is in turn a predictor of positive outcomes. In other words, the perception of the environment is associated with positive outcomes, and that outcomes are related to the effects of perceived restorativeness being experienced by subjects in green environments.

A central question nevertheless remains: what is the combined effect of PSD and perceived restorativeness on restoration experience? And more specifically, to what extent are mediating variable(s) of perceived restorativeness decisive in explaining how PSD provides restoration experience? Marselle et al. (18) suggests that the perception of green space qualities *per se* may not be a major factor in understanding how the green environment might affect outcomes. They have pointed out that “... one can look to theories of restorative environments which identify salutogenic outcomes from interaction with, and the qualities of, environments that facilitate well-being” (pp. 218). In fact, they have suggested that while perceived restorativeness may play a mediating role in the impact of perception of environmental qualities on emotional well-being, the mediation effects of PSD and restoration experience remain unexplored in the literature. In testing pathways linking green space to

health, the modeling approach introduce the methodology of multivariate relationships and sensitive analysis of indirect effects, which few studied followed that (1, 20, 35).

The aim of this study therefore is to systematically examine the supportive and restorative qualities of campus green space that promote mental health on the psychological restoration of a sample of university students. It considers the process of restoration experience through systematically examining the effects of PSD and perceived restorativeness. A partial least squares structural equation model (PLS-SEM) is employed to simultaneously examine the degree of associations between PSD, perceived restorativeness and restoration experience, and more particularly test whether perceived restorativeness can play a mediating role between PSD and restoration experience.

The remainder of the paper is organized as follows: the subsequent four sections conceptualize the various relationships between restoration experience, perceived restorativeness and PSD and potential mediation effect variables. The purpose is to inform development of a conceptual model which frames the hypotheses to be tested. Research methods are then described and statistical analysis and results are presented around three main axes: a measurement model, a structural model and mediation effects. Findings are discussed in relation to the hypotheses, existing literature and the implications for green space mental well-being and wider psycho-social interventions together with associated landscape design considerations.

## LITERATURE REVIEW

### Relationship Between PSD and Restoration Experience

Restoration experience has mostly been discussed with reference to two theories—Stress Restoration Theory (SRT) and ART (13). Based on SRT, restoration in contact with nature derives from stress recovery. It can be manifested through beneficial changes in emotional states and in activity of physiological dimensions of stress response such as blood pressure, heart rate and muscle tension. Based on ART, contact with a natural setting improves psychological resources e.g., capacity of direct attention, mental recovery and cognitive ability. Related studies have supported different aspects of restoration experience in contact with nature (13, 16, 17, 24). Based on these fundamental theories (15), restorative outcomes of natural environments have been operationalized into dimensions of “direct attention restoration,” “clearing random thoughts” and “relaxation and calmness”. Based on the literature, these outcomes provide the foundation for explaining an individuals’ perceived state of restoration in the green environment (15, 17, 36). In this paper, we address restoration experience (outcomes) in outdoor campus landscapes in terms of these three dimensions.

Specification of green spaces characteristics are the result of several attempts between the years 1985 to 2010 (27, 28). Based on Salutogenesis’ concept and Supportive Environment Theory (SET), three sets of characteristics have been suggested and PSD is the outcome of a third generation of these attempts (13). Grahn and Stigsdotter (28) generated PSD through a factor analysis of the preference ratings of 953 individuals (Swedish

population) from a long list of green space experiences. The aim was to identify preference for landscape characteristics that offer restoration from stress and thus improve mental health. The idea in development of PSD is based on Gibson's ecological approach to perception. Within this perspective, landscape perception is the consequence of a perception-action process involving movements of the entire body, stimulation and combination of all sensory systems (28). Landscape perception based on this approach facilitates detection of open space qualities for restoration experience and maintains mental health through collaboration of multiple senses (i.e., touch or tactile sensation, hearing, sight, and smell).

Many studies have recommended that PSD is a supportive requirement to reduce stress, achieve psychological restoration and maintain mental health strength (3, 29, 30, 37, 38). For instance, Memari et al. (13) showed that experience of PSD has created environments offering mental restoration through investigating four dimensions of stress recovery: emotion, physiology, cognition, and behavior and that support people mentally and physically in their everyday life. In the evaluation of mental health promotion of a forest designed environment (29) the presence of PSD components were shown to elicit more restorative responses by measuring psychological restorativeness in regard to providing stress relief. The study (28) also indicated the importance of PSD to public mental health with respect to restoring people from stress. With reference to a nature-based rehabilitation experience (31) showed that PSD is supportive for mental recovery of individuals with stress-related mental disorders. Similarly, Stoltz et al. (38) showed that PSD is a relevant factor with regard to stress reducing in planning of the restorative forest environments to improve human lives and health. Topics relating to mental health promotion of PSD lack research that addresses the importance of perceived sensory qualities of green spaces in relation to psychological restoration experience. When people are exposed to green environments with the presence of perceived characteristics of PSD, it may contribute to their psychological restoration in terms of dimensions, as operationalised by Korpela et al. (15). Thus, the following hypothesis is proposed:

Hypothesis 1: The association between PSD and experience of psychological restoration in green space—in terms of restorative outcomes of “direct attention,” “random thoughts” and “relaxation and calmness”—is positive.

## Relationship Between Perceived Restorativeness and Restoration Experience

The concept of perceived restorativeness is drawn from ART (39). It divides human attention into two parts as direct attention (voluntary form of attention) and indirect attention (involuntary attention). The direct attention is under intentional control, a finite resource and can easily be depleted with high usage (40). Sustained use of direct attention causes exhaustion and leads to Directed Attentional Fatigue (DAF) or so-called mental fatigue. DAF decreases effectiveness in functioning (e.g., less ability to work without error), causes a variety of

negative emotions (e.g., bad humor, irritability, impatience) and eventually leads to serious health related problems (40). In contrast to direct attention, which is susceptible to mental fatigue, indirect attention is resistant to fatigue. It is an effortless process with unlimited capacity. Based on ART, a physical environment with presence of restorative characteristics has the ability to recover mental fatigue or diminish psychological resources (41). In fact, the mechanistic effect of perceived restorativeness is the actual requirement in this process, which involves perception of “being away” (escape and novelty), “fascination,” “extent” and “compatibility” that can lead to psychological and cognitive restoration experience (42, 43). Studies have consistently supported the positive relationship between these restorativeness characteristics and measures of restoration experience. Along with an increase in perceived restorativeness they can lead to an increase in sustained direct attention, stress relief and recovery of mental fatigue (16, 24). For instance, in examining mental health promotion of physical environments, Martínez-Soto et al. (1) showed the recovery of cognitive and affective resources when people are exposed to environments with perceived restorativeness characteristics. In short, perception of restorativeness characteristics enhance the potential of a natural setting for building psychological resilience and promoting better mental health state (6).

There are two approaches to the usage of perceived restorativeness evident in the literature. Some use it as an instrument to measure psychological restoration experience (44, 45), while others use it to measure the capacity of restorativeness of a green environment (16, 46). Although the characteristics involved in perceived restorativeness and restoration experience emphasize the recovering aspects of green environments (47), they are not the same and measure different types of effects (48). Perceived restorativeness is a subject's perception of the restorative capacity of a green environment and restoration experience is the degree to which a subject realizes beneficial changes in contact with a green environment (47, 48). The observed difference that exists between the two measures leads us to examine this relationship further and develop the following hypothesis:

Hypothesis 2: The association between perceived restorativeness and experience of psychological restoration in green space is positive.

## Relationship Between PSD and Perceived Restorativeness

A number of researchers have shown that there is association between perception of green environments and perceived restorativeness (1, 10, 49). From a mental health perspective, the measure of perceived restorativeness takes into account perception of green space qualities that may have substantial restorative value in capturing psychological benefits. For instance, Lai et al. (41) showed that pleasantness and aesthetic quality are significant predictors of perceived restorativeness. Several other perceived qualities have been investigated in this association such as comfort, safety, attractiveness and maintenance (14). However, Grahn and Stigsdotter (28) suggest



that perceptions of green space in relation to restoration experience and the improvement of mental health also involves other substantial multi-sensory qualities, otherwise known as PSD. It has been claimed that PSD can be useful for the evaluation of perceived restorativeness of green spaces and to help develop tools for practitioners in the planning and design of restorative settings to improve mental health (27, 30). To the best of our knowledge, the study by Peschardt and Stigsdotter (27) is the only one to show an association between PSD and self-perceived restorativeness in public urban green spaces. The authors evidence this relationship through examining seven out of eight PSDs and undertaking an expert assessment of PSDs. While the expert assessment is useful (50), there are some conditions that require the users' perspective (51), particularly when determining the results of direct interaction with environment on their health and well-being (28).

The user's experience and active perception of green environment qualities is an important aspect in the development of PSD (28). The expert objective measure of PSD does not take into account all the experiences that determine a user's perception of the green environment (51). Human perceptions and experiences are more likely to be influenced by individuals' characteristics and health status (50) and provide different outcomes, even comparable environments with similar characteristics (45). Thus, the present study seeks to test this relationship according to a green spaces' user's perspective. This is particularly important for determining the ability of a green space to affect a human's being state. Therefore, the following hypothesis is proposed:

Hypothesis 3: The association between PSD and perceived restorativeness from a user's perspective is positive.

## Drivers of Mediation Effects

A mediator variable theoretically links a predictor variable to a criterion variable to provide more information about the relationship (52). Several studies have shown the significant mediating effect of behavioral variables such as physical activity, social cohesion, loneliness (53) and social contacts (54) in the relationship between a green environment and human health. In addition to mental health *per se* this highlights the significance of green spaces for a range of psycho-social outcomes (55, 56) associated with the wider social value of such environments. It also highlights the importance of mediator variables and associated modeling approaches for understanding, evaluating and predicting the experience of psycho-social outcomes as a result of spending time in green environments. Some studies have reported a weak mediating effect, i.e., spending time in nature in the relationship between the level of residential greenness and residents' mental health (57). However, in the literature, there is a general agreement that the perceived restorativeness is a psychological mechanism that underlies the relationship between natural environments and perceived positive health related outcomes such as likelihood of restoration (24), quality of life (32), emotional well-being (18, 46) and a reduction in anxiety and depression as important components of better mental health (6).

Although, the mediating factors increasingly reveal possible reasons how nature affects human health, little research has been conducted on the mediating effect of perceived restorativeness in the relationship between PSD and restoration experience. Most PSD studies have indicated which perceived dimensions of PSD are more optimal for restoration from stress (3, 13) or restorativeness experience (27). However, very few aim to understand whether perceived restorativeness plays a mediating role in the relationship between PSD and restorative outcomes. In addition, whether perceived restorativeness is the only underlying mechanism in this relationship is considerably less clear. Operating mechanism/s help to indicate how effective PSD is for the generation of restoration experience in green spaces. Therefore, the following hypothesis is proposed:

Hypothesis 4: The relationship between PSD and restoration experience is positively mediated by perceived restorativeness.

## Hypothesized Model

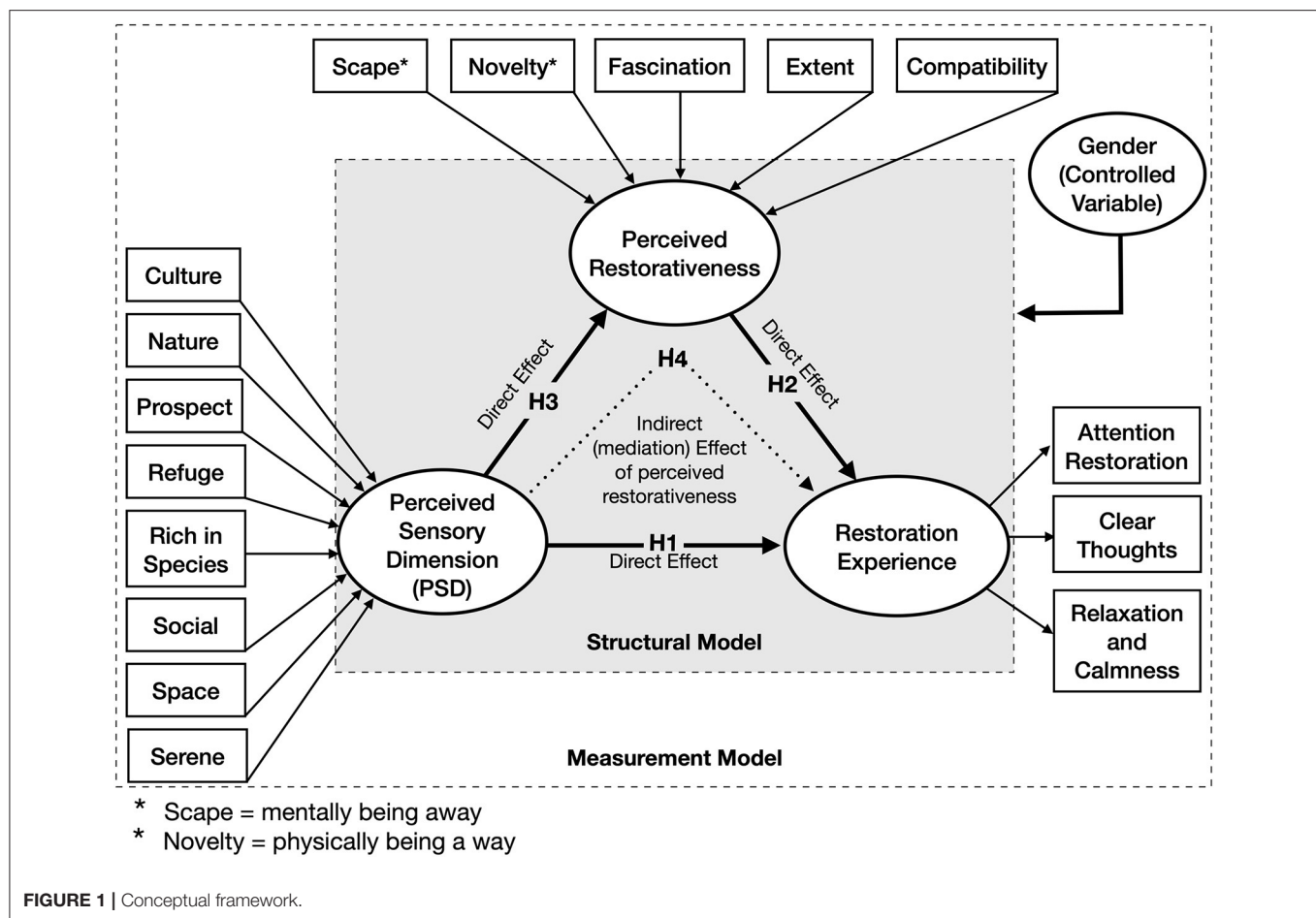
We undertake examination of all four research hypotheses using PLS-SEM as the statistical modeling technique. PLS-SEM is a prediction-oriented method with an exploratory approach and estimates multiple variables, at the same time. It is especially applicable when circular relationships or loops are not allowed in the model and provides a statistical statement about the relationships between a set of theoretically established variables, which are measured in a quantitative fashion (58).

The conceptual framework outlined in **Figure 1** is based on the proposed hypotheses. The path model involves two main elements—a structural model and a measurement model. The structural model contains the hypothesized relationship between constructs that have been developed from the underlying theories and concepts. And as its name depicts, the measurement model contains measurement variables or indicators. As the framework indicates, the study focuses on the relationship between PSD and restoration experience (H1), the relationship between perceived restorativeness and restoration experience (H2) and the relationship between PSD and perceived restorativeness (H3). In addition, it tests the mediation effect of perceived restorativeness on the relationship between PSD and restoration experience (H4). In the PLS-SEM path model, restoration experience is a reflective variable while PSD and perceived restorativeness are formative variables. In the reflective model, “the measures are all caused by a single underlying construct,” and in the formative model “the measures all have an impact on (or cause) a single construct” (59). Therefore, in the reflective model, the direction of the arrows is from restoration experience through to its measurement indicators and in the formative models, the arrows are from the measurement indicators through to their constructs (PSD and perceived restorativeness). In this model, we used gender as a control variable to test its effect on the model evaluation.

## RESEARCH METHODS

### Sampling and Sample Size

This study, involving a sample of university students in Malaysia, tested a theoretically derived model of restoration experience



through the impact of PSD and perceived restorativeness. Students from the Universiti Kebangsaan Malaysia (UKM), University Malaya (UM), Universiti Putra Malaysia (UPM), Universiti Sains Malaysia (USM) and Universiti Teknologi Malaysia (UTM) were taken as the study population. Data were collected through self-completion surveys administered in lecture rooms in each university, in the middle of 2014–2015/2 academic session. This time was selected to ensure that the majority of the students had ample opportunities to use green campus outdoor spaces for recreation. As respondents were required to assess perceived outdoor green space qualities as well as after-visit restorative outcomes, only students who had frequently engaged in use of outdoor campus green space recreation (within 2 months) were requested to answer the survey. This criteria was informed by a previous study of the perceptions of campus green space for students' restoration experience (32) and recalled restorative outcomes of the most recent visits to green environments (17). Through this criterion, we excluded those students that just passed the campus green spaces on their way to other locations. Because, for example, when students passed campus green spaces by bus or car, they were unlikely to be able to transfer the information that is required for assessment of sensory dimension of green qualities and attribution of qualities to outcomes. The green outdoor space

in these universities include landscapes around the academic buildings and the overall campus (see **Figure 2**).

A total of 550 students participated in the study. In a data screening procedure, those with missing data, suspicious response patterns and outliers were excluded ( $n = 106$ ) yielding 444 usable responses for the analysis. The response rate was 81%, with the sample consisting of 300 female and 144 male students. The majority of them were single (93.24%), undergraduate (79.73%), native (92.12%), studying full-time (94.59%), living on a campus setting (77.70%) and ranging in age from 19 to 30 years. The over-representation of females in the sample compared to the wider population was due to their willingness to participate in answering the survey. However, no significant differences were found between the responses of male and female subjects.

## Measurement of Variables

The Restorative Outcome Scale (ROS-6 items) was used in the measurement of restoration experience, as applied in previous studies on the perceived restorative outcomes in a visit to green environments (15, 17, 36). This scale subjectively measures restorative outcomes of the visit to a green environment in terms of recovery in the "direct attention restoration" (1 item), "clearing random thoughts" (2 items) and "relaxation and calmness" (3 items). This scale was measured on a 7-point scale from "not at



**FIGURE 2 |** Some images of University outdoor green spaces.

all” through to “completely.” The mean value of the items was used to indicate the variable value. Although three dimensions of “direct attention restoration,” “clearing random thoughts” and “relaxation and calmness” have been proposed, the factor analysis showed only one factor loading (15). Because of this reason, the three variables of “direct attention restoration,” “clearing random thoughts” and “relaxation and calmness” have been presented as reflective indicators of the construct of restoration experience. The reported Cronbach’s alpha was 0.92 in previous studies (15).

The Restorative Components Scale (RCS-22 items) was adopted to measure perceived restorativeness (42). We measured “novelty” with three items, “escape” with four items, “fascination” with six items, “extent” with four items and “compatibility” with five items. As Laumann et al. (42) explains, in the development of this scale, two concepts emerged from the original term of “being-away.” Novelty—which is a physically being-away, and Escape—which is mentally being away in a green environment. In ART, both physically and mentally being-away aspects of the natural environment are essential conditions for perceived restorativeness (60). The item development in this scale did not emphasize the aspects that make their usage specific for

a population group or a particular environment (42). Again, question responses in this section were measured on a 7-point scale from “not at all” through to “completely.” The psychometric properties of this scale have been previously reported by Laumann et al. (42) and Cronbach’s alpha for the subscales ranges from 0.76 to 0.86. Mean responses for each variable of perceived restorativeness were used.

Measures of PSD were adopted from items used in the study by Grahn and Stigsdotter (28). Prior to final data collection, we carried out an item verification step (with a group of university students and staffs) to rate the most relevant items—from the list of 65 items identified in Grahn and Stigsdotter (28)—to the context of campus green space (from 1 “not relevant” to 4 “highly relevant”). For each of the eight perceived dimensions of PSD, we considered the most three commonly rated items. This yielded a total number of 24 items for use in the final survey, again all on a 7-point scale from “totally disagree” through to “totally agree.” We used mean responses for each dimension of PSD, which has previously been applied in the measurement of green space characteristics across different cultural backgrounds and contexts, such as forest environments, urban parks and care settings (13, 29). Previous studies provided support for the reliability and validity of using PSD in the measurement of green space characteristics (28, 29, 51). Indeed, it has been shown by Memari et al. (13) that all the variables of PSD (except Refuge) had acceptable or good Cronbach alpha values (0.7). The variable Refuge, although showing lower Cronbach alpha in the present study, was considered as acceptable and was duly used. The PSD measurement in this research was based on using four items for each dimension.

In addition, following Hair et al. (58), we included two single-item questions for convergent validity of PSD and perceived restorativeness in the PLS- SEM formative measurement model. These questions asked students to rate their overall perception of restorativeness in the visited site and the sensation of being in a green space with greenery characteristics (from 1 = “not at all” through to 7 = “completely”).

## RESULTS

SmartPLS version 3.0 was used to analyse the data (61). We followed suggested evaluation steps for the PLS-SEM analysis by Hair et al. (58). These steps comprise first, an assessment of the measurement model (formative and reflective), followed by the structural model and finally the meditational model. Results from these analyses are described and presented in the following sections.

### Reflective Measurement Model: Restoration Experience

The reliability and validity tests of the reflective measurement model, were conducted by internal consistency reliability, indicator reliability, convergent validity and discriminant validity (Table 1). The Cronbach’s alpha exceeded the threshold value ( $= 0.861 > 0.7$ ) and the composite reliability value is 0.915, which is within the required range ( $>0.7$  and  $<0.95$ ). The outer



**TABLE 1** | Evaluation of validity and reliability of restoration experience in reflective measurement model.

Indicators and constructs	Discriminant validity						Indicator reliability	Internal consistency reliability		Convergent validity
	Cross loadings			Fornell-larcker criterion				Cronbach's alpha	Composite reliability	
	PR	PSD	RE	PR	PSD	RE				
Attention restoration	0.557	0.451	0.892	-	-	-	0.892	0.861	0.915	0.781
Clearing thoughts	0.583	0.474	0.883	-	-	-	0.833	-	-	-
Relaxation and calmness	0.661	0.553	0.877	-	-	-	0.877	-	-	-
PR	-	-	-	-	-	-	-	-	-	-
PSD	-	-	-	0.655	-	-	-	-	-	-
RE	-	-	-	0.562	0.684	0.884	-	-	-	-

Summary statistic restoration experience = Attention restoration ("Min, 1," "Max 7," "Mean 5.65," "STD 1.17"), Clearing Thoughts ("Min, 3," "Max 7," "Mean 5.57," "STD 1.02") and Relaxation and Calmness ("Min, 3," "Max 7," "Mean 5.35," "STD 1.04").

PR, Perceived Restorativeness; PSD, Perceived Sensory Dimension; RE, Restoration Experience.

**TABLE 2** | Summary statistic and Cronbach's alpha of all variables (PSD, Perceived Restorativeness and Restoration Experience).

Indicators	Min	Max	Mean	STD	Cronbach's alpha	Inter-item correlations
Culture	2.33	7	4.88	0.98	0.554	0.294
Nature	2	7	5.17	1.04	0.674	0.408
Prospect	2	7	5.15	0.99	0.646	0.378
Refuge	2.67	7	5.06	0.91	0.468	0.227
Rich in species	1	7	4.5	1.3	0.855	0.664
Social	2.67	7	5.41	0.84	0.528	0.278
Space	1.67	7	5.22	0.89	0.517	0.265
Serene	2	7	5.32	1.09	0.540	0.322
Escape	2.50	7	5.00	0.99	0.743	0.421
Novelty	2.33	7	4.97	0.99	0.550	0.389
Fascination	2.6	7	5.02	0.90	0.828	0.446
Extent	3	7	5.07	0.86	0.752	0.432
Compatibility	2.4	7	5.05	0.88	0.808	0.460

loadings of measurement indicators are well-above the required minimum level of 0.708. Acceptable values in measures of the inter correlations of measurement indicators and outer loadings of indicators demonstrate a high level of internal consistency and indicator reliability for construct of restoration experience in reflective measurement model in PLS-SEM. The summary statistics for this variable is presented in **Table 1**.

The result of AVE is 0.781, which established that the indicators explain almost 80% of the variation in restoration experience. The discriminant validity shows how much a variable is unique and captures concepts that are not presented by other variables in the model. In a cross-loading assessment, the outer loading of each measurement indicator of restoration experience is higher than all of its cross loadings on the perceived restorativeness and PSD. In the Fornell-Larcker criterion, the square root of AVE of restoration experience should be greater than its highest correlation with perceived restorativeness and PSD. The square root of the VAF value for restoration experience is 0.884, which is higher compared with its correlation

with PSD and perceived restorativeness, implying satisfactory discriminant validity.

## Formative Model: PSD and Perceived Restorativeness

The summary statistics and reliability of the scales for each variable in PSD and perceived restorativeness are presented in **Table 2**. As shown, for some of the variables the Cronbach Alpha is less than the proposed 0.7 (62) using the mean inter-item correlation when the number of items are low in the reliability assessment. For all variables where the value of Cronbach's Alpha are <0.7, the mean inter-item correlation should be between 0.2 and 0.4 as directed by Briggs and Cheek (63). The internal consistency of most of the PSD and perceived restorativeness characteristics are thus within the required range.

The formative measurement model was evaluated through convergent validity, the presence of collinearity among indicators and the significance and relevance of indicators. To examine convergent validity of PSD and perceived restorativeness a simple model connecting the correlation of indicators of each formative variable to its single-item global reflective measure of that variable was specified. The path coefficient in PSD is 0.836 and  $R^2$  value is 0.699. For perceived restorativeness, the path coefficient is 0.839 and  $R^2$  value is 0.704. These results show that the reflective measure of PSD and perceived restorativeness are highly and positively correlated with their formative measurement indicators, which indicate validity of the formative measurement model (higher than 0.7 and  $R^2 > 0.5$ ).

