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COVID-19–Related Racism and Mental Health Among Asian Americans: Integrative Review

Tania Von Visger*, PhD, APRN; Amy Lyons*, MLS, EMBA, AHIP; Yanjun Zhou*, BSN; Kayla Wardlaw*, MSN, RN, CCRN, CNE; Eunhee Park*, RN, APHN BC, PhD; Yu-Ping Chang*, PhD, RN

School of Nursing, State University of New York at Buffalo, 3435 Main St, Wende Hall Suite #201F, Buffalo, NY, United States

*all authors contributed equally

Corresponding Author:
Tania Von Visger, PhD, APRN
School of Nursing, State University of New York at Buffalo, 3435 Main St, Wende Hall Suite #201F, Buffalo, NY, United States

Abstract

Background: Racism against Asian Americans escalated during the COVID-19 pandemic. About 31% - 91% of Asian American adults and children reported experiencing various types of racism during the pandemic. According to the Federal Bureau of Investigation hate crime statistics, anti-Asian hate crime incidents increased from 158 in 2019 to 279 in 2020 and 746 in 2021. In 2022, the incidents decreased to 499, corresponding to the downward trend of the pandemic. The degree of impact racism has on mental health and wellness among Asian Americans requires investigation, specifically during the COVID-19 pandemic.

Objective: We aim to describe racism-related mental health problems experienced by Asian Americans living in the United States and propose implementation strategies for mitigating their consequences.

Methods: We conducted an integrative review of peer-reviewed publications in English reporting anti-Asian sentiments and racism's impacts on mental health among Asian Americans in the United States.

Results: The 29 eligible articles report on studies that utilized cross-sectional survey designs with various sample sizes. Racism is directly correlated with the prevalence of depression and anxiety experienced by victims of racist acts. The prevalence of in-person direct racism (racist expression aimed directly at the victim) is lower than in-person indirect racism (racist expression aimed at the ethnic group the victim belongs to). During the COVID-19 pandemic, the incidence of explicit online racism was lower than online indirect racism.

Conclusions: COVID-19–related racism exacerbated preexisting racism, contributing to worse depression and anxiety among Asian Americans. To address this issue, we propose 2 main approaches: increase public awareness and education about recognizable racist sentiments/acts and systematized reporting of racially motivated crimes to guide political action. At an individual level, culturally responsive, trauma-informed interventions promoting cultural support and cohesion for various Asian American groups will foster this empowerment. These proposed actions will help alleviate racism by reducing stereotypes, empowering victims, and chipping away at the systemic racism structure.

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KEYWORDS

racism; anti-Asian sentiment; integrative review; psychological distress; mental health; review; Asian American; Asian; wellness; psychological; distress; COVID-19; pandemic; cross-sectional survey; survey; depression; anxiety

Introduction

Background

In June 2021, the National Commission to Address Racism in Nursing defined racism as "assaults on the human spirit in the form of actions, biases, prejudices, and an ideology of superiority based on race that persistently causes moral suffering and physical harm to individuals and perpetuates systemic injustices and inequities" [1]. From this broad perspective, there are ranges of defining characteristics depending on how the perpetrators commit the assault and whether the assault is overt, as well as the detrimental outcomes (physical or emotional) of the assaults. More importantly, displays and the impacts of racism vary in form and intensity and can have long-lasting deleterious effects on the social environment. Because racism broadly exists at 3 connected levels, multiple approaches to addressing the issue are necessary. These levels include institutional racism (policies and practices that allow inequity), cultural racism (ideology of inferiority of particular groups), and discrimination (individual level) [2].

Observable and objective consequences of racism, such as physical harm, occur less often than other forms of racism; however, other forms may be more challenging to identify, and psychosocial suffering may be hidden and rarely discussed [3,4].

The complexity of these multiple dimensions and domains of racism (eg, displays of racism [beliefs, words, or actions]; impacts of racism [emotional or physical harms]; and reach of racism [individual, family, community, or society]) presents challenges for defining and measuring constructs of racism and the true psychological impacts on victims. The relationships between racism, perpetrators of racism, and victims of racism do not exist in a vacuum; they are shaped by many cultural racism-related social factors throughout US history [5,6]. The stereotypes baked into the human psyche turn into norms and environmental structures of institutional or systemic racism [7-9]. Systemic racism becomes part of our society and social structure, perpetuating systemic injustices and inequities embedded and reinforced in laws and regulations and unconsciously in biases and prejudices [10].