The Variance Inflation Factor (VIF) in **Table 3** shows that there is no high inner correlation between a measurement indicator and the remaining indicators that are associated with PSD and perceived restorativeness. The value below 0.5 shows the indicators to be highly correlated with their variables, thus there is no collinearity issue in the formative measurement model. Bootstrapping (10,000 sub-samples) is used to establish significant outer weights to estimate the absolute importance of each formative indicator in the measurement of its variable without considering any other indicators. The non-significant indicators should be removed from the model when the



**TABLE 3 |** Evaluation of validity and reliability of PSD and perceived restorativeness in formative measurement model.

Indicators	VIF	Std. Dev.	t-test	p-value	Outer weights	STD	t-test	p-value	Outer loadings
Culture	1.558	0.070	1.064	0.287	-0.071	0.071	1.045	0.296	0.507
Nature	1.908	0.072	2.821	0.005	0.196**	0.072	2.829	0.005	0.729**
Prospect	1.554	0.074	3.347	0.001	0.249**	0.074	3.324	0.001	0.709**
Refuge	1.852	0.073	1.551	0.121	0.121	0.072	1.567	0.117	0.716
Rich in Species	1.896	0.074	3.057	0.002	0.234**	0.073	3.095	0.002	0.659**
Social	1.164	0.056	2.833	0.005	0.156**	0.057	2.784	0.005	0.342**
Space	1.378	0.070	3.739	0.000	0.255***	0.07	3.74	0.000	0.667***
Serene	1.368	0.065	5.687	0.000	0.367***	0.065	5.762	0.000	0.686***
Escape	1.635	0.052	5.076	0.000	0.185***	0.052	3.552	0.000	0.579***
Novelty	1.286	0.043	3.534	0.002	0.134**	0.043	3.182	0.001	0.485**
Fascination	1.589	0.059	4.131	0.000	0.458***	0.059	7.803	0.000	0.869***
Extent	1.699	0.055	7.818	0.000	0.226***	0.055	4.171	0.000	0.738***
Compatibility	1.195	0.065	3.146	0.000	0.332***	0.065	5.085	0.000	0.791***

Significance levels: \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

**TABLE 4 |** Structural model evaluation-significance and predictive abilities of constructs relationships.

Constructs	VIF	t-values	p-value	Path coefficients	R <sup>2</sup> value	F <sup>2</sup> value	Q <sup>2</sup> value	Hypotheses
PSD to RE	1.751	4.310	0.000	0.197***	-	0.043	-	Supported
PSD to PR	1.000	25.276	0.000	0.656***	-	0.753	-	Supported
PR to PSD	1.751	13.423	0.000	0.555***	-	0.344	-	Supported
PR	-	0.034	0.000	-	0.430***	-	-	-
RE	-	0.034	0.000	-	0.485***	-	0.356	-

Significance levels: \*\*\* $p < 0.001$ .

PR, Perceived Restorativeness; PSD, perceived Sensory Dimension; RE, Restoration Experience.

theoretical background supports this decision. Alternatively, the outer loadings must be above 0.50. As demonstrated, all indicators of the perceived restorativeness construct are shown to be significant ( $t$ -value  $> 1.96$ ). In PSD, the “culture” and “refuge” are insignificant. When checking the outer loadings, we find these indicators to be of relative importance for the explanation of PSD in the model, given by the satisfactory outer loadings for “culture” 0.507 and for “refuge” 0.716. Overall, the combination of desirable values provides significant evidence for the formative measurement model validity. These results show the model to contain the entire domain of theoretically derived variables for hypotheses testing, making the case for assessment of the structural model.

## Structural Model: Significance of Relationships and Model Predictive Abilities

This step was performed by assessing the structural model for collinearity issues, assessing the significance of structural model relationships, and assessing the predictive abilities of the model according to the Coefficient of Determination ( $R^2$  value), effect size  $f^2$  and  $Q^2$  and blindfolding. First, we assessed if collinearity among predictive variables was an issue in the structural model. The PSD is shown to be a predictor of restoration experience and perceived restorativeness;

and perceived restorativeness to be a predictor of restoration experience. **Table 4** shows the VIF values are higher than 0.20 and lower than 5.00, indicating significant levels of collinearity in the structural model.

We then assessed the significance of relationships among the variables, using the PLS algorithm and Bootstrapping. The three paths are significant with  $t$ -values greater than the threshold value of 1.96 (0.197\*\*\*, 0.656\*\*\*, and 0.555\*\*\*). With respect to the models' predictive ability, the Coefficient of Determination ( $R^2$  value) of 0.430 and 0.489 can be considered a moderate level of predictive accuracy (58). The effect size of  $f^2$  shows that a large effect of PSD on perceived restorativeness (0.753) is evident, together with a medium effect of perceived restorativeness on restoration experience (0.344) and a relatively small effect of PSD on restoration experience (0.043). The value of  $Q^2$  is considerably greater than the threshold limit ( $0.356 > 0$ ), which implies the predictive relevance of restoration experience in the model. None of the constructs are found to have a very small predictive power. In the structural model evaluation, the results show the significance and predictive relevance of relationships, and so support the three research Hypotheses; H1, H2, and H3. With the significance of relationships between variables in the structural model established, the suggested mediator variable on the relationship between PSD and restoration experience was then tested.

**TABLE 5 |** Mediation effect of perceived restorativeness.

Constructs	Direct effect	t-value	p-value	Indirect effect	Total effect	VAF
PSD to RE (without mediation)	0.569***	17.628	0.000	-	-	-
PSD to RE (with mediation)	0.197***	4.310	0.000	0.362	0.562***	64.9%
PR to RE	0.555***	13.423	0.000	-	-	-
PSD to PR	0.656***	25.276	0.000	-	-	-

Significance levels: \*\*\* $p < 0.001$ .

PR, Perceived Restorativeness; PSD, perceived Sensory Dimension; RE, Restoration Experience.

We used gender as the control variable for this study. The result showed that the difference in effect of PSD on restoration experience between male and female was 0.065 ( $p$ -value = 0.721), PSD on perceived restorativeness was 0.004 ( $p$ -value = 0.461) and restoration experience to perceived restorativeness 0.028 ( $p$ -value = 0.380). Since there were no significant differences between the two groups of male and female in the model evaluation, we can say with some confidence that the control variable gender does not affecting relationships between PSD perceived restorativeness and restoration experience.

### Meditational Model Evaluation

In the mediator model, we examined if the (theoretically established) direct relationship between PSD and restoration experience is mediated by the indirect effect of perceived restorativeness. There are several steps in conducting the mediator effect analysis in PLS-SEM (58). In the first phase, it assessed the direct effect, which is the impact of PSD on restoration experience directly without including the mediator effect of perceived restorativeness in between. If the path coefficient of this relationship is significant ( $p$ -value < 0.05 and T Statistic > 1.96), then the second step will take place, otherwise there is no mediation effect when the original cause and effect relation is insignificant. As shown by the data in **Table 5**, the path coefficient is significant (0.569\*\*\* with a  $t$ -value of 17.628).

The next step is to examine the indirect and total effect. The indirect effect is the impact of one construct (PSD) on another one (restoration experience) through examining the effect of an intermediate construct (perceived restorativeness). Combining the direct and indirect effects creates the total effect, which shows the overall impact of one construct on a dependent construct. The effect should be significant and the mediator absorb some of the direct effect to demonstrate mediation in the model. Both paths from PSD to perceived restorativeness and from perceived restorativeness to restoration experience have a significant value. The path coefficient for indirect effect of PSD on restoration experience is 0.362 and the total effect value is as high as 0.562. With inclusion of the indirect effect of perceived restorativeness, the indirect effect is absorbed the PSD's effect on restoration experience. The direct effect becomes smaller (0.569\*\*\* to 0.197\*\*\*) when the effect of perceived restorativeness is included, confirming the presence of a mediator effect in the model, and supporting Hypothesis 4.

Finally, the variance accounted for (VAF) was calculated to determine how much the mediator variable absorbs the direct relationship. It determines the extent to which the variance of restoration experience is directly explained by PSD and how much the target's construct variance is explained by the indirect effect of perceived restorativeness. There is no mediation when the VAF is <20%, "partial mediation" when the VAF is larger than 20% and <80% and a "full mediation" effect occurs when VAF is above 80%. In this case, the value of VAF confirms that 64.9% of PSD's effect on restoration experience is explained via the perceived restorativeness mediator.

## DISCUSSION

The influence of green space on restoration experience and mental health is a longstanding research topic. In this respect, there is a growing interest on the important role of perceived qualities that can be linked to restoration of capacities and enhance of mental health benefits. Studies have shown that in green environments there are characteristics that support people mentally in their everyday life. Outdoor campus green space is such an environment that include landscapes with greenery qualities with the potential to provide a variety of positive outcomes in support of the university students' mental health. However, relatively little attention has been paid to examining relationships between perceived green space characteristics and restoration experience, or to investigating the mediation effect variables that explain how a green space affects beneficial outcomes.

The aim of this study was to test a theoretically developed model of restoration experience through the effects of PSD and perceived restorativeness. Moreover, we hypothesized that the relationship between PSD and restoration experience is positively mediated by perceived restorativeness. Through employment of a PLS-SEM modeling technique, we have tested the direct and indirect relationships and demonstrated a significant association between PSD and perceived restorativeness with restoration experience. With this model, we have been able to describe almost 50% of the variance in restoration experience and demonstrate that PSD is capable of offering a psychological restorativeness experience, which is an essential step for better explanation of restoration experience. Examination of perceived restorativeness and PSD and psychological restoration provide evidence-based design recommendations for university campus settings in students' mental health promotion. Related observations, including the contribution to existing evidence and suggestions for future research, are discussed in the following sections.

### Relationship Between PSD and Restoration Experience

Previous studies have discussed the restorative value of characteristics of PSD for stress-related mental disorders (3, 31) and support of mental health (13, 30). To our knowledge, no studies have yet examined the direct relationship between PSD and restoration experience. The current study addresses this gap and demonstrates this relationship in terms of the restorative

outcomes of direct attention, clearing random thoughts and relaxation and calmness. Consistent with the findings of Grahn and Stigsdotter (28), this result indicates that experiences of PSD provide possibilities for restoring people's health, well-being and staying mentally healthy. With regard to restoration from stress, PSD is a key element in the design and implications of health-promoting environments (13, 28, 29) and an important therapeutic factor in nature-based rehabilitation programmes (31). Perception of outdoor campus landscapes plays an important role in the university students' quality of life (32), attention restoration (23) and in meeting of their health needs (10, 19, 20). Identifying environmental characteristics of outdoor campus green spaces by determining multi-sensory experiences of PSD with restorative potential provide recommendations for students' mental health in the context of a university campus. Together with the mediation effects discussed below, PSD has associated relevance to the capture and measurement of psychosocial outcomes as the wider social value of such environments is increasingly recognized.

### Relationship Between Perceived Restorativeness and Restoration Experience

It is also important to evaluate the restorative quality of an environment in order to discuss psychological restorative benefits. In the current study, we hypothesized that perceived restorativeness is directly related to perceived restorative outcomes, as previously examined by Korpela et al. (15). Our data supports this hypothesis. Indeed, a majority of other studies also support it, particularly when demonstrating the role of perceived restorativeness in reducing stress disorders or mental fatigue (16, 24). Based on ART, in a restorative setting, there exist positive features that attract people, hold their attention, draw their thoughts away from external demands or afford them intended activities. These restorative properties are environmental conditions that induce a positive state in an individual's psychological system (60). The restoration experience happens through spending sufficient time in a green environment combined with an experience of its restorativeness qualities (39, 43). Four progressive levels of restoration experience in the green environment are "cleaning the head," "recharging directed attention capacity," "enhanced cognitive functioning" and "reflections on one's life." The final level is the deepest and can be experienced through an increase in subjective vitality and self-confidence. This level requires repeated experiences of restorativeness in green environments (43). The existing research within the health-promoting effect of outdoor campus green spaces suggest that the campus restorativeness has potential (19, 20). Enhancing students' perceived restorativeness by restorative resources on campus can balance multidimensional stress and facilitate psychological restoration from prolonged mental efforts (19). The present findings within the area of university students' mental health development indicate that restoration experience in outdoor campus green space can be enhanced by perceived restorativeness characteristics.

### Relationship Between PSD and Perceived Restorativeness

This study has established a significant relationship between PSD and perceived restorativeness, with PSD including values associated with how people experience and perceive landscape characteristics in green spaces such as calmness and observing several animal and bird species (28). Indeed, according to Grahn and Stigsdotter (28), the experience of green space, especially in relation with mental health support involves perceived sensory systems, for example how users of green spaces enjoy the views, sounds and smells of these environments. Our findings reinforce these observations. In landscape assessments, it is thus important to consider the qualities that people prefer over others when actively seeking a restorative environment (28).

Previously, Peschardt and Stigsdotter (27) used an expert on-site approach to assess park characteristics, in terms of representation of PSD qualities, and found its significant association with the park user's perceived restorativeness. However, Qiu and Nielsen (51) have questioned such approaches as they do not involve users' experience, ideas and feelings. In this paper we therefore tested- and confirmed- this relationship through subjective assessments of PSD. Consistent with previous studies (28, 51), the representation of PSD in green spaces should include people's experiences and sensory perceptions of landscape characteristics. The expert judgements are suitable, particularly for readily monitored attributes such as size, distance and habitat types (51). The self-assessment of PSD enables identification of such qualities that are popular and important in relation to recovery of stress and the support of mental health. Understanding how people actually experience and perceive the qualities of green spaces helps to improve knowledge on exactly which qualities satisfy restorativeness experiences (28, 29). In design and planning for mental health promotion within the area of campus settings, perception of outdoor campus landscapes are found to be crucial factors that contribute to the perception of campus restorativeness. These findings provide new insights into the perception of campus qualities for restoration and support the results of previous research regarding perceived qualities and campus restorativeness (23, 32).

### Mediation Effect of Perceived Restorativeness

In Marselle et al. (18) and Hipp et al. (32)'s meditational models, the perception of environmental qualities was presumed to cause perceived restorativeness. Conversely, perceived restorativeness was deemed to result in improved emotional well-being and quality of life. In this paper we have built on these studies, and established the same positive conclusion that perceived restorativeness provides restorative outcomes, and plays a mediation role in the relationship between PSD and restoration experience. While significant, perceived restorativeness was found only to be a partial mediator of the effect of PSD on restoration experience. This finding is similar to previous findings (32) that have found perceived restorativeness to partially mediate the relationship between perceived campus greenness and students' quality of life.

Campus restorativeness supports students' psychological restoration and is related to their health measures on campus, concurring with findings of previous studies (19, 20, 32). The present findings indicate perceived restorativeness to be a mechanism that enables students to feel an inner balance, which in turn leads to a positive psychological restoration experience and provides an avenue for positive health measures through multi-sensory perception of campus landscapes qualities.

## CONCLUSIONS, LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

In this paper we determined university students' psychological restoration in outdoor campus green space by identifying the importance of environmental characteristics of PSD and perceived restorativeness. Implementing health promoting and environmental restorative design strategies could provide the potential to improve the mental health of university students and lead to improvements in their quality of life, general health and learning outcomes. We have shown restoration experience to be clearly related to the PSD and perceived restorativeness. However, PSD itself does not appear to have a large impact on restoration experience. The results further illustrate the relevance of perceived restorativeness in relation to restoration experience; more specifically we have shown that restoration experience is enhanced through the impact of PSD on perceived restorativeness—in other words greater effects on restoration experience come through perceived restorativeness that is affected by PSD. While previous studies have suggested PSD to be a potential resource for restorativeness experience and restoration experience, we have demonstrated that although perceived restorativeness is indeed a mechanism to explain this relationship, PSD itself is capable of promoting favorable experiences of restorativeness in a green space and facilitating psychological restorative outcomes.

Our study is the first to measure restoration experience, and its association with PSD and perceived restorativeness in a sample of university students who are facing stress related mental disorders and in real need for frequent restoration experience. It highlights the impact of perceptions of campus green space qualities for students' mental health support in their everyday context. Although we examined restoration experience and its association with PSD and perceived restorativeness both directly and indirectly, we have not examined precisely which perceived dimensions of PSD or perceived restorativeness influence restoration experience in integration with each other. Building on previous studies which have provided limited awareness around the potential of perceived dimensions of PSD and restorativeness characteristics in green spaces for psychological health and well-being, further research could usefully focus on addressing precisely which dimensions of PSD support perceived restorativeness and restoration experience more than others. In this study we have only assessed these relationships at the construct level. Also, this study provided satisfactory levels of internal consistency of perceived dimensions

of PSD. Continued research is needed to examine psychometric properties of the scale.

In addition, some of the plausible explanations as to why PSD can generate perceived restorativeness and in turn provide restoration experience, are not yet fully accounted for by this model. The behavioral mechanisms (i.e., spending time) may affect these relationships and provide more insights about why some effects are stronger or weaker than others. Such an approach may also be useful in considering other aspects of human health and well-being.

Nevertheless, the paper makes a significant contribution to the restoration experience literature by establishing a significant mediation effect of perceived restorativeness in the relationship between PSD and restoration experience. The findings also suggest that other mediating factors could be influential in this relationship, which is important in two main respects. First, we suggest the relevance of a mechanistic effect of emotional regulation, as proposed by Johnsen (36), whereby people spend time in a particular setting because it makes them happy or reduces negative emotions. This has obvious ramifications for the role of green spaces in maintaining good mental health, as well as their evident role in the move away from medical and public health models which focus on treatment to a situation that promotes independence and well-being through preventative approaches—and contexts—to health care.

Second, the mediation effects of perceived restorativeness examined here point to the relevance of green spaces in providing psycho-social outcomes such as social cohesion and reduced isolation, which to date have not been systematically captured, or statistically validated. The work described here paves the way for further studies that examine the wider psycho-social value of green spaces through the application of mediation effects and personal sensory dimensions.

## DATA AVAILABILITY STATEMENT

The raw data cannot be made available at this time as it forms part of an on-going study. Following completion of this study the raw data supporting the conclusions of the article can be made available. Any requests should be made to the first author.

## ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## AUTHOR CONTRIBUTIONS

The original research was undertaken by FM as part of her Ph.D. Dissertation, which was supervised by HL. Subsequently PC contributed to the conceptualization, design, presentation and intellectual contribution of the research to current public health debates. MV contributed through provision of detailed presentational comments on the operational and analytical



framework, together with expert advice on the statistical analysis presented in the article. All authors contributed to the article and approved the submitted version.

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# Care Deficiencies and Super-Organization of American Nursing Homes in Hospital Referral Region

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Super-organization has been associated with worse care quality in nursing homes. Previous research on the chain ownership of American nursing homes excluded government facilities in public-private partnerships, and focused on corporate entities. This longitudinal study proposes a novel method of demarcating the latent ownership networks of for-profit, government and non-profit nursing homes in the United States through use of open data and social network analysis. Facility characteristics and care quality measures were analyzed from an ecological cohort of 9,001 American nursing homes that had a registered organization for owner, and were reimbursed through Medicare or Medicaid. Information was obtained from the Nursing Home Compare open datasets at five semi-annual processing dates from March 2016 to March 2018. Ownership networks of American nursing homes were constructed using the exact legal name of registered organizations. As hospital discharge is a routine admission source of nursing home residents, hospital referral region was actualized to demarcate focal area. Utilizing Bayesian hierarchical models, the association between nursing home super-organization in hospital referral region (inferred by degree-based centrality and Herfindahl-Hirschman Index) to scope of cited care deficiencies (denoted by Total Weighted Health Survey Score) was explored. The percentage of nursing homes having super-organization increased from 56.8 to 56.9% over the 2-year period. During this interval, the mean size of nursing home ownership group in hospital referral region increased from 3.11 to 3.23 facilities. Overall, super-organization in hospital referral region was not associated with care deficiencies in American nursing homes. However, being part of an ownership group with more facilities was beneficial for care quality among nursing homes with super-organization.

**Keywords:** social network analysis, degree-based centrality, ownership group, total weighted health survey score, registered organization

## INTRODUCTION

Chain affiliation of nursing homes in the United States and the care quality of these facilities has been of concern for the past three decades (1, 2), as well as their super-organization (2). Increased competition among nursing homes for resident admission has been shown to be inversely associated with scope of care deficiency citations (3). However, scholarly work on

super-organization has suffered from caveats, such as excluding government nursing homes with shared owners of for-profit nursing homes in public-private partnerships. The traditional method of assessing competition among nursing homes for resident admission makes use of the Herfindahl-Hirschman Index. Use of this metric is common in health sciences literature to denote market competition (4), and is defined as the sum of the squares of the market share ratio by the number of beds for each nursing home in a given locality (2). To account for the chain affiliation of nursing homes in focal areas, a newer derivation of this metric has been proposed that measures the proportion of market concentration due to super-organization, known as the delta Herfindahl-Hirschman Index (4). Prior research has examined the association between nursing home super-organization and care quality in county (2), and American state (5). As hospital discharge is an admission source of nursing home residents (6), hospital referral region (HRR) can be considered as an ecological basis for the focal area.

With the advent of social network analysis, a novel approach is available to determine the super-organization of nursing homes through shared ownership. The current study uncovers the latent ownership networks of nursing homes, through application of a bipartite projection consisting of facilities and owners. Networks utilizing this method summarize the associative ties between two different levels of actors (7). Until recent, the accuracy of nursing home ownership information reported to the Centers for Medicare and Medicaid Services (CMS) has also been questioned, as governments lacked the ability to levy penalties for non-compliance (8). However, progress on name matching has been made through recent revisions enacted in the Uniform Commercial Code (9). Since 2013, registered organizations with property as collateral in the United States have been required to use their exact legal name from the public organic record on statutory documents, or face civil fines (10).

Risk of spurious association is an issue with key matching, as it is conceivable for multiple individuals to have the same name. However, the exact legal names of registered organizations are required to be unique within American states (9), and are trademark enforced within market area for competing business (11). Thus, it is viable to uncover the ownership networks of nursing homes by registered organizations, while excluding nursing homes that are owned solely by individuals. Due to accountability and tax advantages, many owners of nursing homes are organizations incorporated as limited liability companies or real estate trusts (8). Extending a classification posited previously for chain ownership (2), nursing homes that share one or more owners with another nursing home in their hospital referral region can be deemed to have “multiple affiliation.” Those facilities without a shared owner to another nursing home are considered to have “single affiliation.” Multiple affiliation of a nursing home denotes super-organization (2).

Aside from the Herfindahl-Hirschman Index, supplementary measures derived through social network analysis can be used to denote market concentration in a catchment area. An example is degree-based centrality, which quantifies the number of “others” that a given actor has ties with (12). Key players, affiliation patterns and hierarchies can all be discerned from

degree-based centrality (13). Regarding corporate acquisitions, research has shown actors to obtain ownership in firms that they wish to influence the practices of, with rival actors in strategic competition imitating this behavior (14). Although an association has been shown between chain affiliation and better care quality of some nursing homes (2), it is unknown how super-organization measures derived from degree-based centrality relate to care quality in American nursing homes.

The current study aimed to explore the association between super-organization of nursing homes and scope of cited care deficiencies. Measures of super-organization that were explored included derivations of the Herfindahl-Hirschman Index, and degree-based centrality from social network analysis. The following research questions were investigated over the study period of March 2016 to March 2018:

- Did nursing homes with super-organization (multiple affiliation) through shared ownership by registered organizations in their HRR have fewer care deficiencies?
- Did the percentage of nursing homes with super-organization increase? Was there a change in the size and number of ownership groups in the United States?
- Was there an association between the mean size of nursing home ownership group per HRR and the scope of care deficiencies?
- Did the increase in market concentration due to super-organization (delta Herfindahl-Hirschman Index) per HRR have an association with scope of care deficiencies?
- Was there considerable variation in the scope of care deficiencies between American states, and HRRs?

## METHODS

In this observational study, a two-step analytical procedure was utilized. Social network analysis was performed in the first step to derive variables at the HRR-level, such as the mean size of nursing home ownership group. Measures utilizing the Herfindahl-Hirschman Index were also calculated at the HRR-level. In the second step, statistical analysis was conducted to evaluate the association between variables derived at the HRR-level to scope of cited care deficiencies, while also controlling for facility and resident characteristics of nursing homes. Total Weighted Health Survey Score (TWHSS) was used to denote scope of care deficiencies. This is a metric that is produced by the CMS, and is a weighted count of deficiencies cited from the three most recent cycles of recertification inspection for nursing home, and any complaint inspection in the past year (15).

## Sample and Data Sources

Data at the facility-level of individual nursing homes was linked by “Federal Provider Number” for spreadsheets comprising: Online Survey Certification and Reporting (OSCAR) care deficiencies, Minimum Data Set (MDS) quality measures, penalties, provider characteristics and ownership information from the Nursing Home Compare (NHC) open datasets (16). From the NHC website, datasets containing these measures were obtained at five semi-annual processing dates for the first



day of: March 2016, September 2016, March 2017, September 2017, and March 2018. Files were merged by Federal Provider Number for each processing date, and then aggregated by Federal Provider Numbers between processing dates. This sample yielded a cohort of 15,264 licensed nursing homes that could be tracked longitudinally and placed by ZIP code to one of the 306 HRRs bisecting the 50 American states and District of Columbia. Of these 15,264 nursing homes, 9,001 met the study criterion of having ownership by a registered organization, with information for scope of cited care deficiencies and facility characteristics (such as nurse staffing) for each processing date. Prior research has constrained care quality analysis to nursing homes with complete data for these measures (17).

## Social Network Analysis

The *igraph* package (18) (version 1.2.2) in R (19) (version 3.5.1) was utilized to create networks having two levels of actors within focal areas corresponding to the 306 HRRs in the United States. These levels comprised nursing home facilities and nursing home owners in a bipartite projection, denoted by the “Owner Name” and “Federal Provider Number” fields from the NHC datasets. To facilitate key matching in the creation of these networks, all commas, periods and multiple spacing between characters for records obtained from the Owner Name field were removed (20). From the bipartite projection, explanatory variables at the HRR-level were derived and are discussed in a following section. To determine the ownership groups of nursing homes by registered organizations, the Louvain modularity algorithm was applied for community detection (21).

## Statistical Analyses

Hierarchical modeling was employed using the *MCMCglmm* package (22) (version 2.26) in R (version 3.5.1). A Bayesian analysis of the Poisson random effects model was utilized with repeated measures. This framework was chosen, as it is flexible for over-dispersed case counts and making numerical inference

priors were specified to generate robust estimates of model parameters in the posterior distribution (24). A sampling phase of 115,000 iterations with a burn-in of 15,000 iterations, and a thinning interval of 10 was specified to obtain 10,000 samples in the posterior distribution. To infer statistical differences in hypothesis testing, the highest posterior density interval (HPDI) was utilized, and is similar to a confidence interval (25). The proportion of variation explained in outcome that is attributable to random effect was deduced from the intraclass correlation coefficient (ICC).

## Measures Denoting Super-Organization in Focal Areas

Five explanatory variables denoting super-organization were derived through social network analysis at the focal area level, corresponding to HRR. Respectively, these constitute: prevalence of nursing homes in super-organization (multiple affiliation) per HRR, mean size of nursing home ownership group per HRR, Herfindahl-Hirschman Index, affiliation-accounted Herfindahl-Hirschman Index and the delta Herfindahl-Hirschman Index.

The Herfindahl-Hirschman Index (HHI) is a measure of nursing home competition within a focal area (2). The derivation of the HHI among  $n$ , nursing homes located in a HRR at a specified time point is as follows:

$$HHI = \sum_{i=1}^n \left[ \frac{\text{total number of certified beds in nursing home, } i}{\text{total number of certified beds in HRR}} \right]^2 \quad (1)$$

Similar to the chain-accounted Herfindahl-Hirschman Index (4), the affiliation-accounted Herfindahl-Hirschman Index (AHHI) accounts for the ownership networks of nursing homes with shared ownership by a registered organization. This metric is always equivalent to or greater than the HHI. The computation of the AHHI among  $n$ , nursing homes located in a HRR is:

$$AHHI = \sum_{i=1}^n \left[ \frac{\text{total number of certified beds in affiliated nursing home group, } i}{\text{total number of certified beds in HRR}} \right]^2 \quad (2)$$

for data not obtained through a random sample (22). To adhere to a Poisson distribution, values of cited care deficiencies were discretized to the nearest integer. Two Bayesian hierarchical models (Models 1 and 2) were formulated. This was required to prevent multicollinearity between distinct resident quality measures in the MDS (Model 2), and the Five-Star Quality Measure derived from them (Model 1) (15).

Prevalence ratios (PRs) were calculated from the exponentiated coefficients in the Bayesian hierarchical models (23), and were the measure of inference. This quantity is interpreted as the percentage change in care deficiencies resulting from a unit change in a continuous explanatory variable, or of disparate classification levels to the reference level for a categorical variable. Mean-centering of continuous explanatory variables was performed. To account for cross-classification (24), the random effects of HRR and American state were fitted additively in the models. Non-informative

The delta Herfindahl-Hirschman Index (HHI) is the difference between the AHH and the HHI (4). This denotes the increase in the proportion of market concentration per HRR that arises purely from the super-organization of nursing homes.

## Facility and Resident Characteristic Measures in Nursing Homes

Explanatory variables at the nursing home-level were examined for their association to care deficiencies. Adjusted nurse staffing hours per resident day (HRD) is a metric produced by the CMS that adjusts for case-mix (8, 15), and was analyzed for certified nursing assistant, licensed practical nurse and registered nurse. Facility characteristics of nursing homes were also fitted in the models. These included: number of certified beds, occupancy ratio, years in business, ownership type (for-profit, government, non-profit), hospital location (no, yes), special focus facility (no, yes), continuing care retirement community (no, yes), resident

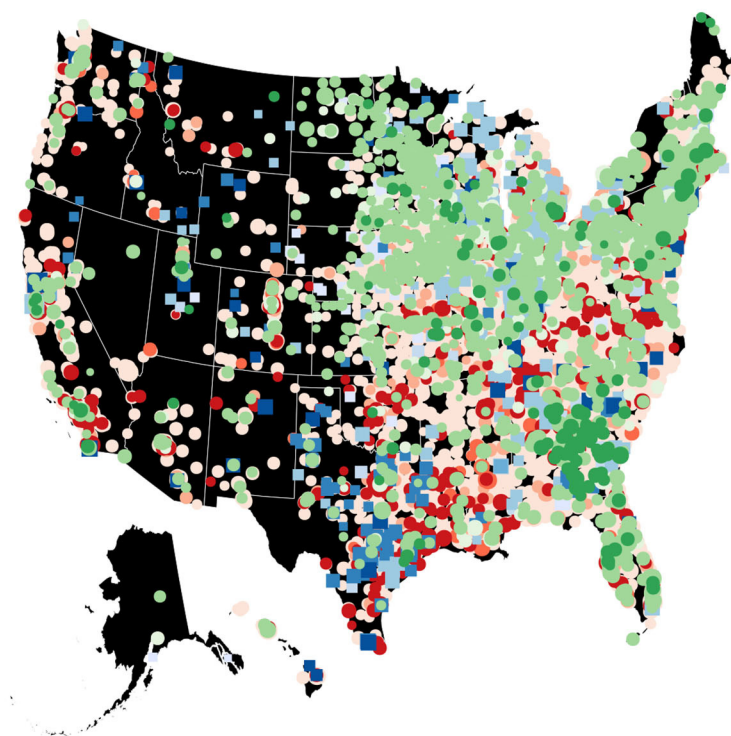
# Nursing Homes Accepting Medicare or Medicaid Funding in the United States Owned by Organizations

Number of Nursing Homes: 9001

Average Number of Residents in Certified Beds: 782891

Average Number of Certified Beds: 965190

Processing Date (Semi-Annually): 2016-03-01 to 2018-03-01



## Ownership Type (Average Number)

- For-profit -- Corporation: 5652  
495329 residents, 615022 beds
- For-profit -- Individual: 321  
27575 residents, 35462 beds
- For-profit -- Limited Liability company: 77  
7499 residents, 8928 beds
- For-profit -- Partnership: 640  
61193 residents, 75852 beds
- Government -- City: 54  
2785 residents, 3410 beds
- Government -- City/county: 53  
4041 residents, 5141 beds
- Government -- County: 321  
29898 residents, 36466 beds
- Government -- Federal: 2  
181 residents, 207 beds
- Government -- Hospital district: 99  
7753 residents, 10352 beds
- Government -- State: 54  
6592 residents, 7635 beds
- Non-profit -- Church related: 273  
22286 residents, 25802 beds
- Non-profit -- Corporation: 1310  
106565 residents, 127588 beds
- Non-profit -- Other: 145  
11189 residents, 13320 beds

## Average Number of Residents in Certified Beds

- 100
- 200
- 300
- 400
- 500

**FIGURE 1** | Nursing homes accepting Medicare or Medicaid reimbursement with a registered organization for owner. Figure was created using R version 3.5.1.

or family council (no, yes), and if ownership changed in the past year (no, yes). The Five-Star Quality Measure (Model 1) and distinct resident characteristics by measure code from the MDS (Model 2) were also fitted, although in separate models to reduce multicollinearity. Effect medication between ownership type and affiliation class of nursing home was also explored.

## RESULTS

### Overview

Complete longitudinal study information for facility characteristics and scope of care deficiencies was available for 9,001 nursing homes having a registered organization as owner (Figure 1; Table 1). Since many nursing homes had missing information for resident characteristics from the MDS for one or more processing date, the sample size of nursing homes for Model 2 is smaller than that for Model 1 (6,693 vs. 9,001). Of the 306 HRRs in the United States (26), each contained

at least one nursing home that had a registered organization for owner. However, the number of HRRs represented decreased to 294 for the sample of 9,001 nursing homes with complete information for each of the five semi-annual processing dates in Model 1, and to 293 HRRs for the sample of 6,693 nursing homes in Model 2.

Of the 9,001 nursing homes, 6,690 (74.3%) were for-profit, 583 (6.5%) were government-owned and 1,728 (19.2%) were non-profit (Figure 1). From the mean population of 782,891 residents in certified beds over the 2-year study period, 591,596 (75.6%) were housed in for-profit nursing homes, 140,040 (17.9%) in non-profit and 51,253 (6.6%) in government facilities (Figure 1).

### Ownership Network

Graph diagrams were formulated for each of the 294 HRRs that contained a nursing home with a registered organization for owner, at each of the five semi-annual processing dates. A visual representation of super-organization with regard to

**TABLE 1** | Prevalence ratios of total weighted health survey score for Models 1 and 2.

Variable	Model 1 (NHs = 9,001; HRRs = 294)				Model 2 (NHs = 6,693; HRRs = 293)			
	PR	I-95 HPDI	u-95 HPDI	MCMC p	PR	I-95 HPDI	u-95 HPDI	MCMC p
Nurse staffing								
Adjusted CNA staffing (HRD)	0.967	0.956	0.980	<0.001	0.963	0.950	0.977	<0.001
Adjusted LPN staffing (HRD)	1.013	0.998	1.030	0.102	1.010	0.991	1.028	0.290
Adjusted RN staffing (HRD)	0.795	0.770	0.820	<0.001	0.822	0.789	0.854	<0.001
Facility characteristics								
Number of residents in certified beds (n)	1.003	1.002	1.003	<0.001	1.003	1.002	1.003	<0.001
Occupancy ratio (%)	0.995	0.994	0.995	<0.001	0.995	0.994	0.996	<0.001
Years in business (n)	1.006	1.004	1.007	<0.001	1.004	1.003	1.006	<0.001
Ownership type								
For-profit	Ref				Ref			
Government	0.954	0.909	0.999	0.047	0.950	0.901	0.997	0.045
Non-profit	0.878	0.845	0.911	<0.001	0.893	0.859	0.930	<0.001
Provider resides in hospital								
No	Ref				Ref			
Yes	0.914	0.861	0.972	0.004	1.116	1.021	1.213	0.010
Special focus facility								
No	Ref				Ref			
Yes	1.855	1.740	1.993	<0.001	1.836	1.711	1.969	<0.001
Continuing care retirement community								
No	Ref				Ref			
Yes	0.914	0.884	0.948	<0.001	0.941	0.906	0.977	0.002
Has a resident or family council								
No	Ref				Ref			
Yes	1.073	1.030	1.120	0.001	1.010	0.958	1.064	0.712
Provider changed ownership in past year								
No	Ref				Ref			
Yes	0.992	0.967	1.016	0.549	0.990	0.963	1.016	0.457
Five-Star Quality Measure from MDS								
Category 1	Ref							
Category 2	0.959	0.940	0.977	<0.001				
Category 3	0.936	0.917	0.955	<0.001				
Category 4	0.899	0.881	0.919	<0.001				
Category 5	0.839	0.821	0.859	<0.001				
Derived from social network analysis at HRR-Level								
Prevalence of NHs in multiple affiliation	0.999	0.997	1.000	0.026	0.999	0.997	1.000	0.084
Mean size of nursing home ownership group	0.983	0.975	0.992	<0.001	0.978	0.969	0.987	<0.001
Delta Herfindahl-Hirschman Index	1.032	0.655	1.635	0.898	1.082	0.668	1.780	0.759
Overall ownership network class by HRR								
Multiple affiliation	Ref				Ref			
Single affiliation	1.022	0.995	1.049	0.103	1.030	1.002	1.058	0.037
Interaction of ownership type by affiliation class								
For-profit and multiple affiliation	Ref				Ref			
Government and single affiliation	0.885	0.822	0.951	<0.001	0.890	0.818	0.969	0.008
Non-profit and single affiliation	0.965	0.919	1.014	0.159	0.986	0.933	1.041	0.612
Resident characteristics by measure code								
Long-stay prevalence, four quarter averages (%)								
401 – Need for help with ADLs has increased					1.006	1.005	1.008	<0.001
402 – Self-report moderate to severe pain					1.001	1.000	1.003	0.135
403 – Have pressure ulcers					1.013	1.011	1.016	<0.001

(Continued)

TABLE 1 | Continued

Variable	Model 1 (NHs = 9,001; HRRs = 294)				Model 2 (NHs = 6,693; HRRs = 293)			
	PR	I-95 HPDI	u-95 HPDI	MCMC p	PR	I-95 HPDI	u-95 HPDI	MCMC p
404 – Lose too much weight					1.002	1.000	1.004	0.019
405 – Lose control of bowels or bladder					0.999	0.998	1.000	0.003
406 – Catheter inserted and left in bladder					1.007	1.003	1.011	<0.001
407 – Have urinary tract infection					0.997	0.995	1.000	0.034
408 – Have depressive symptoms					1.000	0.999	1.001	0.914
409 – Were physically restrained					1.006	1.000	1.012	0.072
410 – Experienced fall with major injury					1.004	1.001	1.007	0.007
411 – Given seasonal influenza vaccine					0.997	0.996	0.998	<0.001
415 – Given pneumococcal vaccine					0.998	0.997	0.999	0.001
419 – Received an anti-psychotic medication					1.005	1.003	1.006	<0.001
451 – Ability to move independently worsened					1.001	0.999	1.002	0.431
452 – Received an anti-anxiety medication					1.000	0.999	1.002	0.465
Short-stay prevalence, four quarter averages (%)								
424 – Self-report moderate to severe pain					1.002	1.001	1.003	0.002
425 – Have pressure ulcers that are new					1.008	1.002	1.013	0.009
426 – Given seasonal influenza vaccine					0.998	0.998	0.999	<0.001
430 – Given pneumococcal vaccine					0.998	0.997	0.998	<0.001
434 – Received an anti-psychotic medication					1.009	1.006	1.013	<0.001
471 – Made improvements in function					0.998	0.997	0.999	<0.001

PR, prevalence ratio; HPDI, highest posterior density interval; MCMC, Markov chain Monte Carlo; HRR, hospital referral region; HRD, hours per resident day; ADLs, activities of daily living; NH, nursing home.

the processing date of March 1, 2018 is presented in **Figure 2** for nursing homes in the HRR of Ogden, Utah. In this graph diagram, six facilities had no shared ownership by a registered organization to another nursing home in this focal area, while eight did. Those nursing homes with shared ownership by a registered organization to another facility were deemed to have “multiple affiliation” or super-organization. Two ownership groups among nursing homes with super-organization were evident. The larger of the ownership groups was comprised of for-profit, government and non-profit facilities, with each nursing home in this group having ownership by a shared organization. Although the HHI of 0.088 implies a market with healthy competition, the AHHI of 0.271 suggests higher concentration when adjusting for super-organization.

## Model 1

Prevalence ratios of care deficiencies with regard to explanatory variables (including the Five-Star Quality Measure) are presented in **Table 1**. With regard to nurse staffing, each additional hour per resident day (HRD) above the overall average for certified nursing assistants was associated with 3.3% fewer (adjusted PR: 0.967; 95% HPDI: 0.956–0.980) care deficiencies. A larger 20.5% decrease (adjusted PR: 0.795; 95% HPDI: 0.770–0.820) in care deficiencies was observed for each hour increase in registered nurse staffing per resident day. Care deficiencies increased by 0.3% (adjusted PR: 1.003; 95% HPDI: 1.002–1.003) for each additional resident in nursing home size. However, each percentage increase in occupancy ratio was associated

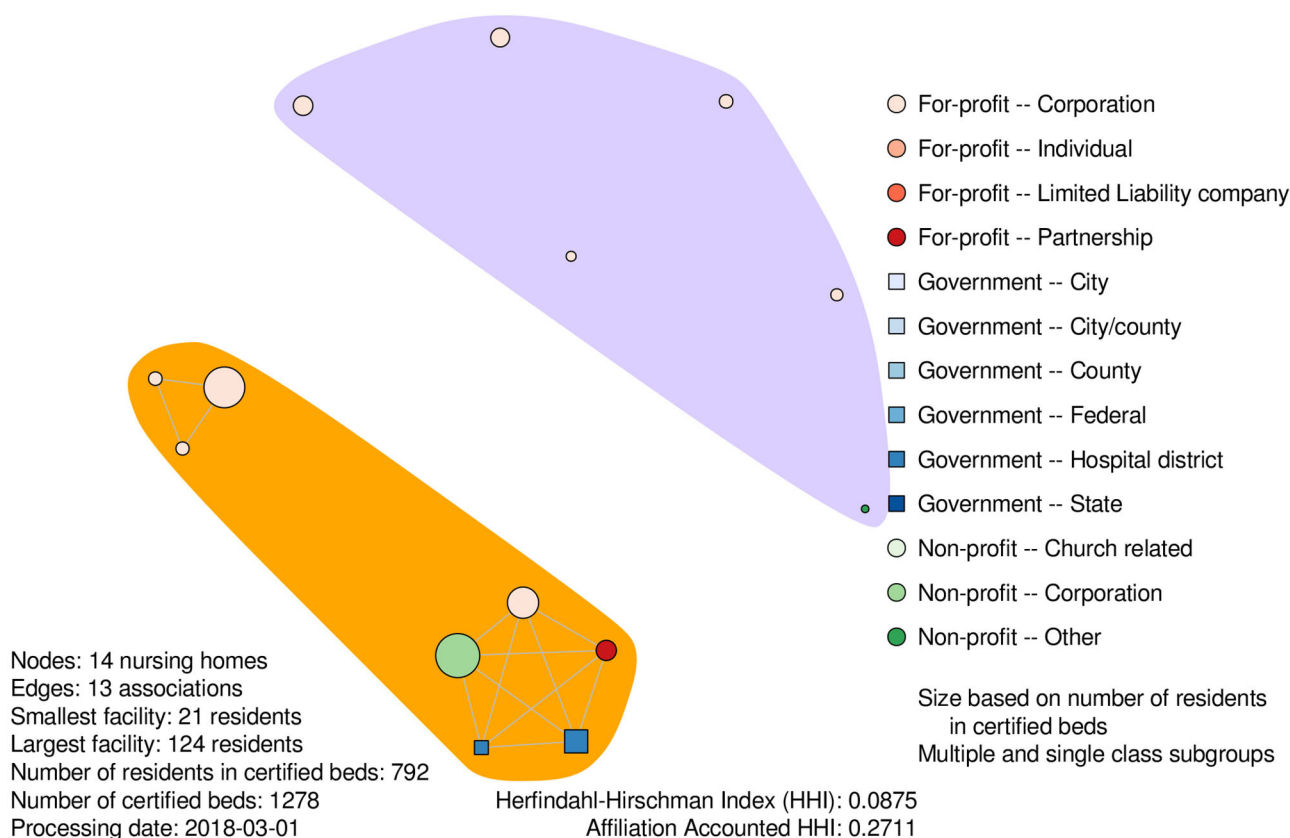
with 0.5% fewer (adjusted PR: 0.995; 95% HPDI: 0.994–0.995) care deficiencies. Nursing homes in business for longer had a higher scope of care deficiencies on average, with a 0.6% increase (adjusted PR: 1.006; 95% HPDI: 1.004–1.007) for each additional year.

In comparison to for-profit facilities, care deficiencies among government nursing homes were 4.6% lower (adjusted PR: 0.954; 95% HPDI: 0.909–0.999); while care deficiencies among non-profit nursing homes were 12.2% lower (adjusted PR: 0.878; 95% HPDI: 0.845–0.911), respectively. Hospital-based nursing homes had 8.6% fewer (adjusted PR: 0.914; 95% HPDI: 0.861–0.972) care deficiencies than non-hospital-based facilities, on average. Special focus facilities had almost 1.9 times as many (adjusted PR: 1.855; 95% HPDI: 1.740–1.993) care deficiencies than non-special focus facilities. Regarding the Five-Star Quality Measure derived from the MDS, consecutive increases in ordinal category were associated with fewer care deficiencies in nursing homes.

Measures denoting super-organization and their association to scope of care deficiencies are also presented in **Table 1**. A 0.1% decrease (adjusted PR: 0.999; 95% HPDI: 0.997–1.000) in care deficiencies was observed for every percentage increase in the prevalence of nursing homes with multiple affiliation (super-organization) in their HRR. For each facility increase in the size of nursing home ownership group per HRR, a 1.7% decrease (adjusted PR: 0.983; 95% HPDI: 0.975–0.992) in care deficiencies was observed. Examining the effect modification between ownership type and super-organization, government nursing homes without a shared owner to another facility in their



## Nursing homes affiliated to other facilities accepting Medicare or Medicaid through owners who are organizations in Hospital Referral Region of 421: Ogden, UT.



**FIGURE 2 |** Exemplar graph diagram of nursing home super-organization in a hospital referral region. Figure was created using R version 3.5.1.

HRR had 11.5% fewer (adjusted PR: 0.885; 95% HPDI: 0.822–0.951) care deficiencies than for-profit facilities with a common owner to another nursing home in their HRR.

### Model 2

Results obtained from Model 2 are similar to Model 1, with the addition of aggregated long-stay and short-stay resident characteristics by quality measure code from the MDS and the exclusion of the Five-Star Quality Measure (Table 1). For every percentage increase in the prevalence of residents whose help with activities of daily living had increased, care deficiencies increased by 0.6% (adjusted PR: 1.006; 95% HPDI: 1.005–1.008) on average in nursing home. Indicative of an adverse event, each percentage increase in the prevalence of residents with pressure ulcers was associated with a 1.3% increase (adjusted PR: 1.013; 95% HPDI: 1.011–1.016) in care deficiencies. A higher than average prevalence of residents who experienced one or more falls with major injury was associated with more care deficiencies (adjusted PR: 1.004; 95% HPDI: 1.001–1.007) in nursing home.

A protective effect was shown in the prevalence of residents given the seasonal influenza vaccine, with every percentage increase above the mean being associated with 0.3% fewer (adjusted PR: 0.997; 95% HPDI: 0.996–0.998) care deficiencies in nursing home.

### Summary of Random Effects at the HRR-Level

Descriptive statistics of explanatory variables derived at the HRR-level through social network analysis are presented by processing date in Table 2. Consecutive increases in Total Weighted Health Survey Score was observed over the study period, ranging from 54.5 in March 2016 to 63.6 by March 2018. The prevalence of nursing homes with super-organization (multiple affiliation) in their HRR was over 56% for each processing date. As scope of cited care deficiencies followed a Poisson distribution, values for the standard deviation can (and did) exceed the mean. From March 2016 to March 2018, the mean size of nursing home ownership group per HRR increased from 3.11 to 3.23

**TABLE 2 |** HRR-level fixed effect characteristics by processing date (Model 1); intraclass correlation coefficients for the random effects (Models 1 and 2).

Variable	Processing Date (n = 5)									
	March 2016		September 2016		March 2017		September 2017		March 2018	
	M/%/n	SD	M/%/n	SD	M/%/n	SD	M/%/n	SD	M/%/n	SD
Total Weighted Health Survey Score of 9,001 NHs in <b>Model 1</b> (n)	54.48	60.41	56.82	65.36	58.99	70.61	60.55	71.66	63.55	80.61
Derived by social network analysis at HRR-level (n = 294) of 9,001 NHs in <b>Model 1</b>										
Prevalence of NHs in multiple affiliation (%)	56.76	16.66	56.99	16.67	56.86	16.98	56.73	16.54	56.91	16.36
Mean size of NH ownership group (n)	3.11	2.20	3.14	2.20	3.18	2.26	3.22	2.30	3.23	2.36
Herfindahl-Hirschman Index	0.06	0.05	0.06	0.05	0.06	0.04	0.06	0.04	0.06	0.04
Affiliation Herfindahl-Hirschman Index	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08
Delta Herfindahl-Hirschman Index	0.07	0.05	0.07	0.05	0.07	0.06	0.07	0.06	0.07	0.06
Total number of NHs owned by organizations	10728		10875		11009		10736		10943	
From NHs in multiple affiliation per HRR										
Total number of NHs with multiple affiliation	6940		7083		7191		7058		7146	
Total number of organization owners	17202		17289		18847		18271		18839	
Total number of ownership groups	1870		1896		1905		1865		1878	
Variable	Model 1 (n = 9,001)			Model 2 (n = 6,693)						
	ICC	I-95 HPDI	u-95 HPDI	ICC	I-95 HPDI	u-95 HPDI				
HRR-level										
Random intercept	0.073	0.042	0.103	0.081	0.044	0.108				
American State-level										
Random intercept	0.176	0.097	0.282	0.193	0.098	0.293				

M, mean; SD, standard deviation; HRR, hospital referral region; NH, nursing home.

ICC, intraclass correlation coefficient; HPDI, highest posterior density interval; HRR, hospital referral region.

facilities. The overall HHI was 0.07 for each processing date. This denotes the increase in the proportion of market concentration among American nursing homes in HRR that was attributable to super-organization.

Summary information regarding the ownership groups from Model 1 is shown (Table 2). When aggregated by HRR, the number of registered organizations in the United States that had shared ownership of a nursing home among one or more “other” registered organizations increased from 17,202 at the start of study, to 18,839 by the end. These registered organizations comprised 1,870 ownership groups in March 2016 and 1,878 ownership groups in March 2018.

Table 2 also presents the ICCs for the additive random effects of American state and HRR that were obtained from Models 1 and 2. The proportion of the total variation in scope of cited care deficiencies attributable to American state after controlling for HRR was approximately 17.6% in Model 1, and 19.3% in Model 2. Conversely, the proportion of total variation in care deficiencies that was explained by HRR after controlling for American state was 7.3% in Model 1, and 8.1% in Model 2.

## Geographical Presentation of Random Effects

Prevalence ratios of the random effects are displayed geographically (Figure 3). Those of American state are discussed first. Examining Model 1, the American states of Alaska, Washington, California, Idaho, Montana, Kansas, Oklahoma, Texas, Wisconsin, Michigan and West Virginia each had a prevalence ratio that was respectively higher than the national average for scope of cited care deficiencies. Nursing homes with the highest care deficiencies were found in Alaska, having a prevalence ratio almost two and a half times higher than the national average. Nursing homes in Rhode Island had the fewest care deficiencies, at almost three-quarters less than the national average.

Prevalence ratios by HRR are also presented in Figure 3. Localities in the United States outside the boundaries of any HRR are shown with an absence of color; gray denotes HRRs that were not included in the present study. With regard to Model 1, some HRRs with a higher prevalence ratio than the national average for scope of care deficiencies were located in American states that also had a higher prevalence ratio of care deficiencies than the national average. An example is Chico, California. Other HRRs had a lower prevalence ratio for care deficiencies than the national average, but were located in American states with a higher than average prevalence ratio, such as Modesto, California. The converse was also possible, such as the HRR comprising Atlanta, Georgia. Geographical findings in Model 2 were similar to Model 1.

## DISCUSSION

Super-organization of licensed nursing homes through common ownership by registered organizations was found to be an intensifying process, as corroborated by the current study that accounted for latent ownership networks. The prevalence of

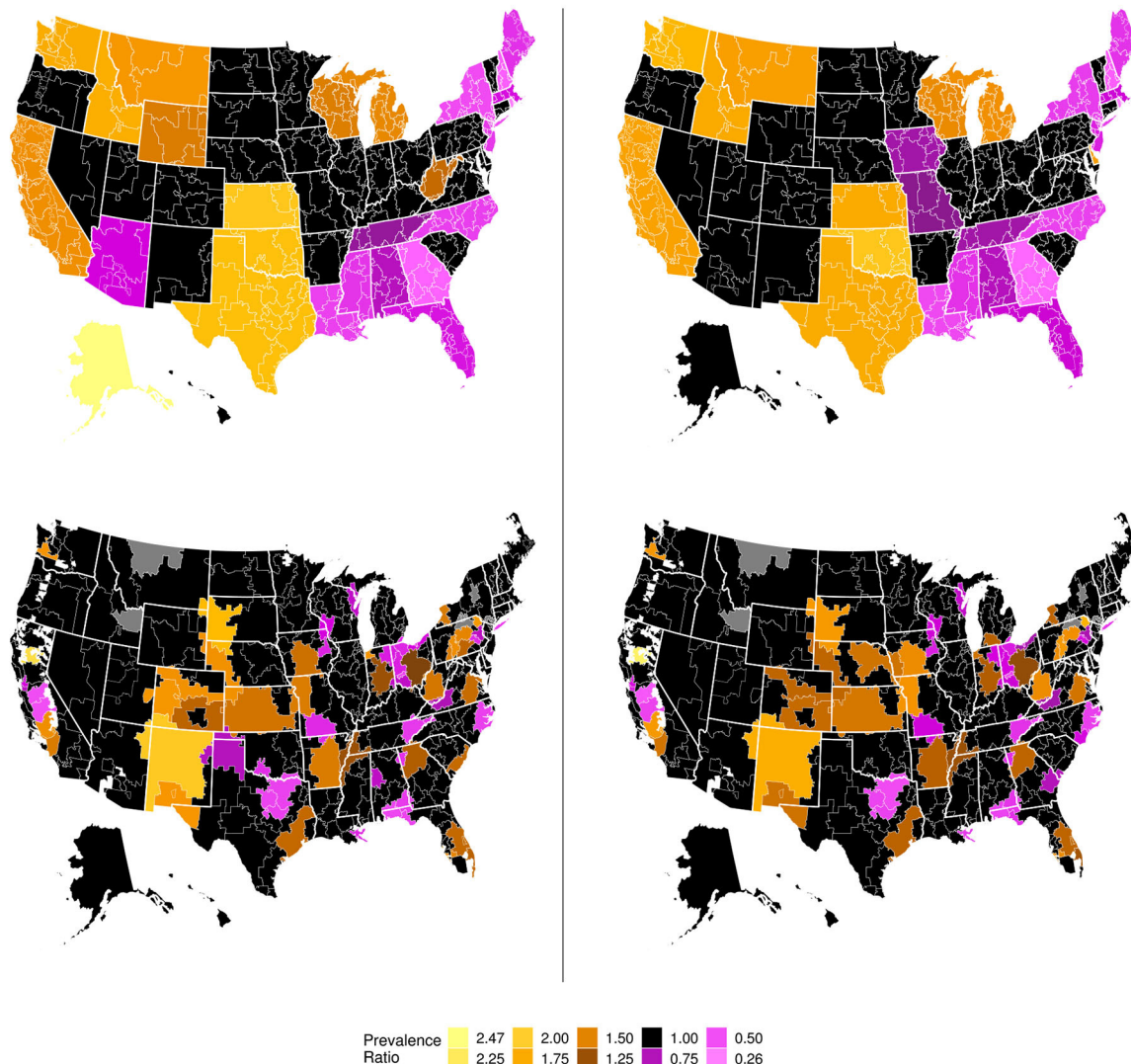
American nursing homes having super-organization in their HRR increased by three twentieths from 2016 to 2018. As hypothesized, nursing homes with shared ownership by a registered organization to another facility in their HRR had a lower scope of care deficiencies than nursing homes without a common owner. An explanation for this could be due to the uptake of improved practices through knowledge transfer among owners (27). Interestingly, the number of ownership groups increased by roughly 1% from 2016 to 2017, and then decreased by 1% to 2018. Nursing homes that were part of a larger ownership group with more facilities had fewer care deficiencies. This relationship was observed in another study with regard to nursing home chains (2).

No association was established between the increase in market concentration that was due to super-organization (HHI) and scope of cited care deficiencies. However, at 0.07, the magnitude of the overall HHI was relatively small. Although this difference was greater than the 0.02 observed between chain-accounted HHIs and unadjusted HHIs of American nursing homes in another study, that used the county-level as a focal area (4). The overall affiliation-accounted Herfindahl-Hirschman Index (AHHI) of 0.13 among American nursing homes in HRR from the current study was much less than the overall chain-accounted HHI of 0.55 observed in the prior study (4). An explanation for this is that market competition of nursing homes is much less concentrated per HRR in comparison to county, which makes sense as HRRs are generally larger by both population and geographical area. A limitation of the current study is that ownership networks are based on the integrity of registered names in the NHC datasets, with market concentration likely being underestimated. Additionally, direct comparisons cannot be made on the nature of market concentration within HRR to county, as the current study used a more encompassing definition of super-organization than the characterization of chain affiliation utilized by previous studies.

Effect medication between ownership type and super-organization of nursing home was shown in the association to care deficiencies. As expected, government facilities without a shared owner to another nursing home in their HRR had a lower scope of care deficiencies than for-profit nursing homes with super-organization. However, no difference in scope of care deficiencies was observed between non-profit nursing homes without super-organization and for-profit nursing homes with super-organization in their HRR. This suggests that super-organization is more beneficial for non-profit than government nursing homes. Regardless of super-organization, government and non-profit nursing homes in general had a lower scope of cited care deficiencies than for-profit nursing homes over the study period. This could be due to a variety of factors, such as profit-seeking behaviors that diminished clinical care, and better adherence to protocol (and enforcement of penalties arising from inspection) among government and non-profit facilities (28).

Many of the findings presented in this study that associate facility and resident characteristics to care deficiencies concur with results in the literature. High levels of registered

**Models 1 (Left) and 2 (Right): Additive Significant Prevalence Ratios Different from 1.00 of Total Weighted Health Survey Score by American State (Above) and HRR (Below) of Nursing Homes Accepting Medicare or Medicaid Funding Owned by Organizations**



**FIGURE 3 |** Additive prevalence ratios of total weighted health survey score by American state and hospital referral region for Models 1 and 2. Maps were generated by author. Figure was created using R version 3.5.1.

nurse and certified nursing assistant staffing were negative predictors for care deficiency count (17). With regard to facility characteristics, special focus facilities had more care deficiencies. This is not unexpected, as that designation is for providers with among the worst care quality as reported from previous inspection (15). On the converse, continuing care retirement community were associated with fewer care deficiencies. Typically, these facilities are populated by residents with greater incomes (29). With regard to resident characteristics, nursing homes containing residents with a higher prevalence of pressure ulcers had more care deficiencies (17). Seasonal influenza and pneumococcal vaccinations of residents offered a

preventative effect to care deficiencies in nursing home, although vaccine implementation as a standard operating procedure may be more prominent in non-profit and government facilities (30).

As a limitation, the current study did not consider the lagged effect of organization changes in nursing home ownership to care quality. However, an indicator which denoted if provider changed ownership in the previous year from the NHC datasets was included for analysis. Lagged effects should be considered in studies with longer follow-up periods. A previous study ascertained that nursing homes acquired by the largest for-profit chains in the United States had more care deficiency



citations in the subsequent 2 years after acquisition (1). Another study of panel data over a 6-year period found care quality to increase in later years for some independent nursing homes, following acquisition by a for-profit chain (2). In interpreting associations, one should be cautious of the ecological fallacy. In particular, the effect of super-organization to care quality for individual nursing homes may be different than the overall group effect. It is conceivable that there may be for-profit nursing homes in small ownership networks that provide superior care to non-profit or government nursing homes, and are still partially reimbursed by Medicare or Medicaid. An example being luxury care homes with higher staffing levels (29).

Unexpectedly, the mean scope of cited care deficiencies in nursing homes increased considerably over the study period. The reasoning for this is difficult to explain, but could be due to changes in the recertification inspection process enacted by states (15). The importance of locality must be stated, as the ICCs of American state and HRR suggest that large amounts of variation in care deficiencies were explained by these random effects. Considerable variation was also exhibited in the magnitude of care deficiencies across the United States, with states in the South and New England regions, in particular, having a lower prevalence ratio in comparison to the American average. Contextual effects within these administrative units have a large impact on care quality. Examples of such aspects include variation in the minimum threshold of registered nurse HRD staffing levels (31), Medicaid reimbursement rate (32), and discrimination due to race (3). As these factors can be addressed through regulation and enforcement, legislators have a responsibility to actualize care equity in American nursing homes.

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## CONCLUSIONS

The present study on the effect of nursing home super-organization to care deficiencies, as demarcated by ownership networks of registered organizations, yielded associations in agreement to those from previous studies. Degree-based centrality measures that were derived from social network analysis, such as the mean size of nursing home ownership group, were better associated with care quality than the Herfindahl-Hirschman Index in hospital referral region. In summary, nursing homes with super-organization in hospital referral region that were part of a larger ownership group with more facilities had fewer care deficiencies than nursing homes with super-organization in small ownership groups. The prevalence of American nursing homes with super-organization is increasing gradually.

## DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: <https://data.medicare.gov/data/nursing-home-compare>.

## AUTHOR CONTRIBUTIONS

TP conceptualized the manuscript, reviewed appropriate literature, created the figures, performed the analysis, contributed to the article and approved the submitted version.

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# Effective Interventions on Improving Elderly's Independence in Activity of Daily Living: A Systematic Review and Logic Model

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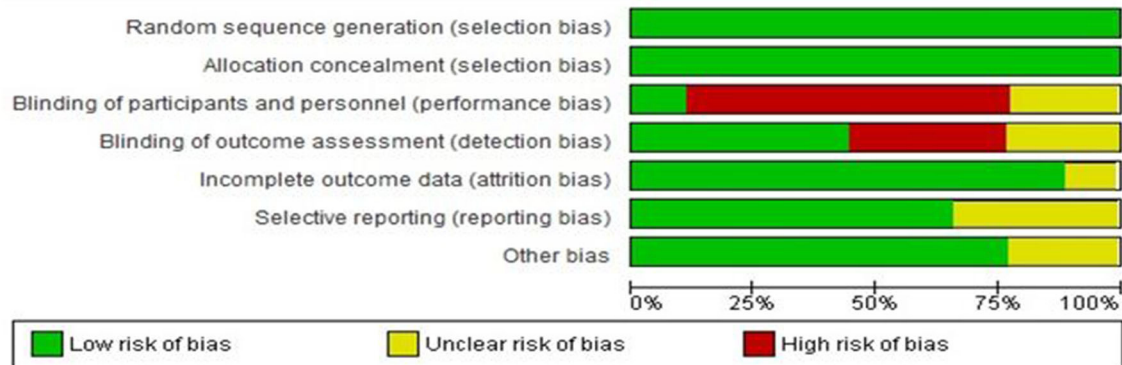
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This systematic review aimed to investigate the types and characteristics of effective interventions when improving the independence of the elderly during activities of daily living. After developing a search strategy, the various databases, including PubMed, Scopus, Cochrane Library, Science Direct, Proquest, and Embase, were searched up to October 16, 2019. The Review Manager 5.1 software was used to determine the risk of bias. The randomized clinical trials were reviewed to find if their interventions' main goal was to improve the elderly's independence in activities of daily living. Data were extracted independently by two authors. Eight randomized controlled trials were included in the final analysis. Three types of interventions were identified and categorized as cognitive training, physical exercises, and multicomponent interventions. All reviewed studies provided evidence of the effectiveness of interventions in improving older people's ability to perform the activities of daily living. However, the lack of uniform measurement indicators to identify and compare the most effective interventions forced us to develop a conceptual framework for designing future interventional research. This conceptual framework included designing tailored interventions, creating an age-friendly environment as well as financial, psychological, and social support. The proposed conceptual framework can also help develop future systematic reviews focusing on a particular intervention type.

**Keywords:** independent living, systematic review, elderly, aged, activity of daily living

## INTRODUCTION

Independence among the elderly when performing individual and social tasks is a very challenging issue in all societies. Independence is considered self-determination, emancipation from coercion, and freedom of thought, selection, and performance (1, 2). Independence among the elderly is defined as the degree of individual autonomy in meeting their daily needs (eating, dressing, showering, etc.) and their right to choose (3). During the aging process, implicit physical, physiological, psychological, and social changes generate disability in activities of daily living and reduce independence (4, 5). Activities of daily living include Basic Activities of Daily Living (BADLs) and Instrumental Activities of Daily Living (IADLs) (6). BADLs include self-care skills such as bathing, dressing, eating, and IADLs, including more complex activities such as using the



**FIGURE 1 |** Risk of bias graph: review authors' judgments about each risk of bias item presented as percentages across all included studies.

public transport system, financial management, and buying (7). Decreased independence in the elderly has unpleasant consequences and can cause dependence on others in activities of daily living (ADLs), reduce quality of life, and damage health (8). So it is crucial to maintain the elderly's ability and independence in ADLs (9).

A review of health promotion initiatives showed that various interventions with varying degrees of effectiveness were examined to enhance the elderly's activities of daily living in different studies. Some studies have focused on physical activity, especially mobility exercise and functional training, to improve muscle strength, balance, and ADL (10, 11). Some other studies have measured the effect of cognitive interventions on improving the elderly's performance in ADL (12, 13). A cross-sectional study has also documented that the living environment changes can facilitate the activity and presence of the elderly in the community and thus help increase their independence (14). The question is what kind of interventions can help promote the elderly's independence in activities of daily living and the characteristics of the successful interventions in ADL independence?

In the last decade, several systematic reviews have focused on the elderly's physical functioning and quality of life. Still, their primary purpose was not to investigate effective interventions in terms of the elderly's ADL independence and measure it (10, 11, 15–17). The systematic review of Beswick et al. (18) was the only study to examine the impact of community-based interventions on maintaining the elderly's physical activity and independence. This study has reported a combination of interventions, including education and counseling, fall prevention, community-based care, and interventions aiming to change the elderly's physical and social environment. Still, it did not include cognitive and physical interventions (18). Although various interventions have been reported in the literature to improve the elderly's ability to perform ADLs, it seems most healthcare providers have focused on physical interventions in practice. Therefore, a systematic review of articles can provide them with a list of effective interventions. Consequently, this review was conducted to identify the types and the characteristics of interventions

effective in promoting the elderly's independence in practicing their activities of daily living.

## METHODS

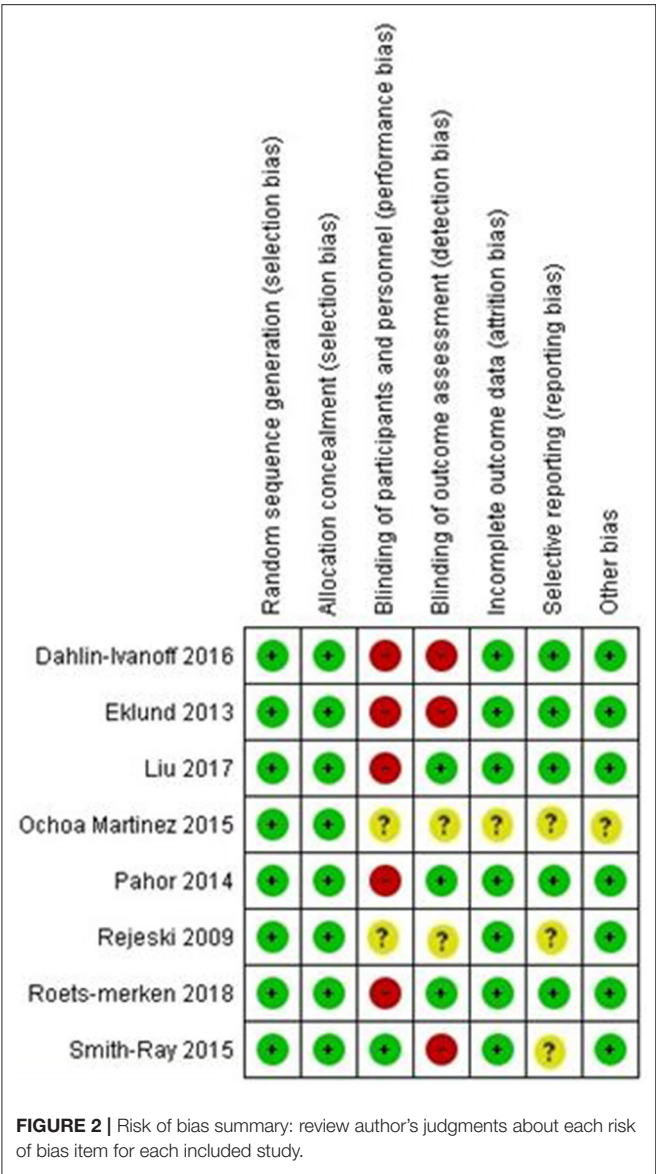
This systematic review, which was designed in 2019, is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis checklist (PRISMA) (19).

We adopted a four-step search strategy to identify relevant articles. First, the PICO strategy based on the Joanna Briggs Institute (20) was used for a research question defined as what kind of interventions were used to increase the elderly's independence in daily living activities in randomized controlled trials? After that, the PICO framework contributed to the definition of the inclusion criteria—Population: elderly; Intervention: cognitive, physical, and environmental interventions; Context: dwelling in the community; and Outcome: independence in ADL. Second, the search was conducted without a time limit up to October 16, 2019 in PubMed, Cochrane trial, Scopus, Science Direct, Proquest, and Embase databases. See **Supplementary Material** for the search strategy. Third, Google and Google scholar were searched for gray literature. Fourth, search results of all databases collected in the EndNote X7 software and duplicate articles were removed.

## Study Criteria

Studies were individually screened in two steps: screening titles and abstracts and screening full-text articles by two investigators using eligibility criteria. Articles with these characteristics were selected to review (a) randomized controlled trials; (b) study participants, including the elderly without Alzheimer, cognitive problems, and impaired mental function; (c) using one or more interventions to improve the elderly's ADL independence; (d) directly or indirectly measuring older people's ability and independence in performing individual or social ADL, and (e) English language studies. The exclusion criteria were non-original articles, including letters to the editor, case reports, review and meta-analysis studies, and articles presented at





conferences. It should be noted that articles without full text were excluded.

Risk of Bias in Included Studies

Review Manager 5.1 (RevMan) software was used to determine the risk of bias. Details of the risk-of-bias items are presented separately in each article in Figures 1, 2.

Data Synthesis

We did not perform a meta-analysis due to heterogeneity in quantitative indices and outcome measurement tools. Instead, we chose a narrative approach to synthesis according to the steps outlined in the Center for Reviews and Dissemination Guidance: developing a theory of how the intervention works, why and for whom, developing a preliminary synthesis of results of included studies, exploring relationships in the data, considering the robustness of the synthesis (21).

RESULTS

Description of Studies

A total of 343 articles were found after searching the database. Then, 212 articles remained after removing the duplicate articles. After reviewing the articles' titles and abstracts, 33 articles entered the next stage. At this stage, the articles' full texts were reviewed, and eight RCT studies entered the final analysis. Several articles were excluded in the screening stages of studies for various reasons, such as non-relevant topics, non-interventional subjects, and non-original articles. The flowchart of the studies entered is shown in Figure 3.

Study Characteristic

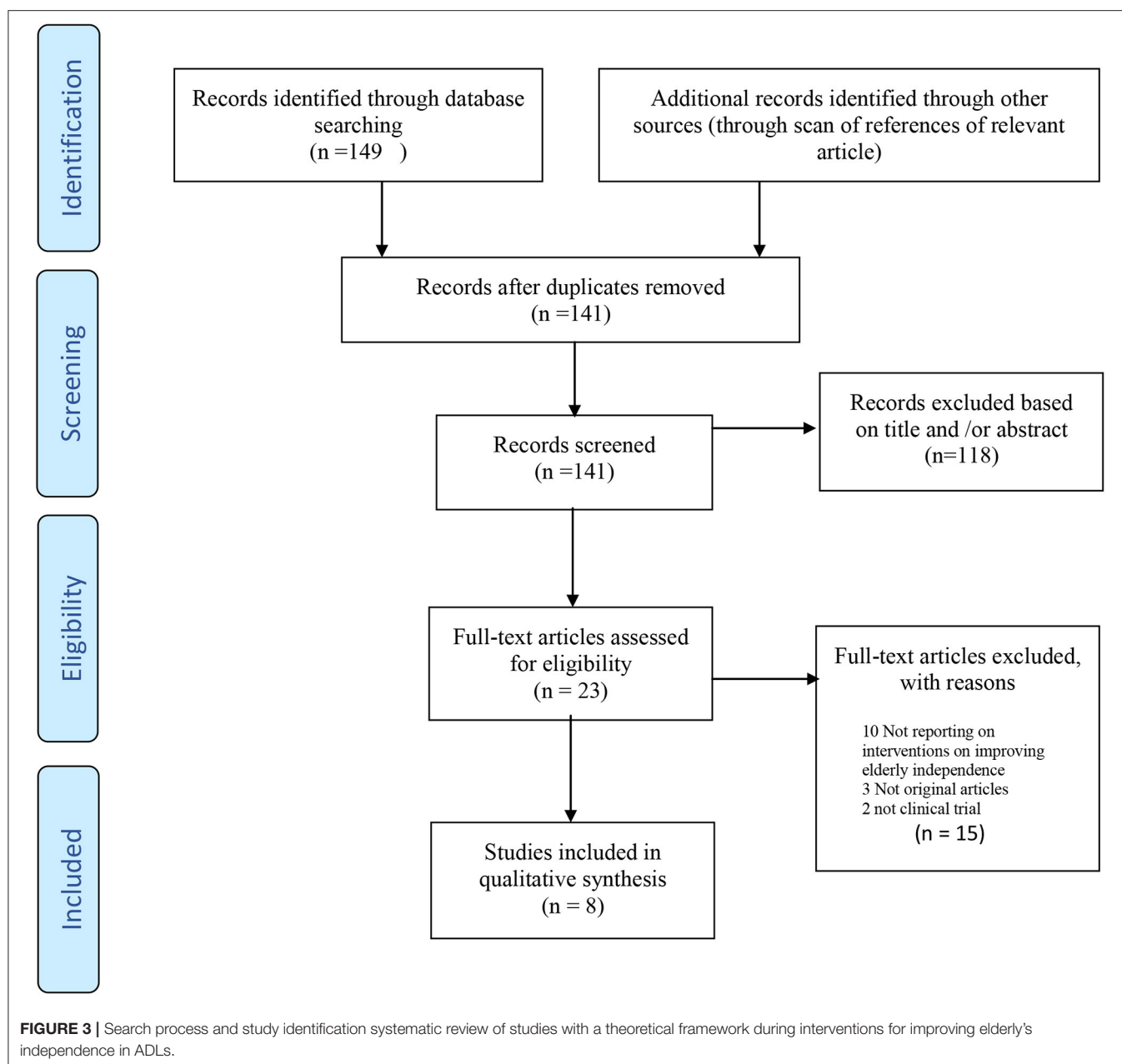
Eight eligible randomized controlled trials were conducted in four different countries, including the USA (four studies), Sweden (two studies), Netherland (one study), and Mexico (one study) (22–29). The sample size varied from 26 (25) to 1,635 participants (26), with an average of 354 participants. The interventions' duration varied from 10 weeks (24, 29) to 12 months (26, 27). The follow-up time range varied from a very brief follow-up (29) to 36 months (27). The characteristics of the studies are summarized in Table 1.

Based on the overall key risk of bias items, seven (87%) of eight articles were rated as low risk of bias (studies with three or more items were considered low risk). Seven (87%) studies were identified as high or unclear risk of performance, indicating that participants were not blind in five studies, and in two studies, their blindness was unclear. In three studies, the assessor was not blind, there was an unclear risk of detection bias in two articles, and attrition rates were clearly reported in seven articles (Figure 2).

Different interventional programs have been used in selected articles to promote the elderly's independence that can be divided into three categories of cognitive, physical, and multicomponent interventions. Two of the eight articles utilized cognitive interventions to improve ADLs, including "the self-management program" (SMP) (28) and "cognitive training programs and the computer software program, Insight" (29). Two articles focused on the elderly's physical training intervention, which included the three-step workout for life (24) and the water exercise training program (25). Four articles also used three multicomponent interventions, including the Elderly Persons in the Risk Zone (EPRZ) (22), "Lifestyle and Independence Interventions for the Elderly" (LIFE) (26, 27), and a Continuum of Care for Frail Older People (23).

Between cognitive interventions, SMP focused on improving the elderly's IADLs with five skills: problem-solving, decision-making, resource utilization, formulation of participation, and actions (28). The insight program was another cognitive intervention that emphasized promoting BADLs by improving executive function, including working memory, processing speed, and inhibition, using three different games: Road Tour, Jewel Diver, and Sweep Seeker (29).

As a physical training intervention, a three-step workout for life program focused on slowing down disability in the elderly and improving performance in ADLs. In this exercise,



functional movements, selective daily activities, and resistance exercises were used three times a week, 60 min each time, for 10 weeks (24). The other physical intervention was water exercise training, which revealed significant improvement in the elderly's functional independence. Five water exercises were performed in this intervention, including walking 10 meters, standing up from a chair and walking straightaway, dressing and undressing, standing up from a sitting position, and standing up from a lying position (25).

One of the multicomponent interventions was the LIFE protocol consisting of cognitive and physical interventions (26, 27). The LIFE protocol had several components: social cognitive

theory (self-efficacy and outcome expectations) (36), aerobics, endurance exercises, and flexible training activities. This program was finally able to improve BADLs (18). The EPRZ program focused on the elderly's independence in ADL and encouraged the elderly to decide independently and gain control over their lives and learn how to turn their home into an age-friendly environment (22). "Continuum of care for frail older people" was a program that concentrated on interprofessional shared decision-making for continuous care (23). The independence of the elderly in this program was improved in five BADLs (bathing, dressing, going to the toilet, transferring, and feeding) and four IADLs (cleaning, buying, transporting, and cooking) (33).

**TABLE 1 |** Summary of the included RCT studies.

Results	ADL or independence scales	Duration month	Interventions to maintain independence	Country/Year	Authors
SMP was more effective in IADL	<b>-The Patient Autonomy Questionnaire (PAQ) (30)</b> <b>- Activity Card Sort (ACS) (31):-4 domains:</b> Instrumental activities of daily living (IADL) Social-cultural activities High-physical-demand leisure activities Low-physical-demand leisure activities.	5	<b>- Self-management program (SMP) (32):</b> - Problem-solving approach—5 steps: Problem identification Collecting alternatives Choice and planning Execution Reflection	Netherlands 2018	Roets-Merken et al. (28)
3-Step Workout for Life improves the performance of ADLs for older adults who are at risk of losing independence at home.	<b>- Assessment of Motor &amp; Process Skills (AMPS):</b> - A standardized observational evaluation - Evaluation of 16 motor skills and 20 process skills of familiar ADL	2.5	<b>- The 3-Step Workout for Life program (24):</b> - Task-oriented approach—3 components: Muscle strength training Functional training ADL training	USA 2017	Liu et al. (24)
There is a positive effect of ADL independence in the intervention group	<b>- ADL staircase (33):</b> - Evaluation of personal and instrumental ADL(10 original activities) - A scoring range of independence to dependency	—	<b>- Elderly Persons in the Risk Zone (EPRZ):</b> - Empowerment approach—2 interventions due to maintaining independence: Preventive home visit (PHV) Senior group meetings (SM).	Sweden 2016	Dahlin-Ivanoff et al. (22)
Maintaining balance and gait through improving working memory and speed processing.	<b>- Measurement of ADL through a demographic questionnaire</b> <b>- Berg Balance Scale</b> - Functional balance test	2.5	<b>- A computer-based cognitive training program “Insight” :-3 simple computer games target executive function domains</b> - A self-driven program that adapts to the individual's performance by increasing or decreasing task difficulty	USA 2015	Smith-Ray et al. (29)
Positive improvements in functional autonomy	<b>- 5 tests to determine the functional autonomy according to GDLM protocol</b> 10 m walk (10 mW) Getting up from a seated position (GSP) Getting up from the prone position (GPP) Getting up from a chair and movement around the house (GCMH) Putting on and taking off a shirt (PTS)	3	<b>- Water exercise training program:</b> - Five times a week, with 50 min per session for 3 months - Providing functional autonomy (34)	Mexico 2015	Ochoa Martínez et al. (25)
Reducing major mobility disability in activity daily living	<b>- Short Physical Performance Battery (SPPB)</b> - Measurement of walking, balance, and strength tasks - Score ranging from worst performance to best performance - prediction of mobility disability and ADL disability	12	<b>- The Lifestyle Interventions and Independence for Elders (LIFE):</b> - The physical activity (PA) intervention along with group-mediated behavioral counseling sessions focusing on self-regulatory skills (35)	USA 2014	Pahor et al. (26)
Promoting ADL independence up to 1 year and postponing ADL dependence up to 6 months	<b>- ADL staircase</b> - Evaluation of ADL - A scoring range of independence to dependency	6	<b>- Continuum of Care for Frail Older People:</b> - An integrated care and rehabilitation by a multi-professional team from hospital to homes	Sweden 2013	Eklund et al. (23)
Better SPPB and walking speed	<b>- Short Physical Performance Battery (SPPB)</b>	12	<b>- The Lifestyle Interventions and Independence for Elders (LIFE)</b> - Similar to the study of Pohar et al. 2014 (26)	USA 2009	Rejeski et al. (27)

## DISCUSSION

This systematic review provides available evidence about the impact of cognitive, physical, and multicomponent interventions on the elderly's independence in IADLs and BADLs.

Cognitive programs sought to prevent the reduction of executive functions and other aspects of working memory that is damaged during the aging process (37). According to the results, cognitive interventions had two outcomes: improving independence in IADLs and BADLs. As a cognitive program,

SMP strengthened the elderly's independence in IADLs by improving internal locus of control, participation, problem-solving, and self-determination skills (28). It is justified in light of the self-efficacy theory that the internal control mechanism can gradually control the individual's behaviors and allows the person to adapt to the social and physical environment (38). Rebok et al. also showed that active cognitive training effectively improved IADLs in the elderly for 10 years (12). The "Insight program" enhanced BADLs in the elderly by using computer games stimulated parts of the brain that controls movements (29). This program therefore focused on executive functions that include selective attention and working memory (39). Selective attention can solve the problems of essential cognitive ability and improve BADLs (40). Researchers in a study stated that video game training could significantly enhance the elderly's cognitive and physical performance, independence, and right to choose (41). The weakness of these two studies was the lack of evaluation of IADLs and BADLs simultaneously.

The results showed that the outcome of physical intervention was the improvement of independence in BADLs. The "three-step workout for life program" (24) and "water exercise training program" (25) focused on physical activity and improving familiar and simple activities for promoting the elderly's independence in BADLs. Physical exercise is an efficient and cost-effective way to prevent the loss of the elderly's functional ability (42). Physical activity's positive effects include independence in self-care activities, higher self-esteem, better life quality, higher life expectancy, and lower mortality (43). Some studies state that exercise can delay elderly dependence and improve physical performances, such as sitting and standing, maintaining balance, and movement (44, 45). Chou et al. support this finding that exercise training interventions are beneficial to boost walking speed and improve balance and performance in the elderly's ADLs (10).

Multicomponent interventions had a variety of consequences. LIFE intervention improved BADLs (26, 27) and focused on psychological empowerment, concepts of Bandura's social cognitive theory (46), and a group-mediated approach (47). This method leads to the internalization of the locus of control (48). The results of Blankevoort et al.'s study support this finding and indicate multicomponent interventions can improve the elderly's physical performance and BADLs (49). Bandura's cognitive theory justifies how enhancing self-efficacy beliefs and outcome expectations in the elderly increases their self-confidence and sense of control over life and make them more independent (50). According to these results, in two programs of the "continuum of care for frail older people" (23) and the "EPRZ" (51), researchers have been able to purposefully improve the independence of the elderly in both IADLs and BADLs. It should be noted that tailoring interventions can be designed as cognitive, physical, or combined interventions based on independence in IADLs or BADLs. Also, the emphasis on creating an age-friendly environment is very valuable in EPRZ because it is made in accordance with the restrictions of the elderly and preserves their independence. In a study consistent with this finding, researchers stated that combined interventions should be tailored based on the elderly's needs and preferences to build a safe and independent life for them (18).

## A Proposed Logic Model for Designing Intervention

Given that independence has different dimensions and is known as a multifactorial phenomenon, it requires tailored multifaceted interventions (52, 53). It seems that the design and evaluation of multicomponent interventions using standard protocols in different elderly populations should be considered in future studies. On the other hand, individual socioeconomic differences among the elderly indicate that tailoring interventions are necessary. Therefore, inspired by the logical models in health promotion program planning, we developed a conceptual framework for designing multicomponent interventions to promote the elderly's independence in activities of daily living. The main components of our proposed logic model are plotted in **Figure 4** and described below.

In the input, situational analysis performs. In our logic model, situation analysis refers to analyzing a collection of the elderly's individual strengths and weaknesses and opportunities and threats of physical and social environments (SWOT analysis).

The process section shows the methods and activities designed to implement the interventions and provide services to the target audience (54). According to the situational analysis, this phase uses problem-based interventions, including cognitive, physical, and multicomponent interventions. Creating an age-friendly environment is also considered to maintain the elderly's independence in our proposed model. According to the WHO, health is affected by how people live, and the physical and social environment can affect people's health-oriented behavior (55). Therefore, it is necessary to design cities and elderly's homes under age-friendly environments. The third component of the process is the need for economic, psychological, and social support to sustain the elderly's independence, which can be achieved through family, friends, NGOs, and the government.

The output demonstrates the achievements of a program in the target audience (56), and it was specified in our logic model as having improved the elderly's independence in ADLs.

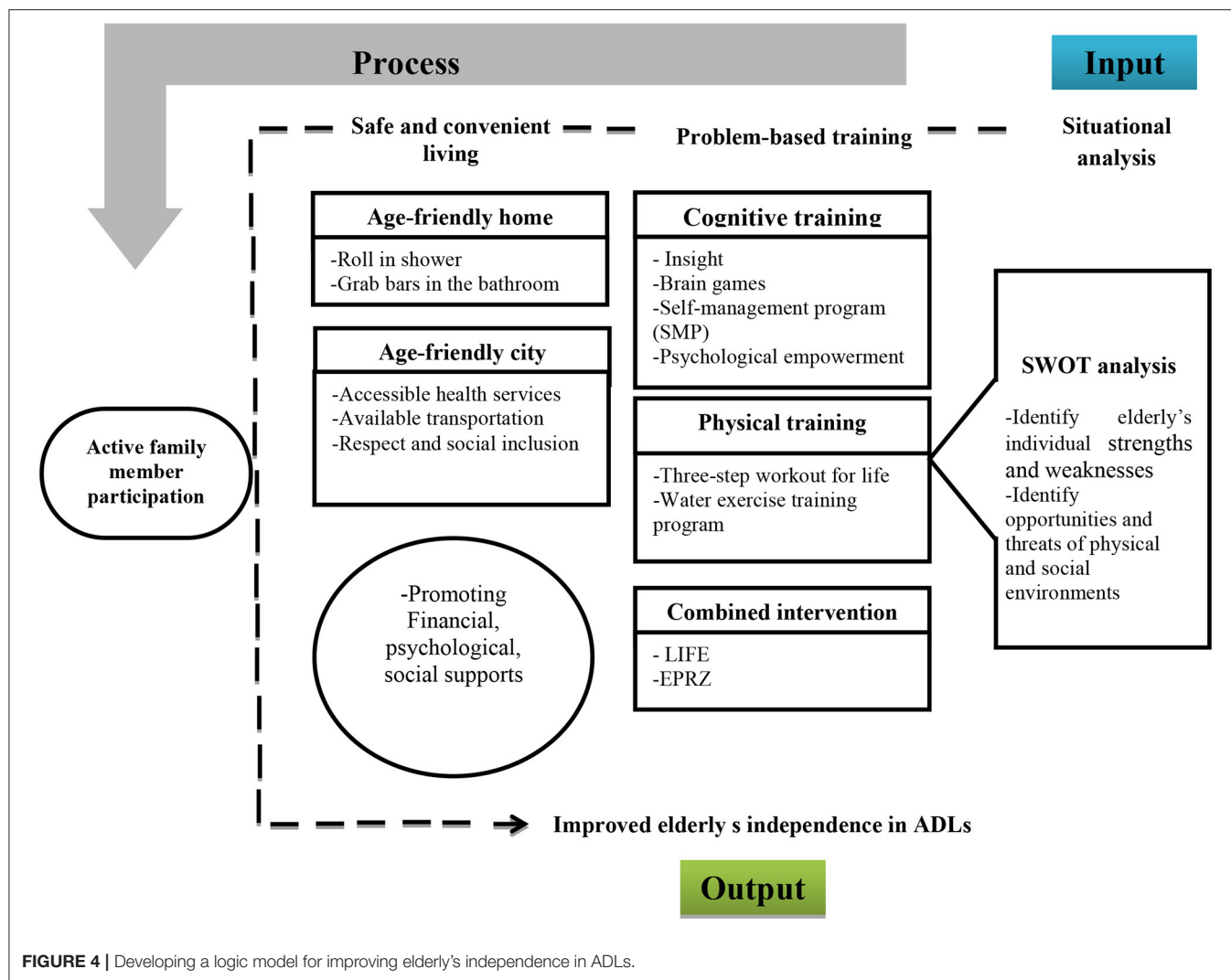
## CONCLUSION

This systematic review provides a useful overview of effective interventions to improve the elderly's independence in ADLs. The development of a conceptual framework is the novelty of this study, which provides a better insight to design interventions for the elderly's independence. We recommend the use of standard protocols for the design, implementation, and evaluation of interventions because it can help to better compare interventions in systematic review and meta-analysis studies. Our proposed logic model can, therefore, be tested as a guiding framework in the design of interventions. Another systematic review should also be performed—one that focuses on a specific type of intervention, such as cognitive interventions.

## Limitation

In its binding to English-language publications, the studies' geographical scope has been limited. Also, the studies done in





Persian but not indexed in English databases were not included in the strategy search. In the present study, the meta-analysis was not performed due to shortcomings in quantitative indices and different measuring tools.

## DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article/**Supplementary Material**.

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## AUTHOR CONTRIBUTIONS

MK and MM-J collaborated equally on all parts of this manuscript.

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# Using Stakeholder Perceptions to Inform Future Efforts to Implement Mental Health First Aid Training in China: A Qualitative Study

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**Background:** The Mental Health First Aid (MHFA) training program has been widely implemented in many high-income countries. Evidence on the adaptation of this and other similar programs in resource-constrained settings like China is very limited. This study aimed to explore the views of key stakeholders on the implementation issues and contextual factors relevant to the scale-up of MHFA in China.

**Methods:** Informed by the *Consolidated Framework for Implementation Research*, five implementation domains of intervention characteristics, characteristics of individuals, contextual adaptation, outer and inner setting, and implementation process were investigated through semi-structured in-depth interviews. Twenty-four stakeholders with diverse expertise in the Chinese mental health system were interviewed. Transcripts were coded using NVivo 12 software and thematically analyzed.

**Results:** Fifteen themes and 52 sub-themes were identified in relation to the five domains. Participants saw MHFA as meeting the need for more evidence-based interventions to improve population mental health. Previous participants in MHFA training were satisfied with the course, but their intentions to help and levels of self-efficacy varied. Contextual adaptation of course content, delivery formats, and financing models, was seen as essential. External health policies and some socioeconomic factors (e.g., improved living conditions) were perceived as potential enablers of scalability. Low levels of engagement in health interventions and lack of supportive social norms were identified as potential barriers while executive support, quality control, and sustainable funding were viewed as facilitators of implementation.

**Conclusion:** MHFA training meets some very important current societal and public health needs in China. To achieve its potential impact, significant contextual adaptation is required, particularly in terms of course content, delivery formats, and financing models. Overcoming low levels of engagement in community-based mental health interventions and combating stigma will also be critical for its scale-up.

**Keywords:** implementation, scale-up, mental health, Mental Health First Aid, evidence-based intervention, qualitative research



## INTRODUCTION

Mental, neurological, and substance use disorders affect a significant portion of the global population with a high burden, particularly in low- and middle-income countries (LMICs) (1). The latest epidemiological data show increases in the prevalence of these disorders in China, with an estimated 12-month prevalence of any of the above disorders of 9.3% in 2013 compared with 1.1% in 1982 (2), and a projected increase of 10% in the disease burden between 2013 and 2025 (3). In both developed and less-developed countries, the number of people with untreated mental disorders far outweighs those that receive treatment. In China, this unmet need constitutes an ongoing challenge to the mental health system (4).

Many factors, both individual and structural, interact to influence people's mental health service use (5). Among these factors, mental health literacy—defined as “knowledge and beliefs about mental disorders which aid their recognition, management or prevention” (6)—has been associated with improved attitudes and intended helping behaviors towards people with mental illness (7). Higher mental health literacy has been found to be a predictor of mental health service use (8). Unfortunately, evidence shows that Chinese people, including both laypeople and general health professionals, often have poor mental health literacy (9, 10) and high levels of stigma remain a significant problem (5, 11).

In recent decades in high-income countries (HICs), concerns about the contribution of poor mental health literacy and stigma to the mental health treatment gap have led to the development of interventions designed to address these issues (12). These interventions include the Mental Health First Aid (MHFA) training program, which focuses on training members of the public to provide mental health first aid (i.e., the help offered to a person with a mental health problem or crisis until appropriate professional help is received or the crisis resolves) (13). The content of the MHFA training course is based on a series of guidelines developed using the Delphi expert consensus method (14). In an MHFA course, people who are qualified to independently deliver courses are called *MHFA Instructors* (Instructors), and people who have completed an MHFA course are called *Mental Health First Aiders* (MHFAiders).

Since its inception in 2000 in Australia, MHFA has evolved into a global movement and is now implemented in over 27 (mostly English-speaking high-income) countries (14). In most countries, local MHFA organizations use a “*train the Instructor model*” that Instructors pay for their Instructor training and then charge their MHFAider trainees or are funded by their organizations to run training. This model (see **Supplementary File 1** for details) has been found to facilitate the dissemination of MHFA in these countries.

MHFA programs have been extensively evaluated and shown to improve knowledge, mental health first aid intentions and confidence and reduce stigma (15, 16). Several small studies conducted in Chinese-speaking communities in Hong Kong and Australia have shown similar effects (17, 18). However, evidence in LMICs on how best to sustainably implement MHFA is still limited (13), although such countries are likely to benefit from

evidence-based interventions developed in HICs with a greater budget allocated to health care and preventative services (19).

The Shanghai Mental Health Center, a specialized mental health institution in China, started to conduct the *Standard MHFA Training Course* in mainland China in 2017 after authorization by the *Mental Health Association of Hong Kong*. As of December 2020, there are 13 trainers in Shanghai and 30 training sessions have been delivered to 759 participants. The latter adopted the MHFA program from Australia and drew up the Chinese curriculum in 2004, maintaining much of the original format (14). Hong Kong and Australia have largely similar community-based mental health systems (20, 21); however, the mental health service system in mainland China is still largely hospital-centered (21, 22). Cultural understanding of mental health may also vary between Hong Kong and mainland China (e.g., In China, it may be more common to relate mental wellbeing to a harmonious relationship with others in the social context, rather than to an individual's growth and autonomy) (23).

This paper reports on a qualitative study that was undertaken to understand the implementation issues and contextual factors among key stakeholders in order to promote future scale-up of MHFA in China in a culturally appropriate way.

## METHODS

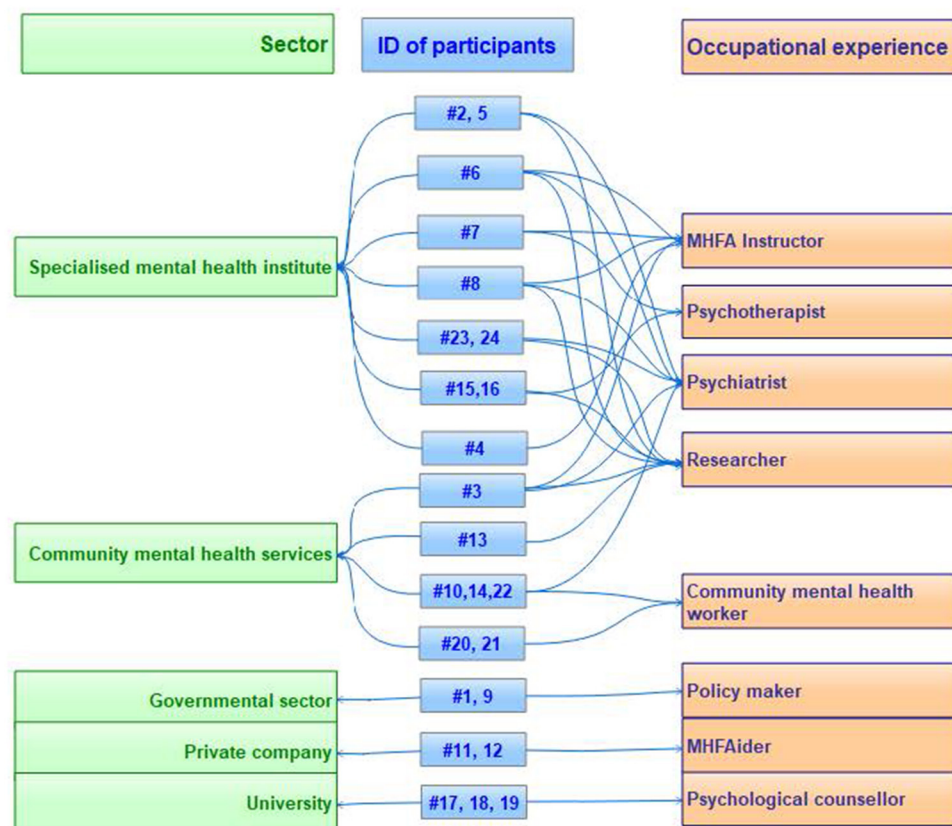
### Study Setting

Semi-structured in-depth interviews were conducted in 2019 in Shanghai, China. As one of the most developed metropolitan regions of China, Shanghai has a relatively well-resourced mental health system and the ability to implement high-quality interventions (22). Due to its long history of openness and internationalization, Shanghai may also be more likely to be a pioneer adopter of an international intervention such as MHFA. Shanghai residents may also have higher than average levels of mental health literacy and greater interest in interventions in this field (24).

### Participants and Recruitment

Participants were potential key stakeholders for the wider implementation of MHFA in China. We employed maximum variation (in terms of gender, age, occupation, geographical region) and purposive and snowball sampling strategies in order to increase the likelihood that the findings reflect a wide range of views and perspectives. Participants were recruited from diverse mental health service settings *via* personal contacts or through MHFA training sessions happening in Shanghai during the study period. Participants were encouraged to introduce other eligible individuals they knew. Recruitment of participants was discontinued until data saturation was reached, i.e., when no further new information was obtained in subsequent interviews.

Twenty-four participants (women, 50%) were interviewed, representing the following stakeholders: psychiatrists ( $n = 10$ ), mental health researchers ( $n = 3$ ), mental health policy makers ( $n = 2$ ), community mental health workers ( $n = 2$ ), psychological counselors in universities ( $n = 3$ ), human resource (HR) staff in



**FIGURE 1** | Background and occupational experience of participants ( $n = 24$ ).

large-scale enterprises ( $n = 2$ ), and psychotherapist and social worker ( $n = 1$ , respectively).

**Figure 1** demonstrates the diversity of relevant settings and occupations of participants in this study. More than half of the participants ( $n = 13$ , 54%) had multiple occupational roles. Notably, 3 out of the 10 psychiatrists and the psychotherapist and social worker were also Instructors, and the two HR staff were MHFAiders. Seven participants had personal experience of MHFA training and were asked additional questions about their perceived satisfaction with their participation experience, motivations to participate, and self-efficacy as an Instructor/MHFAider.

The demographic and occupational characteristics of participants are shown in **Table 1**. Participants came from five provincial regions of China, aged between 28 and 53 years (mean 38.1, median 44), and all of them had a university education. On average, participants had 11.4 years (SD 7.5, range 3–27) experience in their relevant occupations.

## Data Collection

Informed by the *Consolidated Framework for Implementation Research* (CFIR) (25), five key implementation domains were identified, i.e., intervention characteristics, characteristics of individuals, contextual adaptation, outer and inner setting, and

the implementation process. Given that MHFA is still at an early stage and has not been widely implemented in mainland China, the CFIR domains identified as being most relevant for the future scale-up of MHFA in China were selected, rather than those that are relevant during or after the implementation. These domains, their definitions, and relevant constructs of CFIR are presented in **Table 2**.

An interview guide consisting of open-ended questions derived from the above implementation domains was developed for the interviews. These questions were organized in a flexible schedule, allowing for probing of further information and clarification where appropriate (see **Supplementary File 2** for the full interview guide in English and Mandarin languages). Interviews were conducted in Mandarin by SL and audio-recorded with participant consent via face-to-face (63%,  $n = 15$ ), over the phone (8%,  $n = 2$ ), or WeChat (29%,  $n = 7$ )—a commonly used mobile application for social interaction in China. Interviews took place in a private room at the workplace of either the interviewer or participant and lasted 37–86 min (mean 53.1, SD 9.9).

Given that MHFA has been mostly implemented in HICs and the majority of people in China have limited knowledge of it at this stage, a document consisting of an introduction to MHFA and its implementation models in Australia and

**TABLE 1** | Characteristics of participants by occupation.

Occupation	Region	N	Gender (%, women)	Mean age in years (SD)	Average occupational years (SD)
Psychiatrists*	Shanghai	6	50%	43.0 (6.1)	19.4 (7.3)
	Beijing	2			
	Heilongjiang	1			
	Henan	1			
Mental health researchers	Shanghai	2	67%	29.7 (2.1)	4.7 (0.6)
	Chongqing	1			
Mental health policymakers	Shanghai	1	0%	39.5 (0.7)	5.0 (5.7)
	Beijing	1			
Community mental health workers	Shanghai	2	100%	43.0 (14.1)	4.0 (1.4)
Psychological counselors	Shanghai	3	67%	35.3 (3.1)	8.3 (3.5)
Human resource staff <sup>#</sup>	Shanghai	2	0%	35.5 (3.5)	14.0 (2.8)
Psychotherapist*	Shanghai	1	100%	40.0 (NA <sup>£</sup> )	11.0 (NA <sup>£</sup> )
Social worker*	Shanghai	1	100%	31.0 (NA <sup>£</sup> )	5.0 (NA <sup>£</sup> )
Total		24	50%	38.1 (6.8)	11.4 (7.5)

\*Three out of the 10 psychiatrists and the psychotherapist and social worker were also qualified Instructors.

<sup>#</sup>The two human resource staff were also MHFAiders.

<sup>£</sup>Not Applicable.

**TABLE 2** | Selected implementation domains, definitions, and constructs of the Consolidated Framework for Implementation Research (CFIR) used in the study.

Domains	Definition of domains	Relevant constructs of CFIR
1. Intervention characteristics	Stakeholders' perceptions of MHFA as an intervention, including its potential impact, advantages, and disadvantages over current practice	Relative advantage Evidence strength and quality
2. Characteristics of individuals	Motivations to participate, experience and satisfaction, and self-efficacy among people with participation experience of MHFA training	Knowledge and beliefs about the intervention Self-efficacy
3. Contextual adaptation	Components of MHFA that perceived to be adapted, tailored, or refined to meet the local needs of China	Adaptability
4. Outer and inner setting	Outer and inner setting-related factors that may facilitate the future implementation and scale-up of MHFA in China	External policies and incentives Peer pressure Implementation climate
5. Implementation process	Contextual factors that could support or hinder the implementation process	Planning Engaging Evaluating

other HICs was sent to participants before their interviews (see **Supplementary File 1** for the full text of this document in English and Mandarin languages). The research was approved by the Human Research Ethics Committee at the University of Melbourne (Ethics ID: 1853289.1) and the Ethics Committee at the Shanghai Mental Health Center (No: 2018-62).

## Data Analysis

Recorded interviews were transcribed verbatim and checked for accuracy by SL. Identifying data were removed from the transcripts prior to analysis, and participants were relabeled by their occupational roles and a number (e.g., Psychiatrist #1). Data were systematically managed, organized, and coded using NVivo 12 software. Data were analyzed using the thematic analysis method (26). SL developed and applied an initial coding framework. A discussion of this preliminary coding among the authors led to the iterative development of the final analytical framework. KS independently performed coding on 10% of transcripts. Fifteen themes and 52 sub-themes were identified, which were structured around the five implementation domains as listed in **Table 3**.

## RESULTS

### Domain 1. Intervention Characteristics Perceived Impacts and Challenges

Participants acknowledged that MHFA meets the enormous needs for mental health interventions in China and has the potential to improve the mental health of the population. Specifically, participants thought that, if successfully implemented, MHFA may have the following impacts: (1) to help to improve levels of mental health literacy among members of the public, which will improve the supportive social environment for people with mental illness; (2) to enhance the capability of health professionals in general hospitals and communities for prevention, detection, and treatment of mental disorders; (3) to support families of patients with mental illness in providing better care; (4) to help members of the public to identify and support individuals with mental health problems in specific settings, such as universities or workplaces.

**TABLE 3 |** Domains, themes, and sub-themes of implementing MHFA in China.

Domains	Themes	Sub-themes
1. Intervention characteristics	1.1 Perceived impacts	1.1.1 To Improve mental health literacy of people 1.1.2 To enhance the capability of general health professionals 1.1.3 To facilitate families of patients to provide better care 1.1.4 To identify individuals with mental health problems 1.1.5 To promote early detection 1.1.6 Limited potential benefits
	1.2 Relative advantages	1.2.1 Systematically designed contents 1.2.2 Inclusion of MHFA skills 1.2.3 Standardized training procedure 1.2.4 Active interactions in the course
	1.3 Relative disadvantages	1.3.1 No clear target in population or mental health problems 1.3.2 Course content too complex 1.3.3 Limited flexibility for Instructors 1.3.4 Failure to consider mental health-related stigma 1.3.5 Lacked localized contents
2. Characteristics of individuals (only participants with personal experience of MHFA training involved)	2.1 Experience and satisfaction	2.1.1 Instructors: all have delivered at least one course 2.1.2 MHFAiders: just completed a standard course 2.1.3 All satisfied with their experience
	2.2 Motivations to participate	2.2.1 Instructors: helpful for career development 2.2.2 MHFAiders: nominated to do so by their employers
	2.3 Self-efficacy	2.3.1 Instructor: confident; tight for time; could be better 2.3.2 MHFAiders: better knowledge but not confident to offer help
3. Contextual adaptation	3.1 Course contents	3.1.1 More flexibility 3.1.2 Extra content on anti-stigma 3.1.3 More cases from Mainland and community 3.1.4 Enhancing skills development 3.1.5 Optimizing the current course
	3.2 Course delivery	3.2.1 Involving new media and Internet 3.2.2 Concerns about the effectiveness of these new methods
	3.3 Financing models	3.3.1 Limited affordability 3.3.2 Charging may impede participation 3.3.3 Possible alternative financing sources
4. Outer and inner setting	4.1 Policies	4.1.1 Most mental health policies are supportive
	4.2 Socioeconomic enablers	4.2.1 Attitudes change in a favorable way 4.2.2 Increased knowledge and interests 4.2.3 Improved living conditions 4.2.4 The establishment of mental health network
	4.3 Pressure from existing programs	4.3.1 Few programs similar to MHFA exist 4.3.2 Current public services already cover the content of MHFA training
5. Implementation process	5.1 Target population	5.1.1 Target institutions or organizations 5.1.2 Instructor candidates need to have a medical background 5.1.3 Any interested adults can be MHFAiders
	5.2 Barriers	5.2.1 Poor mental health literacy 5.2.2 Low engagement in health education programs 5.2.3 Lack of supportive social norms and values 5.2.4 Shortage of mental health resources
	5.3 Facilitators	5.3.1 Executive support from the government and involved organizations 5.3.2 Continued quality monitoring 5.3.3 Development of a local implementation network 5.3.4 Sustainable funding 5.3.5 Offering a certificate 5.3.6 other strategies for scale-up and sustainability



Several participants worried that MHFA could be difficult to be put into practice in China and doubted that the implementation of MHFA would bring any impacts. The major perceived constraint was the upfront cost of training that would be borne by Instructors and MHFAiders. Another reason was limited understanding of the concept of mental health first aid in China. They also thought that it would be difficult for the program to realize its objectives without sufficient government support, which is currently the case with MHFA.

People attend a training course aiming to help others, and you are trying to charge them personally for this! Who is willing to do such a thing?!... I think this program is unlikely to succeed in practice. (Psychiatrist #2)

### Relative Advantages and Disadvantages

Participants thought that, compared to other mental health programs in China, the most prominent advantage of MHFA was that it was systematically designed and could be applied to a wide range of mental health problems and diverse groups of people. Interviewed Instructors and MHFAiders also mentioned that the inclusion of opportunities to practice skills (as well as information provision) was attractive. Another advantage was the standardized training procedure, which was thought to be helpful to guarantee the course quality. Active interactions during the course were also positively appraised by previous Instructors and MHFAiders.

We lack such systematically designed interventions like MHFA, with both knowledge and skill practice included. It can be much more powerful for acquiring knowledge through systematic learning than by sporadic learning. (Psychotherapist #1/MHFA Instructor #4)

However, some of the above advantages were considered by other participants to be disadvantages. For instance, MHFA coverage of a wide range of mental health problems and diverse groups of people, one participant commented that “*targeting on all means no target at all*” (Psychiatrist #5). Several participants thought that the content included in the MHFA curriculum was too much and too complex for members of the public to master through a 12-h course (the length of a *Standard MHFA Course*).

Under a first aid circumstance, people usually depend on their instinctive reactions on the spot, with no time to think at all, so the simpler the better... Are you sure the public can remember so many points when needed? (Mental health researcher #1)

Several Instructors pointed out that the standardized training procedure used in MHFA gives them limited flexibility in course delivery and limits the performance of Instructors, who have different expertise and teaching styles. At least two participants mentioned that “*the current MHFA curriculum failed to consider the widespread stigma and discrimination toward mental illness in the Chinese context, but subjectively presumed that the general public is willing to offer help (to people with mental health problems), which may not be the case in reality*” (Community mental health worker/MHFA instructor #1). Instructors and

MHFAiders consistently pointed to a lack of localized content in the current curriculum.

## Domain 2. Characteristics of Individuals

Interviewed Instructors had delivered at least one course in the previous year of the study and the two MHFAiders had just completed their course. Overall, they were satisfied with their participating experience, appraising it as attractive, interesting, and lively. Most Instructors indicated that they were motivated to be an Instructor because they viewed it as helpful for career development. The two MHFAiders participated because they were nominated by their organizations.

Instructors expressed high self-efficacy, though some of them felt that the course schedule was rather tight or that their course delivery could improve. MHFAiders thought the course would facilitate them to offer timely support to employees with mental health problems in their organizations, although they worried that their skills would not be good enough to help others, that they might make mistakes or might forget the material before getting a chance to offer help.

## Domain 3. Contextual Adaptation

### Course Content

Several participants suggested more flexibility in course content, rather than adhering to the standardized format. For example, they advised dividing the current course into several packages by type of disorder or according to the needs of different groups of potential users (e.g., relapse identification-related content for families of patients with mental illness; early detection-related content for non-mental health professionals; and suicide or self-harm-related content for university students).

The training content should be determined by the actual needs of the audience. ... Only in this way, a training course can be attractive to the audience and effective in practice. (Psychiatrist #5)

However, nearly the same number of participants took an opposite position on this issue as they thought that it was important for learners to have an overall understanding of common disorders, because it is hard to know what problems might happen to people around them.

Several participants suggested adding extra content on stigma, because, currently, many (Chinese) people lack adequate knowledge of mental health and believe myths about people with mental illness, including that they are unpredictable, dangerous, and immoral. A few Instructors and MHFAiders also advised including scenarios from Mainland China rather than from Hong Kong.

Several Instructors also provided suggestions on how to optimize the current curriculum, for example, to edit expressions and jargon from Cantonese style to Mandarin. The videos used in the current curriculum were seen as having a strong Hong Kong focus which they found distracting due to failure to reflect life in mainland China. Two Instructors further suggested adjusting the disorders included in the course (e.g., “*to include bipolar, but slightly reduce contents of substance abuse*,” MHFA Instructor #1).

Several other participants addressed the need to culturally adapt the content in a general way.

The prevalence of mental disorders varies by countries and regions, so the focus of the course contents should also be different. (Psychiatrist #10/ MHFA Instructor #2)

People from the East and West are different. For example, Chinese people are more subtle, whilst foreigners are more open; our people ask for more privacy (when talking about mental health problems) but Westerners may feel okay to talk openly. ... Thus, it is critical to culturally adapt the course content. (Psychiatrist #6)

### Course Delivery

Although happy to attend the course, most Instructors and MHFAiders felt it was challenging for them to allocate 2 days to the training due to their full work schedule. Regarding this barrier, some participants suggested involving new media, for example, mobile apps for social networking, and the Internet to deliver the course. These formats may enable participation at people's convenience or by people from rural areas and remote regions (generally with limited mental health resources). These course delivery formats were thought to be appropriate for people who increasingly prefer to access resources and training *via* digital sources. Nevertheless, there were even more participants worrying about the effectiveness and quality of these new training formats.

Online courses are not good at interacting, their actual effectiveness is unknown either. For a new thing like MHFA, learning online might be not as effective as traditional face-to-face training. (HR staff member #1/ MHFAider #1)

### Financing Models

As previously mentioned, in the implementation of MHFA in Western HICs, both Instructors and MHFAiders need to pay for their courses (unless the course is funded by a participant's organization). While a few participants thought that certain groups of people (e.g., families of patients with mental illness, people with strong personal interests or for career development) might be willing to pay for the course, most participants thought that many potential users would be less likely to participate if the financing model used in HICs was adopted in China, because they believed that while people are still struggling to live, they have limited interests in such learning.

It can be very difficult to implement a (health education) program if you charge participants, even in the most developed regions of China like Shanghai. (Mental health policy maker #1)

Alternatively, more than half of participants thought that government-funded services or institutions paying for staff to attend training were feasible options for financing.

## Domain 4. Outer and Inner Setting Policies

Most participants acknowledged that the aims of MHFA align with the directions advocated in most current mental health policies in China, including the Mental Health Law, "Healthy

China 2030 (i.e., a recent agenda of the central Government for health and development) and the China National Mental Health Working Plan (2015–2020)."

### Socioeconomic Enablers

Several other socioeconomic factors were perceived as enablers, and the one that received the most recognition related to the societal change of attitudes toward mental illness. Overall, participants thought that members of the public were more accepting and less likely to avoid people with mental illness and more interested in mental health. They opted to attribute such changes to increased mental health knowledge and improved living conditions. Another social enabler was the mental health network in Chinese society, in which multiple government sectors beyond health were actively involved.

### Pressure From Existing Programs

Most participants thought that, currently in mainland China, there were few programs similar to MHFA. However, several psychiatrists included in this study thought that the contents of MHFA had been fully covered by public mental health services in specialized psychiatric hospitals through activities like health education to patients with severe mental illness and their carers and regular campaigns on mental health knowledge dissemination among the general public.

## Domain 5. Implementation Process Target Population

More than half of participants thought that Instructors should be mental health professionals, such as psychiatrists, psychotherapists, or psychiatric nurses or those with some medical background, in case misleading knowledge was transmitted. One interviewed psychiatrist explained that "*the large amount of improper health knowledge, which is being produced and disseminated almost every day, causes far more troubles than ignorance*" (Psychiatrist #5).

Almost all participants thought that any interested adult could be trained to be an MHFAider. Furthermore, participants thought that people who were staff in the health and education sectors, community practitioners, social workers, policemen, or volunteers were more likely to want to undertake training.

Though it was well-understood that the target population of MHFA in HICs are those interested individuals in the community (a wide concept, not limited to residential communities), more than half of participants thought that targeting organizations for recruitment would be more feasible, and such organizations could be general hospitals or community health centers. Given that MHFA was an "unfamiliar concept for most Chinese people, it was also seen as favorable to focus on universities and large-scale enterprises, as people in these were more likely to be open to innovation and better at learning new skills compared to other population groups.

### Barriers

The most commonly mentioned factors that may impede the wide implementation of MHFA were stigma, discrimination, and prejudice, although most participants acknowledged the

improvement in knowledge of and attitudes toward mental health in the past decades.

It is better (than decades ago), but members of the public are still apt to avoid or refuse people with mental health problems. (Community mental health worker #2)

Another major barrier was low engagement, which is common for most community health programs. Several participants emphasized that the engagement in mental health-related activities is usually even lower than in other activities, e.g., for chronic disease. As noted above, lack of time to attend training and the requirement to pay for attendance were also mentioned as reasons for low engagement in training.

The lack of supportive norms and values in Chinese society was highlighted. More than three participants mentioned that, unlike in HICs, at present, Chinese people have limited motivation to help others, not to mention that they need to pay for this. One researcher who was also a social worker mentioned that *“even if I would like to help, how can I?! Our culture advocates for keeping family scandals domestic, so it is difficult for outsiders (people beyond the family) to get involved”* (Social worker #1). The shortage of mental health resources, especially in those less developed and remote regions and rural areas in China, was perceived as another barrier.

### Facilitators

Government support was thought to be an indispensable factor for the successful implementation of a program in China, because such support has the potential to encourage supportive policies and funding, and supported programs, particularly health-related ones, are usually seen as better quality. Similarly, executive support and alignment with the priorities of the organization where the program would be implemented were thought to be essential.

The importance of continuing to monitor course quality was addressed. One psychiatrist took the recent cancellation of a social training program for psychological counselors in China<sup>1</sup> as an example to illustrate the possible consequences of poor quality control.

To achieve a wide implementation, the development of a local implementation network with relevant organizations was thought to be necessary. Local health sectors and specialized mental health hospitals, professional associations or groups, mental health-related social organizations, or traditional and new media were identified as potential members of such networks.

As mentioned in the contextual adaptation domain, most participants doubted the feasibility of the financing model of HICs being applied in China. The necessity of developing a sustainable financing model that may work for China was highlighted, but no specific suggestions were given.

Offering a completion certificate after an MHFA course was commonly practiced in HICs, but participants in this study had varied opinions on the value of this practice. Instructors, researchers, and psychological counselors were more supportive, while others were more hesitant as they thought the certificate would bring neither financial benefits nor career promotion. At least two participants expressed their concerns about possible improper utilization of the certificate, for example, the risk of it being seen as an approval to conduct psychological counseling.

Several participants also proposed that, in the long run, it was essential for MHFA to be integrated into the current mental health system. However, almost all participants thought that this would only be possible after the program has shown effectiveness. Several factors, including shortage of mental health professionals, extra burden on already heavy workloads, and limited executive support, were raised as obstacles to achieve this goal.

Several other strategies for scale-up were proposed, including (1) highlighting the potential benefits for self-help (besides helping others); (2) starting with certain settings like universities or workplaces in economically developed metropolitan areas; (3) advertising widely through various media in order to raise the awareness of this program; and (4) offering free courses to the public at the early stage.

## DISCUSSION

Based on the views and perceptions of key stakeholders, this study investigated the implementation issues and contextual factors relevant to the future implementation of MHFA in China. The findings of this study can provide guidance on how best to adapt and implement MHFA in China in a culturally appropriate way. It also offers learnings for adapting population-based mental health interventions that have shown benefit in HICs to lower-resource settings with higher levels of stigma and reluctance to engage in mental health education interventions.

### Consistency and Divergency

Most participants agreed that the implementation of MHFA in China aligns with the societal and public health needs for more evidence-based mental health interventions, and it also aligns closely with recent mental health policies in the country (*“Healthy China 2030,”* for example). However, most interviewees agreed with the need to include locally appropriate course content and to consider how such a program could be funded and supported. These findings indicate directions that are likely to be used by program implementers to effectively adapt MHFA for the Chinese context.

Some participants favored simplified course content, media/Internet course delivery, and more flexibility for Instructors; however, others preferred a comprehensive approach, worried about the actual effectiveness of online training, and believed that limited flexibility for Instructors would enhance fidelity and produce better outcomes. Evidence suggests that stakeholders often have different values and perspectives on effective public health interventions (27). For example, practitioners often find evidence-based interventions difficult to conduct in community settings, especially when there

<sup>1</sup>To satisfy the increasing demand of psychological counseling services, the Chinese Ministry of Labour (the currently Ministry of Human and Social Affairs) authorized qualified social organizations to carry out training programs of psychological counselor since 2001. However, these social training programs were canceled in Sep. 2017, partly due to their poor training quality.



is limited information about how to adapt programs to the local context, and health policy makers and program implementers are often reluctant to consider “new” interventions when effectiveness has not been demonstrated in their particular setting. Therefore, a better understanding of these divergent perceptions of stakeholders as well as the development of strategies to comprehensively address them should be taken into consideration in future implementation. Such dynamic interaction between the features of MHFA as a program, its potential users, and the local setting will facilitate the uptake of this program in a new cultural context (28).

## Adaptability vs. Fidelity

Adaptability and fidelity are central concerns of implementation research in public health, although their relative value has been controversial (29). Contextual adaptations are often necessary to improve stakeholder buy-in, increase the program’s relevance for local populations, and facilitate the delivery of the intervention to the target population (30). Meanwhile, evidence shows that fidelity to the original intervention improves effectiveness, whereas significant modifications or deletions can diminish effectiveness (29).

This study identified several key adaptations of MHFA to be implemented in China, including those related to course content, delivery formats, and financing models. Some of these adaptations increase the likelihood of reaching a wider population or improving the acceptability of the program. A good example is to include extra anti-stigma components in the curriculum. In conceptualization, designers of MHFA presumed that people are willing to offer help to someone with mental illness if they possess relevant knowledge and skills. Originally, the anti-stigma content was not separately listed in the course, but embedded in the whole process of providing mental health first aid, such as to be empathetic, non-judgmental, and respectful to the person (14). Nevertheless, Chinese participants thought that, when combatting mental health-related stigma in China (11), a more direct approach may be necessary.

Evidence suggests that, in many LMICs, experiences of stigma, discrimination, and human rights abuses due to mental illness are common and severe (31). Multi-nation epidemiological studies have also shown higher rates of reported stigma among people with mental disorders in developing countries than in developed ones (32). Therefore, it seems necessary to include more anti-stigma content in the MHFA curriculum for China. Such adaptations may substantially enrich the content of MHFA to be implemented in LMICs, as well as further enhance its efficacy as an anti-stigma program.

While maintaining fidelity to achieve outcomes can result in research-based models’ poor fit with the real world, improper adaptations may result in program drift away from the core elements needed to achieve designed outcomes (30). For example, some participants proposed allowing more flexibility to the systematically designed MHFA curriculum by splitting the courses into several packages targeting different disorders or people with particular interests. Such cultural tailoring might help to attract more attendance; nevertheless, it may blur the

core elements of MHFA that make it distinguishable from other interventions and may also reduce its effectiveness.

## Other Health Workers as a Target Population

In addition to delivery in the community, some study participants suggested that health care settings, such as general hospitals or community health centers, could be suitable for MHFA implementation. If so, other health workers (i.e., those not directly involved in mental health) offer a potential first-line audience of MHFA in its wider implementation. This is very different from the practice in HICs, which generally excludes health workers (mental or other) (13). This may be partly explained by the differences in the mental health system between China and HICs. Western HICs such as Australia have relatively well-developed community mental health services (21), and most health practitioners in these countries have undertaken basic mental health training. In comparison, mental health services in China mostly remain hospital-based (22) and the recovery-oriented community mental health system is still in its early stages of development (33). Besides mental health specialists, most general health workers in China lack the skills and capability to recognize when a person is developing a mental illness in a timely manner or to provide needed support (10). However, these health workers have a higher chance of coming into contact with people with mental health problems than the general public, and frequently they act as gatekeepers for early detection of mental illness (34). Therefore, to have this group of people as the target population in the implementation process is of practical significance in enhancing early detection and narrowing treatment gap for mental disorders.

## The Role of MHFA in Behavior Change

Shonkoff stated that “the gap between what we know and don’t do, is much larger than the gap between what we know and don’t know” (35). By design, MHFA is a mental health intervention aiming to fill the “Know-Do” gap. It includes not only dissemination of mental health first aid knowledge but also promotion of behavior change (i.e., enabling people to offer help to someone in need and promote help-seeking) (13). However, this aspect of MHFA was not typically recognized across the study participants. Compared with the high endorsement among Instructors/MHFAiders, psychiatrists were more likely to understand MHFA as a very traditional health intervention, largely focused on raising awareness or providing knowledge. Accordingly, they perceived that such an approach would have quite limited benefits.

This finding suggests that behavioral change-oriented programs like MHFA are still relatively new among mental health stakeholders in China and their value is yet to be fully appreciated. A similar issue has also been reported in interventions for non-communicable diseases in China, which heavily rely on “what is known/said,” rather than on “what is done” (36), though research has repeatedly indicated that a change in knowledge or attitudes will not necessarily lead to a change in behavior (37). Therefore, during the wider implementation of MHFA, it may be useful to address the role of



MHFA in promoting behavior change, i.e., the mental health first aid actions that are central to the program.

## Strengths and Limitations

This study is the first formal effort to consider how a program like MHFA could be culturally adapted and taken to scale in a resource-constrained setting like China. The study participants were all identified as having relevant knowledge about the future development and implementation of MHFA in China. Their diverse roles in relation to the field of mental health settings and service delivery provided a wide range of views and perspectives. Nonetheless, several limitations of the study should be considered. Firstly, participants were mostly from metropolitan regions of China (87.5%, Shanghai and Beijing), so the study findings are likely to be most relevant for urban areas compared to rural or less developed regions, although these regions are likely to be those with the highest demand for programs such as MHFA. Additionally, the study participants are unlikely to be representative of the full range of stakeholders who will influence future implementation. Although every effort (e.g., wording in a neutral way, taking a neutral position during interviews and data analysis) was taken to minimize possible information bias, the way that participants expressed their opinions might be positively biased due to their prior familiarity with the interviewer or the MHFA training program.

## CONCLUSION

As an evidence-based mental health intervention in developed countries, the MHFA program could meet some of the urgent societal and public health needs in China to improve mental health care delivery and outcomes in the population. However, to achieve this promise in a very different society and context from where MHFA was originally developed, significant contextual adaptation is required, particularly in terms of course content, delivery formats, and financing models. To enable this adaptation, it is very important to understand the barriers and facilitators to wider implementation, as well as how to address these in the Chinese context, in particular, stigma and a low level of engagement in mental health education interventions. As the re-development of MHFA currently underway and a randomized controlled trial funded and planned, further reflection on the findings of this study and other lessons from this research will contribute to the evidence base for cultural adaptation and implementation of health education interventions in China.

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## DATA AVAILABILITY STATEMENT

Raw qualitative data cannot be shared due to ethical restrictions. Anonymized quantitative data will be shared on a reasonable request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Human Research Ethics Committee at the University of Melbourne (Ethics ID: 1853289.1) and the Ethics Committee at the Shanghai Mental Health Center (No. 2018-62). The participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

SL designed the study, developed the interview guide, coordinated and conducted fieldwork, analyzed data, and drafted the manuscript. YH was the key liaison for the recruitment of participants. KS conducted double-coding on 10% of transcripts and checked key themes. NR and BO advised and supported the development of the study design. PA provided input to the final draft. All authors read and approved the final version of this manuscript for publication.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2021.557282/full#supplementary-material>

**Supplementary File 1** | Introductory document on MHFA in English and Mandarin languages.

**Supplementary File 2** | Full interview guide in English and Mandarin languages.

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

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# Health Control Beliefs and Attitude Toward Treatment in Psychiatric and Non-Psychiatric Clinical Samples

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Although there is accumulating evidence on the potential influencing factors of medication adherence, the knowledge about patients' attitudes and beliefs toward treatment is only partly utilized in adherence-improving strategies. Several internal and external factors determining adherence have been described regarding many chronic somatic diseases but in recent research, insight on psychiatric patients has been exclusively lacking. As a result, there is a scarcity of effective adherence-improving interventions. Identification of any specific differences or similarities between the attitudes toward treatment of psychiatric and non-psychiatric patients would help to support adherent behavior.

We recruited 189 participants from four departments of general psychiatry (GEN PSYCH,  $n = 106$ ), addictology (ADDICT,  $n = 42$ ) and somatic diseases (NON PSYCH,  $n = 41$ ). The Patient's Health Belief Questionnaire on Psychiatric Treatment (PHBQPT) was performed to assess the patients' attitude toward drug treatment, perceived health locus of control, and psychological reactance.

The most robust difference of the PHBQT scores occurred between the GEN PSYCH and ADDICT subgroups. ADDICT patients scored significantly higher on the internal and external health locus of control and on the Psychological Reactance subscale as well. While GEN PSYCH subjects provided higher scores on the Positive Aspect of Medication compared to ADDICT persons. Interestingly, the only difference between the GEN PSYCH and NON-PSYCH groups was the more pronounced mistrust in physicians in the case of psychiatric patients.

Our data suggest that mistrust toward medication does not differ in psychiatric and non-psychiatric samples, while the acceptance of the doctor's competency may be stronger in the non-psychiatric sample. The analysis of these factors provides information which could help us better understand this important issue and to develop more efficient interventions for improving adherence.

**Keywords:** compliance, adherence, drug attitude, health belief, psychiatric treatment

## INTRODUCTION

Medication non-adherence is one of the most challenging problems of healthcare. In the case of patients requiring psychiatric treatment, non-adherence is considered to be one of the major factors which influence the course of illness and the outcome. According to a report from the WHO, about 50% of patients with a chronic disease are non-adherent to their medication (1) and some authors suggest that improving adherence at a population level may have a higher influence on health than the discovery of a new compound (2). Detailed reviews are available about the factors influencing adherence (3–8) and there are some interesting data on the mediating role of depression on adherence in chronic somatic diseases, such as hypertension (9), cardiovascular disease (2), diabetes (10), and chronic kidney disease (11). However, few direct comparisons have been made between somatic and psychiatric patients' adherence. Further evidence suggested that health-related locus of control can moderate the relationship between a serious somatic disease causing disability and the consecutive occurring depressive symptoms. Authors emphasized the importance of assessment of control beliefs of patients undergoing treatment for serious somatic illness in order to facilitate the recovery process (12).

Medication taking is a complex behavior and several potentially influencing factors have been investigated and proven to correlate with it. The results have shown that demographic, medical, or personality factors have less influence on adherence than psychological and emotional aspects. Comprehensive analysis of these factors led to the recognition of the importance of beliefs about medication's impact on health (13). Further studies confirmed the crucial role of social cognition in medication adherence and Social Cognition Models appeared in the literature of medication adherence (14). One of these concepts is the Health Locus of Control (HLOC) which has been identified as a determining dimension of medication adherence in several fields of medicine (4, 15). The Multidimensional Health Locus of Control Scale was developed by Wallston, Wallston, and de Vellis in order to measure HLOC. HLOC refers to "the degree to which individuals believe that their health is controlled by internal vs. external factors" Wallston et al. (25). The external factor has been divided into two subfactors, such as "chance or fate" and "powerful others." Drug attitude and health control belief have been intensively studied in numerous fields of medicine in order to understand its complexity and impact on adherence. Self-efficacy also plays a positive role in developing patients' attitudes toward treatment. Patients with higher beliefs in their capabilities (higher self-efficacy) are more likely to be pharmacophilic (16).

Medication adherence can be negatively influenced by side effects, stigma, fear of addiction, previous negative experiences, negative attitudes toward drug treatment, and poor insight (17–19). In an exploratory study of adherence of schizophrenic patients it was found that the patients believing that their illness can be controlled by themselves and/or by their physicians were more likely to follow their prescriptions. The link between health locus of control and adherence appeared to be refined by insight

(20). According to the results of one study, psychiatric patients' attitudes toward medication could be negatively influenced by educational level, patients with a higher educational level have been shown to be more skeptical about the usefulness of psychoactive drugs (16).

In this pilot study we investigated the role of beliefs and health locus of control in influencing the attitude toward pharmacological treatment in samples of patients with general psychiatric, addictive, and somatic disorders.

## METHODS

### Study Sample

A total of 195 participants were recruited from four different departments of general psychiatry (Departments A, B, C, and D; hereinafter together referred to as GEN PSYCH,  $n = 112$ ), a department of addictology (ADDICT,  $n = 42$ ), a department of internal medicine (IM,  $n = 20$ ), and a department of neurology (NEUR,  $n = 21$ ) of the Nyíró Gyula National Institute of Psychiatry and Addictions, Budapest, Hungary. A dataset of 189 subjects were entered into the final statistical analysis, as six patients were excluded because of missing data (106 from GEN PSY + 42 from ADDICT + 41 subjects from IM+NEUR depts). Subjects were asked to participate in the survey anonymously. Patients treated at the department of addictology were admitted to the department after a motivational interview. Participants from the GEN PSYCH were diagnosed with psychiatric disorders coded ICD F2, F3, and F4. All patients were voluntarily treated. Patients being treated with at least one psychotropic medication (generally an anxiolytic) from IM and NEUR were selected to participate in the study. For the comparative analysis of different clinical samples with altered adherence characteristics, three subgroups were created: patients from the departments of general psychiatry (GEN PSYCH); department of addictology (ADDICT); and patients from the departments of internal medicine and neurology (NON-PSYCH). The study was approved by the Hungarian Central Ethical Committee, Budapest, Hungary (number of approval: 45735-5/2020). A signed informed consent was obtained from all subjects. The study was conducted according to the Declaration of Helsinki.

### Questionnaires

We used the Hungarian version of the Patient's Health Belief Questionnaire on Psychiatric Treatment (PHBQPT) to assess the patients' attitude toward drug treatment, perceived health locus of control, and psychological reactance developed by Armitage and Conner (14), De las Cuevas et al. (21), Pogany et al. (22). The questionnaire contains 17 items from three previously validated scales, the Drug Attitude Inventory (DAI-10) (23), the Hong Psychological Reactance Scale (HPRS) (24), and the Multidimensional Health Locus of Control (MHLC, Form C) (25) on five subscales (Positive Aspects of Medications, Negative Aspects of Medications, Doctor-HLOC, Internal-HLOC, and Psychological Reactance). Patients can rate on a 6-point Likert scale the degree to which they agreed or disagreed with the statements, from strongly disagree to strongly agree. The



Hungarian version of the PHBQPT questionnaire was validated by our research group.

Originally, this newly developed questionnaire was validated in a sample of psychiatric patients. In the present study we decided to use this instrument also in the case of patients treated at internal medicine and neurology departments who were taking at least one psychotropic agent. The patients involved in the study were hospitalized at one of the four departments of the general psychiatry, were treated for addictions, or underwent treatment at the internal medicine and neurology department. The involvement of these different subpopulations aimed to compare the potential effects of the awareness of being treated for a psychiatric illness on the beliefs and attitude toward medication treatment.

## Data Analysis

To test the distribution of the scores we used the Kolmogorov-Smirnov test. To assess the differences between clinical subgroups (GEN PSYCH vs. ADDICT and GEN PSYCH vs. NON-PSYCH), the mean scores of items and subscales of the PHBQPT were compared using one-way ANOVA or *t*-test in the case of normal distribution. For comparing the mean scores between two groups we used the Mann-Whitney U test. The ANOVA test and *post hoc* Tukey's test was performed to analyse the differences among the mean scores of the three groups.

Chi-square tests were performed in the case of binary categorical variables. The effects of age and gender on the dependent variables were calculated by a general linear model. Missing data were excluded from the statistical analyses. Results were accepted as significant if the  $\alpha$ -level was  $<0.05$ . All statistic tests were run in the SPSS 24.0 program.

## RESULTS

### Descriptive Statistics

The distribution of mean scores deviated significantly from normal in the case of all subscales of PHBQPT according to the Kolmogorov-Smirnov test ( $p > 0.001$  in all cases). The mean age of the NON-PSYCH subsample was significantly higher than of the GEN PSYCH or ADDICT subpopulations ( $p < 0.05$ ). Gender ratio was equilibrated in the PSYCH subsample, but women were overrepresented in the NON-PSYCH sample ( $p = 0.012$ ). The scores on the PHBQPT items and subscales showed similar trends with the results of De las Cuevas et al. (21). The effect of age and gender were tested by general linear models on the PHBQPT subscales. We found that in the NON-PSYCH sample only Psychological Reactance depended on the gender ( $p = 0.045$ ). However, age had a significant effect on the Doctor-HLOC subscale in both PSYCH subsamples ( $p = 0.025$ ;  $p = 0.023$ ; respectively). Interestingly, Internal-HLOC was gender-dependent only in the ADDICT subgroup ( $p = 0.026$ ). The detailed results of descriptive statistical analyses are shown in Tables 1, 2.

Regarding the associations of mean scores of the PHBQPT subscales among the three clinical samples, we found significant associations in the case of Positive Aspect ( $p_{ANOVA} = 0.004$ ), Doctor HLOC ( $p_{ANOVA} = 0.002$ ); Internal HLOC ( $p_{ANOVA}$

**TABLE 1 |** Mean age and gender prevalences in the investigated subsamples.

	<i>N</i>	Age (mean $\pm$ S.D.)	Gender (male/female)
PSYCH (1)	148	46.7 $\pm$ 14.7	74/74
GEN PSYCH (2)	106	48.0 $\pm$ 15.6	48/58
ADDICT (3)	42	43.2 $\pm$ 11.8	28/14
NON-PSYCH (4)	41	66.8 $\pm$ 13.5	11/30
<i>p</i> -value		(1) vs. (4) $<0.001$	(1) vs. (4) 0.012

Differences between groups were calculated by *t*-test and chi square tests.

$= 8 \times 10^{-7}$ ), and Psychological Reactance ( $p_{ANOVA} = 0.43$ ) (Figure 1). Results of the *post hoc* paired-samples tests are described in sections Comparison of the PHBQPT scores in the GEN PSYCH and ADDICT clinical subsamples and Comparison of the PHBQPT scores in the GEN PSYCH and NON-PSYCH clinical subsamples.

### Comparison of the PHBQPT Scores in the GEN PSYCH and ADDICT Clinical Subsamples

Regarding pronounced differences in the attitude toward medication in patients with addictions, first we compared the PHBQPT scores between GEN PSYCH and ADDICT subgroups. As it was expected, participants treated for an addiction gave significantly different responses on almost all items of the questionnaire. Patients with addictions scored significantly higher on items 1, 2, 3, 6, 7, 8, 12, and 14 (all  $p$ -values  $< 0.05$ ). In contrast, robustly higher scores were given by GEN PSYCH subgroup members on items 4, 11, 15, and 16 (all  $p$ -values  $< 0.05$ ). Significantly higher scores on the Positive Aspects of the Medications subscale were found in the GEN PSYCH subpopulation while there was no difference in Negative Aspect between the two subsamples. However, patients with addictions scored significantly higher on the Doctor-HLOC, Internal-HLOC, and Psychological Reactance subscales (all  $p$ -values  $< 0.05$ ). Results of the comparative analyses between GEN PSYCH and ADDICT subsamples are presented in Table 3 and Figure 1.

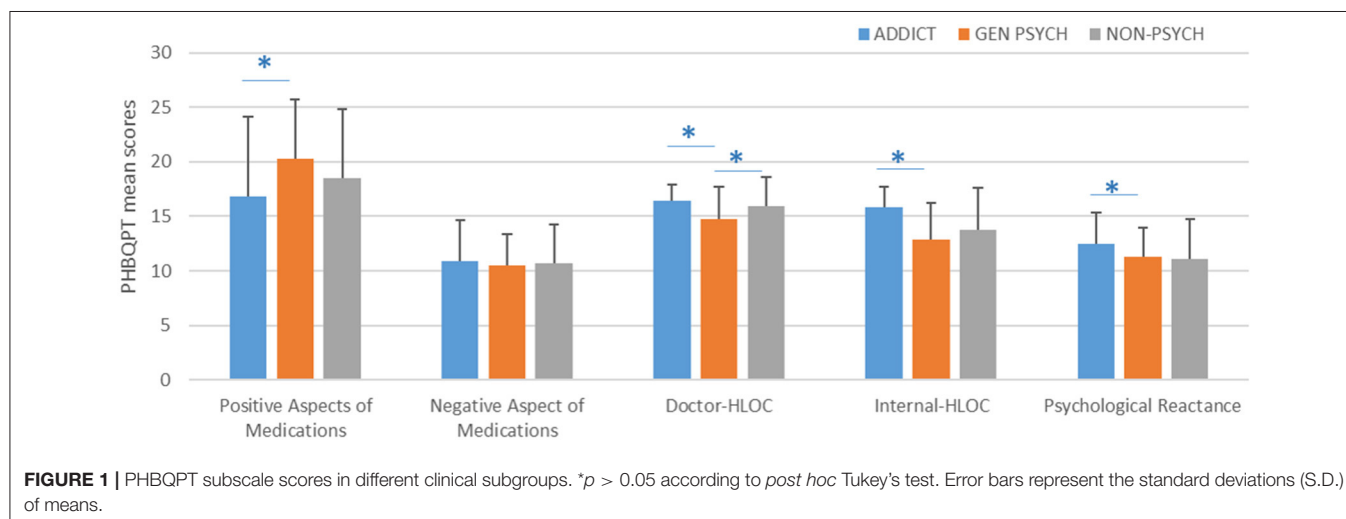
### Comparison of the PHBQPT Scores in the GEN PSYCH and NON-PSYCH Clinical Subsamples

Considering the major differences between the GEN PSYCH and ADDICT subsamples, we performed comparison analysis of the PHBQPT scale in the NON-PSYCH sample only vs. the GEN PSYCH subgroup. In this analysis the highest degree of agreement was found for the item "Whenever my condition worsens, I should consult a medically trained professional" in both subsamples ( $5.3 \pm 1.1$  and  $5.6 \pm 0.7$ ;  $p > 0.05$ ), similar to the results of the study of De las Cuevas et al. (21). However, psychiatric patients considered it significantly less important to follow their physician's suggestions ( $5.1 \pm 1.0$  vs.  $5.5 \pm 0.8$ ;  $p = 0.03$ ) and found regular visits to their doctors to be less effective ( $4.6 \pm 1.4$  vs.  $5.2 \pm 1.1$ ;  $p = 0.010$ ). Surprisingly, resistance

**TABLE 2 |** Effect of gender and age on the PHBQPT subscales in the GEN PSYCH, ADDICT, and NON-PSYCH subsamples.

	TOTAL SAMPLE		GEN PSYCH		ADDICT		NON-PSYCH	
	Gender	Age	Gender	Age	Gender	Age	Gender	Age
Positive Aspects of Medication	NS	NS	NS	NS	NS	NS	NS	NS
Negative Aspects of Medication	NS	NS	NS	NS	NS	NS	NS	NS
Doctor-HLOC	NS	0.014	NS	0.025	NS	0.023	NS	NS
Internal-HLOC	0.027	NS	NS	NS	0.026	NS	NS	NS
Psychological Reactance	NS	NS	NS	NS	NS	NS	0.045	NS

Effect of age and gender on PHBQPT subscale variances were tested by regression models.  
 PHBQPT, Patient's Health Belief Questionnaire on Psychiatric Treatment.



against others' influence was more pronounced among patients with somatic disorders than in the PSYCH subgroup ( $4.3 \pm 1.4$  vs.  $5.0 \pm 1.6$ ;  $p = 0.01$ ). Concerning the PHBQPT subscales, NON-PSYCH participants scored significantly higher on the Doctor-HLOC subscale compared to the GEN PSYCH group ( $15.3 \pm 2.7$  vs.  $15.9 \pm 2.7$ ;  $p = 0.04$ ). The results of comparative analysis between the GEN PSYCH and NON-PSYCH samples are presented in **Table 4** and **Figure 1**.

## DISCUSSION

This is the first report on a comparative analysis of the drug attitude and health concept of different clinical samples. Despite the fact that drug adherence is a hot topic in clinical psychopharmacology and it is generally considered that psychiatric patients are less adherent with their treatment and the mistrust toward medication is more common among them compared to the non-psychiatric patient population, there have not been any direct comparisons regarding these aspects in psychiatric and non-psychiatric subsamples so far. The analysis of different samples may provide valuable information which could help us better understand the specific features and the general common mechanisms behind the attitudes toward treatment of patients suffering from different chronic

diseases. This information can be used to develop more efficient interventions for improving adherence.

Poor treatment adherence leads to an enormous healthcare and economical burden. According to Krueger et al. (26), self-reported data overestimate medication adherence in clinical practice by as much as 200%. Lapane et al. (27) demonstrated that while doctors estimated that 9% of patients do not talk about their non-adherence, in reality 83% of patients reported that they would never tell their physician if they did not plan on picking up a prescription. According to some financial analyses, non-adherence leads to a loss of 100–300 billion dollars in the United States annually (IMS Institute for Healthcare Informatics). Certain estimations suggest that improving adherence to diabetes medication would prevent 699,000 emergency department visits and 341,000 hospitalizations each year in the United States of America (28). Some statistical data suggest that 33–69% of the hospitalizations are related to poor adherence (29).

The results of our study have shown that there is a more robust difference regarding attitude toward medication between ADDICT patients and GEN PSYCH patients than between the latter population and NON PSYCH subjects. Although positive aspects of medication appeared more pronounced in the GEN PSYCH sample, the trust in doctors and feelings of personal responsibility for their own health were presented at a higher

**TABLE 3 |** Comparison of PHBQPT item scores and subscales between ADDICT vs. GEN PSYCH subsamples.

	GEN PSYCH	ADDICT	p-value
1. I am directly responsible for my condition getting better or worse	4.8 ± 1.3	5.5 ± 0.8	0.001
2. If I see my doctor regularly, I am less likely to have a problem with my condition	4.6 ± 1.4	5.2 ± 1.3	0.007
3. When someone forces me to do something, I feel like doing the opposite	2.9 ± 1.4	3.7 ± 1.4	0.004
4. For me, the good things about medication outweigh the bad	4.3 ± 1.3	3.4 ± 1.8	0.001
5. I feel strange, “doped up”, on medication	3.7 ± 1.3	3.5 ± 1.8	NS
6. The main thing which affects my condition is what I myself do	4.3 ± 1.3	5.3 ± 0.8	0.000
7. Following doctor's orders to the letter is the best way to keep my condition from getting any worse	5.1 ± 1.1	5.6 ± 0.5	0.003
8. I resist the attempts of others to influence me	4.3 ± 1.4	4.8 ± 1.4	0.041
9. Medications make me feel more relaxed	4.2 ± 1.3	3.8 ± 1.7	NS
10. Medications make me feel tired and sluggish	3.6 ± 1.7	3.6 ± 1.6	NS
11. I feel more normal on medication	4.2 ± 1.4	3.5 ± 1.7	0.011
12. If my condition takes a turn for the worse, it is because I have not been taking proper care of myself	3.9 ± 1.5	4.9 ± 1.2	0.000
13. Whenever my condition worsens, I should consult a medically trained professional	5.3 ± 1.1	5.6 ± 0.7	NS
14. It is unnatural for my mind and body to be controlled by medication	3.4 ± 1.6	4.1 ± 1.9	0.012
15. My thoughts are clearer on medication	3.6 ± 1.6	2.7 ± 1.7	0.002
16. Taking medication will prevent me from having a breakdown	4.0 ± 1.4	3.3 ± 1.7	0.015
17. I become angry when my freedom of choice is restricted	4.2 ± 1.3	4.0 ± 1.6	NS
<b>Subscales</b>			
<i>Attitudes toward medication</i>			
Positive Aspects of Medication	20.3 ± 5.4	16.8 ± 7.3	0.001
Negative Aspects of Medication	10.5 ± 2.9	10.9 ± 3.8	NS
<i>Perception of health controls</i>			
Doctor-HLOC	14.8 ± 2.9	16.4 ± 1.5	0.001
Internal-HLOC	12.9 ± 3.3	15.8 ± 1.9	0.000
Psychological Reactance	11.3 ± 2.7	12.5 ± 2.8	0.012

Mean scores were compared with Mann-Whitney U tests.

PHBQPT, Patient's Health Belief Questionnaire on Psychiatric Treatment.

level among patients with addictions. Participants belonging to the GEN PSYCH sample were more skeptical regarding the importance of seeing their physician than patients treated due to somatic diseases, as it is shown by the reduced Doctor-HLOC subscale score. GEN PSYCH patients do not believe that regularly seeing their doctor would decrease the risk of getting worse and they do not think that “following the doctor's order to the letter” is the best way to keep their condition from getting any worse. Analyzed together with other items of the scale, it can be concluded that GEN PSYCH patients believe that they might need some help, but they frequently refuse to follow the instructions of the medical professionals. However, according to the Positive and Negative Aspect subscale scores, beliefs and attitude toward medication do not differ significantly in the GEN PSYCH and NON-PSYCH samples.

In conclusion, the attitude toward medication was more positive in the GEN PSYCH than in the ADDICT subsamples, and similar in the GEN PSYCH and NON-PSYCH samples. Concerning the health control locus, the strongest external and internal health control belief appeared in the ADDICT subgroup while only the Doctor HLOC was higher in the NON-PSYCH

than in the GEN PSYCH sample. Nevertheless, attitude toward medication is partially associated with beliefs and health locus of control.

Despite the fact that in the NON-PSYCH sample there were higher levels of external locus of control than in the psychiatric group, it seems that the level of mistrust toward medication is similar in both samples. These results are in concordance with the conclusions of a review published by Brown et al. (5). They emphasized that besides individual experiences the increasing mistrust of societies toward healthcare systems contribute to the negative beliefs. The authors highlighted that patients' negative beliefs are often stronger than their clinicians would suppose. An important factor contributing to patients' mistrust is the assumed relationship between the pharmaceutical companies and doctors. Grande et al. reported that 55% of patients believed that their doctors received gifts from the companies and this belief was associated with lower trust in their physician and doubled the chance of mistrust in the entire healthcare system (30). Another factor leading to mistrust was the contradiction between the information acquired from different sources (healthcare provider, media, internet) (5). De las Cuevas et al. (31) found

**TABLE 4 |** Comparative analysis of the PHBQPT items and subscales between the GEN PSYCH and NON-PSYCH subsamples and results of De las Cuevas et al. (21).

	GEN PSYCH	NON-PSYCH	p-value	De las Cuevas
1. I am directly responsible for my condition getting better or worse	4.8 ± 1.3	4.9 ± 1.4	NS	4.7 ± 1.7
2. If I see my doctor regularly, I am less likely to have a problem with my condition	4.6 ± 1.4	5.2 ± 1.1	0.010	4.6 ± 1.7
3. When someone forces me to do something, I feel like doing the opposite	3.0 ± 1.4	2.9 ± 1.8	NS	2.7 ± 1.8
4. For me, the good things about medication outweigh the bad	4.4 ± 1.6	4.8 ± 1.1	NS	4.6 ± 1.7
5. I feel strange, "doped up", on medication	3.7 ± 1.5	3.8 ± 1.8	NS	3.1 ± 2.0
6. The main thing which affects my condition is what I myself do	4.4 ± 1.3	4.7 ± 1.7	NS	4.2 ± 1.8
7. Following doctor's orders to the letter is the best way to keep my condition from getting any worse	5.1 ± 1.0	5.5 ± 0.8	0.03	4.9 ± 1.5
8. I resist the attempts of others to influence me	4.3 ± 1.4	5.0 ± 1.6	0.01	3.3 ± 1.9
9. Medications make me feel more relaxed	4.1 ± 1.4	3.8 ± 1.7	NS	4.9 ± 1.5
10. Medications make me feel tired and sluggish	3.6 ± 1.5	3.6 ± 1.7	NS	3.7 ± 2.0
11. I feel more normal on medication	4.0 ± 1.5	4.4 ± 1.4	NS	4.3 ± 1.8
12. If my condition takes a turn for the worse, it is because I have not been taking proper care of myself	3.9 ± 1.5	4.2 ± 1.7	NS	4.2 ± 1.9
13. Whenever my condition worsens, I should consult a medically trained professional	5.3 ± 1.1	5.6 ± 0.7	NS	5.5 ± 1.2
14. It is unnatural for my mind and body to be controlled by medications	3.6 ± 1.7	3.9 ± 1.8	NS	2.9 ± 1.9
15. My thoughts are clearer on medication	3.4 ± 1.6	3.1 ± 1.7	NS	4.0 ± 1.9
16. Taking medication will prevent me from having a breakdown	3.8 ± 1.5	2.9 ± 1.8	NS	4.1 ± 1.9
17. I become angry when my freedom of choice is restricted	4.2 ± 1.3	3.9 ± 1.8	0.002	4.2 ± 1.8
<b>Subscales</b>				
<i>Attitudes toward medication</i>				
Positive Aspects of Medication	19.3 ± 6.2	18.5 ± 6.3	NS	18.1 ± 4.8
Negative Aspects of Medication	10.6 ± 3.1	10.7 ± 3.6	NS	9.7 ± 4.2
<i>Perception of health control</i>				
Doctor-HLOC	15.3 ± 2.7	15.9 ± 2.7	0.04	15.1 ± 3.4
Internal-HLOC	13.8 ± 3.2	13.8 ± 3.8	NS	12.9 ± 4.2
Psychological Reactance	11.6 ± 2.7	11.1 ± 3.7	NS	10.2 ± 3.8

Significance of differences of items and subscale scores were tested by Mann-Whitney U tests.

PHBQPT, Patient's Health Belief Questionnaire on Psychiatric Treatment.

that highly psychological reactant patients were more likely to be noncompliant; they generally resist any guidance or assistance.

Mago et al. (32) reported that in a sample of 2,096 subjects suffering from major depressive disorder, the most frequent negative emotion reported by patients regarding their medication was frustration (29.8% of respondents). Concerning feelings about their healthcare providers, the majority reported feeling understood, trust, and confidence but almost 20% reported frustration due to not feeling heard, ineffective treatment, and feeling rushed/lack of quality visit. The reasons for frustration with medication were lack of effectivity and tolerability issues. In contrast, physicians estimated that only 11% of patients were frustrated with their medications and 5% with the healthcare quality (32). In another survey, data of 3,684 subjects were analyzed concerning compliance to antidepressant treatment. They found that 22% was the overall level of compliance, thus only one in four patients complied with treatment. Surprisingly, better compliance was observed in patients with polypharmacy (33).

Understanding patients' health beliefs and attitudes toward drug treatment is needed for successful therapy. It is also essential that patients who are in their first contact with mental health care professionals are given comprehensive and appropriate information regarding the planned treatment (34).

Nevertheless, there are some limitations in this study, as, in the case of the patients recruited from the somatic departments, the sample size was smaller since the mean age of patients treated at the internal medicine and neurological departments was higher and their general health status was worse. The occurrence of neurocognitive disorders was higher in this group compared to the group of patients treated at departments of general psychiatry. Thus, we found fewer patients who were eligible for enrollment into the study. Another limitation is that we did not investigate treatment adherence (all patients were hospitalized throughout the entire duration of the study). On the other hand, it is the strength of our study that we are among the first researchers to have used



the recently developed PHBQPT questionnaire in different clinical samples.

In conclusion, mistrust toward medication did not differ in the GEN PSYCH and NON-PSYCH samples, while acceptance of the doctor's competency was stronger in the non-psychiatric subsample. In other words, our findings suggest that psychiatrists have to deal with more intense mistrust which can be partly explained by the assessed population (psychiatric patients hospitalized mainly due to acute decompensation) and this does not correlate with the level of patients' confidence in medication.

Many aspects still need to be elucidated regarding the attitudes of the patients toward medication and healthcare professionals. Clinicians generally tend to overestimate the level of adherence to treatment of patients. More attention needs to be paid to the changeable variables in the background of beliefs and attitudes toward treatment in order to implement efficient adherence-improving interventions. Our results indicate that mental health professionals would need reliable methods for the systematic assessment and modification of patients' attitude toward treatment.

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## DATA AVAILABILITY STATEMENT

The datasets generated for this study will not be made publicly available. There is no such an option by the ethical permission.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Hungarian Central Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

LP recruited the patients, collected data, and prepared the manuscript. JL contributed to the study design, statistical analysis, and review of the manuscript.

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

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# Social-Cognitive Determinants of HIV Testing Among Tuberculosis Infected Patients in Kassala State, Sudan

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**Background:** Use of HIV testing and counselling (HTC) services remains low among TB patients in Sudan. Identifying the social-cognitive (sub) determinants associated with HTC uptake is essential before developing interventions to promote uptake. This study aims to assess the sub-determinants of intention to use and actual behaviour of using HTC services among TB patients in Sudan and to ascertain the most relevant beliefs to inform future interventions.

**Methods:** A cross-sectional study was carried out in five health facilities selected randomly in Kassala State. First, a small elicitation study ( $N = 25$ ) was conducted to inform the Reasoned Action Approach (RAA) based questionnaire. A total of 411 TB patients completed the survey questionnaire. Confidence Interval Based Estimation of Relevance analysis (CIBER) was employed to establish the sub-determinants' relevance.

**Result:** The studied beliefs explained 38–52% of the variance in the intention and 20–35% in the behaviour variance. The beliefs that “Using HTC services increases my fear of being tested positive for HIV” and “Using HTC services increases my fear of losing my partner if I have a positive test result” were negatively associated with intentions and use of HTC services; and both were highly relevant for intervention. The belief “If I use HTC services, I would know my HIV status” was positively associated with intentions and use of HTC services. However, it was less relevant for intervention. Perceived susceptibility to HIV infection was not associated with intention and only weakly associated with use of HTC services. Its relevance was low for intervention.

**Conclusions:** The study showed that the social-cognitive beliefs (sub-determinants) vary in their relationship with the intention and use of HTC services among TB patients; with variable relevance for intervention. Interventions to enhance the use of HTC services should address the most relevant beliefs to maximise the effectiveness of interventions. Further studies are needed to identify other relevant sub-determinants of HTC use behaviour.

**Keywords:** beliefs, determinants, social-cognitive, HIV testing, confidence interval-based estimation of relevance, TB patients

## INTRODUCTION

Tuberculosis (TB) is a public health problem worldwide, particularly in developing countries, and it is categorised within the top ten leading causes of death (1). An estimated ten million people were infected globally and 1.4 million died due to TB in 2019 (2). HIV-infection increases the TB patients' morbidity and mortality by turning latent TB into an active form, increasing the TB relapse rates and risk of death. Also, co-infected TB patients have higher management costs than other patients (3, 4). Therefore, detecting the HIV status of TB patients can improve the survival rate of TB patients and reducing treatment costs (1, 5–7).

Sudan is part of the World Health Organization (WHO) and the Middle East and North Africa (MENA) countries. The country has a population of 41 million, with around two-thirds of them are rural areas' dwellers (Sudan Federal Ministry of Health, 2018). Among Sudanese, TB is a common health problem (8). Poverty among the Sudanese population remains high, with 46% of the population living below the poverty line (9). Poor living conditions and malnutrition associated with poverty may increase the risk of TB infection (10).

In Sudan in 2019, the estimated TB incidence rate was 67 per 100,000 population, and TB related death rate was about 10 per 100,000 (11). At the time of this study in 2017, rates were higher at 77 per 100,000 incidence and 13 per 100,000 mortality. Sudan alone shouldered about 31% of the new HIV infection cases and 27% of the AIDS-related death in MENA countries. The estimated rate of co-infection was 1.8 per 100,000 (12). From 2009, HIV testing has been offered routinely through Provider Initiated Testing and Counselling (PITC) to all TB patients who seek care in Tuberculosis Management Units (TBMUs) with patients having the right to decline testing for HIV (13). The Sudan National Tuberculosis policy stated that every TB patient should be offered HIV testing (Sudan National Tuberculosis Policy, 2013).

The HIV infection rate appears to be high among TB patients in Sudan. A study by Abdallah et al. (14) in Kassala State in Sudan showed that the prevalence of HIV infection among TB patients was 18.3%. Despite this high rate, HIV testing among TB patients in Sudan remains consistently low (15). Increasing uptake of HTC services among TB patients is needed to detect co-infected cases earlier (14).

Previous studies showed that different social-cognitive factors could influence human health behaviours, including HIV testing behaviour. These social-cognitive determinants include attitude, social pressure, perceived facilitators and barriers, and perceived risk of HIV infection (16–18). Without understanding the social-cognitive (sub) determinants, it would be hard to change people behaviours (19–22).

Social cognitive theories, such as the Reasoned Action Approach (RAA), are useful in explaining human health behaviours (21). According to the RAA, behavioural intention is the most proximal predictor of behaviour, and this intention is a product of attitude, subjective norms, and perceived behavioural control. The latter three constructs originated from behavioural beliefs, normative beliefs, and control beliefs, respectively (23).

A previous meta-analysis found that attitude, subjective norms and perceived behavioural control accounted for 39% of the behaviour variance and 27% variance in the intention. A previous study investigating the predictors of intention to Voluntary Counselling and Testing reported that attitude, subjective norms, and perceived behavioural control explained 30.3% of the intention's variance (24). The RAA can include other variables such as past behaviour and perceived risk to improve the model's prediction utility. For example, a previous study showed that the inclusion of the perceived risk of HIV infection could increase the prediction of behavioural intention for HIV testing (25).

There is a lack of insight into social-cognitive (sub) determinants of HTC services use among TB patients in Sudan. Therefore, this study employed an RAA to investigate the association between social-cognitive beliefs (sub-determinants), intentions and behaviour to assess their relevance for interventions to enhance HTC services use among TB patients in Kassala State, Sudan.

## METHODS

### The Study Design and Settings

This cross-sectional study was carried out in Kassala State. Administratively Kassala is divided into eleven localities, with an estimated population of 2.9 million. In total, there are 22 TBMs serving TB infected patients in the state. Data from the State TB program showed that about 8,730 TB patients attended these TBMs in 2017. These sites open in the daytime from 8 am to 3 pm with 2 days specified for referred clinics each week. HIV testing is provided as part of the TB patient standard care in all TBMs. The HIV testing in the TBMs is provided under joint and direct administration of the National TB program and the AIDS Control Program. Data were collected from five randomly selected TBMs in the state; namely Kassala, Rural Kassala, Halfa, Khashim Algirba, and Wed Elhelew TBMs. The recruitment period was from July 2017 to February 2018.

Well-trained data collectors used a structured questionnaire to collect data from the study participants. Before the interview, data collectors explained the purpose of the study to all participants and then obtained informed consent from them. Children and those who were very ill or did not provide informed consent were excluded from the study. During the interview process, the immediate next one replaced the participant who refused to participate. Ethical approval was gained from the Research Ethical Committee in the Ministry of Health in Kassala State. Permission was received from the State National Tuberculosis Program and the administrative authorities for the selected TBMs.

### Participants

The eligible participants were all TB patients aged 18 years and over with confirmed TB infection diagnosis who attended the selected five TBMs in Kassala State during the study period. A three-step random sampling design was used. First, five localities were selected through a simple random sampling method from the Kassala State's total eleven localities. Second, from each locality, one TBM was chosen randomly. Finally, in



each TBMU, on-site systematic random sampling was employed to select the participants.

## Variables and Measurements

In the analysis, the outcome variables were the behavioural intention to use and actual HTC services use. The predictors were behavioural beliefs, normative beliefs, control beliefs, perceived risk beliefs, and past HTC services use behaviour. The behaviour in question refers to using HTC services in the TBMU in the next 3 months, and learning their HIV status.

A written questionnaire was used to collect socio-demographic and social-cognitive variables related information from the participants. The socio-demographic data included age, gender, residence, education level, working, and marital status.

The social-cognitive variables were assessed to be congruent with HTC use behaviour in TBMs in the next 3 months. The social-cognitive variables questions were developed based on similar previous studies (26) results and findings from a beliefs elicitation study. The elicitation study was conducted among a small group ( $N = 25$ ) of the study population to identify their behavioural beliefs, normative beliefs, and control beliefs regarding HTC services use. The most commonly mentioned salient beliefs were included in the final survey questionnaire.

The intention to use HTC services was assessed by asking the participants to indicate how likely they intend, want, and expect to use HTC services in the next 3 months. Answers ranged from unlikely (+1) to likely (+7).

The actual use of HTC services was assessed after 3 months by asking the participants who had completed the questionnaires to indicate whether they did use the HTC services or not. The participants' responses were verified through their medical records in the TBMs. The medical record information was taken if there was a discrepancy between the patient's response and their record.

The behavioural beliefs were examined by asking the participants to indicate to which extent their use of HTC services in the next 3 months is likely to be influenced by the following statements: they would know their HIV status, protect themselves from getting HIV infection in the future, increasing their fear of being tested positive for HIV, prevent transmitting HIV infection to their family, and increasing their fear of losing their partner if they tested positive. Responses ranged from unlikely (+1) to likely (+7).

For normative beliefs, respondents were asked to rate the extent to which they believed that their friends, counsellor, partner, and doctor think that they should use HTC services in the next 3 months. Responses were rated on a 7-point bipolar agree-disagree scale.

The control beliefs about HTC services use were assessed by asking the participants to rate five salient beliefs: "I have enough money to reach HTC services," "If I use HTC service, my health care providers will keep the test result confidential," "If I think about using HTC services, I feel scared about disclosing the positive test result," "If I use HTC services and tested positive for HIV, I could have treatment," and "Using HTC services increases my fear that people would assume I am infected with HIV." Participants responses ranged from unlikely (+1) to likely (+7).

Two items were used to measure the perceived susceptibility to HIV infection. The participants were asked to indicate how likely they believe themselves or their partners may be infected with HIV infection, and how likely their friends may be infected with HIV. Answers were arranged on a 7-point scale. The past behaviour was measured by asking the participant whether they had attended HTC services during the last year. Responses ranged from disagree (+1) to agree (+7).

## Study Size

A pre-specified confidence interval for correlation values (27) was used to estimate the sample size. By taking 0.05 as a correlation coefficient and confidence interval half-widths at 0.10, the required sample size was 383. Then 15% was added to cater for refusal. Therefore, the final sample was 441 participants.

## Statistical Analysis

The Statistical Package for Social Science (SPSS) version 21 and R version 3.6.1 were used for data analysis. Descriptive characteristics included the distribution of the socio-demographic variables.

A Confidence Interval Based Estimation of Relevance (CIBER) (28) was used to establish the relevance of sub-determinants (social cognitive beliefs in this study) for interventions targeting intention and use of HTC services. CIBER is a data visualisation method whose output consists of two panels with diamond shapes.

In the left-hand panel, the diamond shows the sub-determinant's mean with a 99% confidence interval. The diamond fill colour gives information about the item's mean: the redder indicates a lower mean, and the greener colour indicates a higher mean. The blue colour indicates the item with mid-scale mean.

The right-hand panel shows diamonds indicative of the strength of association (correlation coefficients) between the sub-determinants and dependent variables (intention and use of HTC services in this study) with 95% confidence intervals. The right-hand diamond fill colour is indicative of the nature of the association: redder diamond indicates a strong negative association, greyer diamond indicates a weaker association, and greener diamond shows a strong positive association. At the top of the plot, CIBER provides the explained variance in outcome variables by all sub-determinants.

Data visualisation has three advantages in the context of determinant selection. First, visualisation enables mapping the data onto spatial dimensions, facilitating comparisons, which are necessary when making selections. Second, visualisation foregoes the seeming accuracy and objectivity afforded by numbers (29). Given the relative width of most sampling distributions and the subsequent variation that occurs in estimates over samples (30), caution in basing decisions on the exact computed numbers seems prudent. Third, visualisation enables assessing confidence intervals for means in the context of the raw data. In short, CIBER acknowledges that several metrics need to be combined and interpreted in order for data to become valuable information for selecting determinants.

**TABLE 1 |** Socio-demographic characteristics of study participants (*N* = 441).

Variable	<i>n</i>	%
<b>Gender</b>		
Female	182	41.3
Male	259	58.7
<b>Age group</b>		
Below 20	14	3.2
20–29	131	29.7
30–39	105	23.8
40–49	88	19.9
50–59	77	17.5
60 and above	26	5.9
<b>Residence</b>		
Urban	161	36.5
Rural	280	63.5
<b>Education level</b>		
Illiterate	191	43.3
Informal education	86	19.5
Primary school	76	17.2
Higher secondary school and above	88	20.0
<b>Working status</b>		
Not working	217	49.2
Working	224	50.8
<b>Marital status</b>		
Never married	136	30.8
Ever married	305	69.2
<b>Testing status</b>		
Tested	65	14.7
Not tested	376	85.3

## RESULTS

The total number of the participants was 441 TB patients attending five selected TBMs in Kassala State. The refusal rate among the eligible participants was 3.5%, and the main reason mentioned was lack of time.

**Table 1** shows the socio-demographic variables of the study participants. Of the total participants, 29.2% were in the age group 20–29 years, and 23.8% in the age group 30–39 years. Males accounted for 58.7% of the participants. The majority of the respondents (63.5%) were from rural areas. Among the participants, 43.3 % were illiterate, 19.5% received informal education, and 37.2% had primary school or above. Almost seventy per cent of the participants were ever married, and approximately half were not working. About fifteen percent (14.7%) of the participants reported using HTC services in the following 3 months and learned their HIV status.

**Figure 1** presents the CIBER analysis results. The studied social-cognitive beliefs explained 38% to 52% of the intention's variance and accounted for 20 to 35% of the HTC use behaviour variance.

The results indicated that the belief “If I use HTC services, I would know my HIV status” has a positive association with

intention and HTC use behaviour and its scores are in the upper part of the panel. The belief “Using HTC services increases my fear of being tested positive for HIV” has scores in the lower panel showing a strong negative relationship with intention and behaviour. The participant's belief that “If I use HTC services, I can prevent transmitting HIV infection to my family” has a strong positive relationship with the intention and the behaviour, and its item scores are relatively high. The mean score of the belief “Using HTC service increases my fear of losing my partner if I have positive test result” is located in the middle of the scale and negatively associated with both intention and behaviour regarding HTC services use.

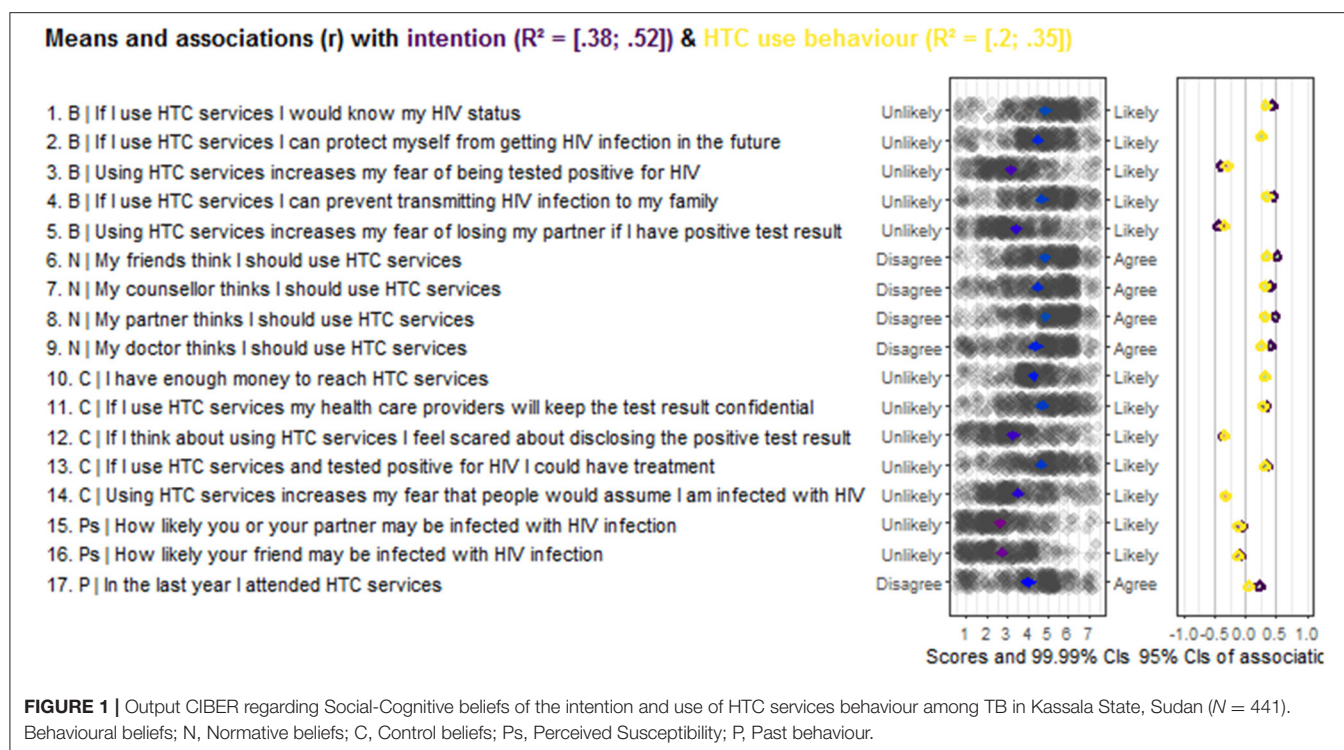
The respondents' beliefs that their friends think they should use HTC services is positively associated with intention and behaviour, with scores on the upper end of the scale. The participants who believed that their counsellor or their doctor thinks they should use HTC services showed a positive association with intention and behaviour, and the scores are relatively above the middle of the scale. The mean score of belief “My partner thinks I should use HTC services” is relatively high, and it has a positive association with the intention and HTC services use.

Also, the CIBER results show that the belief about confidentiality of the test result is positively associated with the intention and HTC service use behaviour. It scored in the upper half of the panel. The belief “If I use HTC services and tested positive for HIV, I could have treatment” scores in the upper part of the scale and is positively associated with intention and HTC services use. The scores for the items “If I think about using HTC services, I feel scared about disclosing the positive test result” and “Using HTC services increases my fear that people would assume I am infected with HIV” are in the middle of the scale, and both are negatively associated with intention and behaviour regarding HTC services use.

Our results also indicate the belief “How likely you or your partner may be infected with HIV infection” is not associated with intention and weakly associated with HTC behaviour, scoring below the middle of the scale. The item “How likely your friend may be infected with HIV infection” is also not associated with intention and use of HTC services. Participants who in the last year had attended HTC services were positively associated with intention, but not with behaviour to use HTC again.

## DISCUSSION

This study aimed to investigate the association between social-cognitive beliefs and the intention and use of HTC services by TB patients, and to assess the relevance of these beliefs for developing future interventions to enhance HTC services use behaviour. Our study results showed that the proportion of participants who use HTC services and tested for HIV infection is relatively low (14.7%), which is in line with the national HIV testing rates among TB patients in Sudan. The study suggests that the social-cognitive beliefs have variable relevance for interventions to enhance intentions and use of HTC services among TB patients.



Based on all the social cognitive beliefs included in the study, the explained variance in the intention and HTC use behaviour ranged from 38 to 52% and 20 to 35%, respectively. This result fits with Armitage and Conner's meta-analysis (31), in which they reported an explained variance of 27% in the behaviour and 39% in the intention.

A study from Uganda (32) reported an association between Voluntary Counselling and Testing use and the need to know HIV status. Our study results suggested that the belief "If I use HTC services, I would know my HIV status" was strongly and positively associated with the intention and use of HTC services with scores in the upper scale. A high mean score indicates that participants are already convinced that by using HTC services, they become aware of their HIV status. This combination makes it less relevant for targeting this belief with an intervention.

Our study results also suggest that the participants' belief "If I use HTC services, I can prevent transmitting HIV infection to my family" had a strong association with the intention and behaviour of HTC services use. This agreed with a study among college students in the United States (33). However, participants' scores are in the upper part of the scale which suggests that they believed that using HTC services results in preventing their family from getting HIV infection. This combination leaves little room for improvement, making it a less relevant belief to be selected. Nevertheless, this belief can still be reinforced and can be aimed at participants who are not convinced that the use of HTC services prevents the spread of HIV infection.

In this study, the belief "Using HTC services increases my fear of being tested positive for HIV" showed a strong negative relationship with the intention and actual use of HTC services

and its scores are roughly distributed in the middle of the scale. This combination makes it a relatively highly relevant belief, suggesting that it needs to be targeted by an intervention. This might suggest messages that focus on the benefits to individuals if they learn their HIV status, and in this way we can reduce their fear of receiving a positive test result.

The belief "Using HTC services increases my fear of losing my partner if I have a positive test result" showed a strong negative relationship with the intention and use of HTC services, scoring middle of the scale. This pattern makes it a viable candidate to be targeted by interventions. HIV related stigma is well-documented as a barrier to accepting and using HTC services in different settings (34–36). A previous study (37) conducted among TB patients found that fear of HIV related stigma was a reason for low use of HIV testing, and our finding shows that fears of a positive HIV result and fears of losing their partner if tested positive are both relevant for intervention among TB patients. This implies that HTC services use can be improved by tackling these fears.

This study found a strong positive association of the belief "My doctor thinks I should use HTC services" with the intention and HTC services use. This finding suggests that doctors can influence the TB patients' acceptance and uptake of HTC services. The role of doctors in HIV testing decisions was suggested in a previous study in Sudan among pregnant women (18). However, this belief's relevance in terms of intervention is relatively low, as the scores were in the middle of the scale indicating that nearly half the participants were persuaded that their doctors believe that they should use the HTC services. It could still be

possible to target interventions to convince the other half to change their perception.

The belief “My friends think I should use HTC services” has a significant positive association with the intention and behaviour of using HTC services. A previous study conducted among adolescents showed that peer pressure was associated with HIV testing behaviour (38). The belief with a mid-scale mean indicates that many participants believe that their friends think they should use HTC services. However, the belief can be considered to have relatively low relevance for intervention.

Our results also suggest that the belief “If I use HIV Testing and counselling service, my health care providers will keep the test result confidential” was positively and strongly associated with intention and behaviour regarding HTC services use. This finding is supported by previous studies conducted in Uganda (39) and Northern Tanzania (40), which reported confidentiality as an essential factor that can affect the HIV testing service uptake. The relatively high mean scores of the beliefs reflects that many participants believe that health care providers will maintain their test result confidential.

Our study shows that the score for the belief “How likely is it that you or your partner may be infected with HIV infection” is in the lower part of the scale which implies that most of the participants do not perceive themselves and their partner to be susceptible to HIV infection. This result disagrees with a study conducted in Sudan (18) which reported high perceived susceptibility among its participants. Results of previous studies on the relationship between perceived susceptibility of HIV infection and HIV testing are controversial. Some studies showed association (25), while others suggested no association (24, 41). In our study, this belief is not associated with the intention to use and weakly with HTC use behaviour.

There are some limitations to our study, and they will need to be addressed in further studies. The use of self-reported data in the study can be affected by social desirability bias. Previous exposure of some of the study participants to the HTC services interventions may have resulted in the positive effect of some beliefs regarding the use of the HTC services. We believe that social desirability bias has been minimised by referring to the patients’ medical records.

The questionnaire did not include all other possible beliefs related to HTC services use, but it focused, as recommended

by the RAA methodology, on the most salient beliefs that the participants reported in the elicitation study. An elicitation study provides important information on what individual beliefs are prominent regarding the behaviour of interest.

In conclusion, our study suggests that different beliefs among TB patients influence their intention and use of HTC service. Fear of testing positive for HIV and losing their partner if tested positive are strongly negatively related to intentions and behaviours to use HTC services, and they are highly relevant to be selected for targeting in future interventions. The belief “If I use HTC services, I would know my HIV status” was positively associated with intention and behaviour, but it has a low relevance because there is little room for improvement. The same goes for the belief, “If I use HTC services, I can prevent transmitting HIV infection to my family.” Perceived susceptibility to HIV infection was not associated with intentions and only weakly associated with HTC use behaviour. The relevance of participants beliefs about their doctors, friends, and confidentiality of the test results regarding HTC services use was relatively low.

The study was carried out in a particular geographical area in Sudan and this may lead to a possible bias in the generalisability of the study results to the TB population across the country. Since our participants are demographically quite similar to other TB patients in Sudan, they may not differ much in what they believe about HIV infection and HTC services. We believe that our study results can be used for other TB patients in Sudan and these insights can be relevant to other settings in Sudan. National TB programme interventions that target enhancing HTC services use should address the highly relevant beliefs first to have better results for influencing positive behaviour change.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## AUTHOR CONTRIBUTIONS

AI, RC, and HWB developed the study concept and design. AI collected the data. All authors analyzed the data, interpreted the results, drafted the manuscript and discussed and agreed on the final version of the manuscript.

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

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