Verbal or written expressions of racist attitudes toward a specific racial-ethnic group are considered "hate speech." Regardless of the delivery method of racist expression (direct vs indirect) and the intensity of the racist expression (subtle microaggressions to overtly racist remarks), individual-level racism (such as hate speech) and discrimination are associated with poor mental health and a higher risk of psychiatric disorders across minority groups [11]. Racism has also been shown to affect physical health through the mechanism of the physiologic stress response, as measured by chronic inflammatory markers, and it also directly links to increased depressive and anxiety symptoms [12]. In a meta-analysis involving 293 studies, racism was associated with poor mental health (depression, anxiety, and psychiatric distress) and poor general health and physical health [13]. One study showed everyday discrimination is associated with higher odds of developing psychiatric experiences (odds ratio [OR] 4.59) and lifetime psychotic experiences (OR 4.27) in a large sample that included Latino, Asian, African American, and Caribbean Black adults [12]. The association between racism and mental health was stronger among Asian Americans than among Blacks [13]. Everyday discrimination experiences among Asian Americans increased the likelihood of being diagnosed with depression (OR 1.72) and anxiety (OR 2.24) disorders within the past 12 months while controlling for confounding variables such as poverty level, acculturation, physical health, family cohesion, and social desirability [14]. Among studies that explore Asian American subgroups, racism is associated with poor mental health in college students, East Asian adults, and South Asian adults [15-17]. Regardless of the range of mental health severity impacts, racism experiences among minoritized groups yield consistent results of harmful psychological and physical health deterioration.

Displays of Individual-Level Racism

Expression or displays of racism can vary in subtlety, from microaggressions to more deadly acts of physical assaults. Racist words can be directly aimed at an individual, which is called direct racism, or at the minority group identified by the individuals, termed indirect or vicarious racism [18]. Those who experience repeated racism may harbor a constant state of fear and heightened awareness called racial discrimination vigilance [11]. The developmental theory of embodiment emphasizes the strong connection between the social environment and how people come to understand the world around them, such that the social structure of domination and privilege can lead to the embodiment of health inequities [19]. This internalization of unjust social premises is an antecedent to conscious and unconscious vigilance, leading to poorer mental and physical health [19]. Due to the COVID-19 pandemic lockdown, more racist attacks were perpetuated online, although face-to-face or in-person racist acts continued to rise as well [18,20-23]. The increased use of social media during and immediately after the lockdown contributed to an increase in online anti-Asian sentiments, as these platforms are venues where people tend to be uninhibited [24]. An analysis of more than 1 million social media hashtags distinguishing the degree of anti-Asian sentiment association with word choice revealed that 50.4% (392,037/777,852) of #ChineseVirus contained anti-Asian sentiments compared to 19.7% (of 495,289) of #COVID-19 [25]. The use of these terms increased dramatically from March 9 to 23, 2020; the degree of increase was statistically different between #ChineseVirus and #COVID-19 [25]. Regardless of the method or intensity of anti-Asian racist expression, data indicate that all types of racism negatively impact Asian American individuals' mental health and well-being. This impact is especially pronounced when racism is perpetrated through social media platforms [25]. Throughout this article, we use "anti-Asian sentiment" to represent the central concept encompassing this broader display of racism, whether subtle or overt.

Racism Experienced by Asian Americans in the Context of the COVID-19 Pandemic

In the last weeks of 2019, COVID-19 emerged in Wuhan, China, eventually leading to a worldwide lockdown in March 2020. COVID-19 is related to an earlier viral strain that caused a smaller-scale pandemic in November 2002 with clinical presentation of severe acute respiratory syndrome. Both phenomena originated in China, fueling the spread of misinformation and anti-Asian sentiments. Studies indicate that anti-Asian sentiments (racist sentiments, including microaggression and unconscious biases) increased significantly during the COVID-19 pandemic [18,20,21,24-27]. Like other racial minorities living in the United States, racism against Asian Americans is not a recent phenomenon; it persists throughout American history, as documented in the Yellow Peril, Japanese internment, and the perpetuation of the model minority sentiment [5,6]. The intensity and wide range of racist displays against Asian Americans, including social media posts [24,28], discriminatory behaviors, and hate incidents, dramatically increased during the COVID-19 pandemic [20,26]. Systematic reviews about Asian American hate or Asian American hate combined with mental health during the COVID-19 pandemic are limited. We are mindful that an accurate assessment of the impact of the COVID-19 pandemic is limited by incomplete and inaccurate reporting of physical and mental health outcomes [29].

We conducted an integrative review to explore mental health problems experienced by Asian Americans during the COVID-19 pandemic. The purpose of this review is to understand how anti-Asian sentiments (prejudice, hatred, or racism) impact mental health (anxiety, depression) among Asian

Americans (Asian immigrants and Asian Americans) living in the United States during the COVID-19 pandemic. Guided by the integrative review procedures, we focused our research investigation on the PICO question, “How do anti-Asian sentiments (prejudice, hatred, or racism) impact mental health (anxiety, depression) among Asian Americans (Asian immigrants and Asian Americans) living in the United States during the COVID-19?”

Methods

Study Design

We followed the integrative review methodology described by Whittemore and Knafl (2005) [30], which includes five general steps: (1) defining the target population and problem, (2) literature search, (3) data evaluation, (4) data analysis, and (5) data presentation. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were used to guide the reporting of this review.

Search Strategies

From June 2021 to November 2023, the authors, including a librarian with expertise in conducting systematic reviews, searched multiple electronic databases. Searched databases were Embase, PubMed, CINAHL, Cochrane, PsycINFO, and Web of Science. We extensively searched for publications reflecting the impact of the COVID-19 pandemic lockdown officially implemented in March 2020. We included articles published between January 1, 2020, and November 31, 2023, to include the effect of COVID-19 in the initial phase, even before the national announcement of the COVID-19 lockdown mandate.

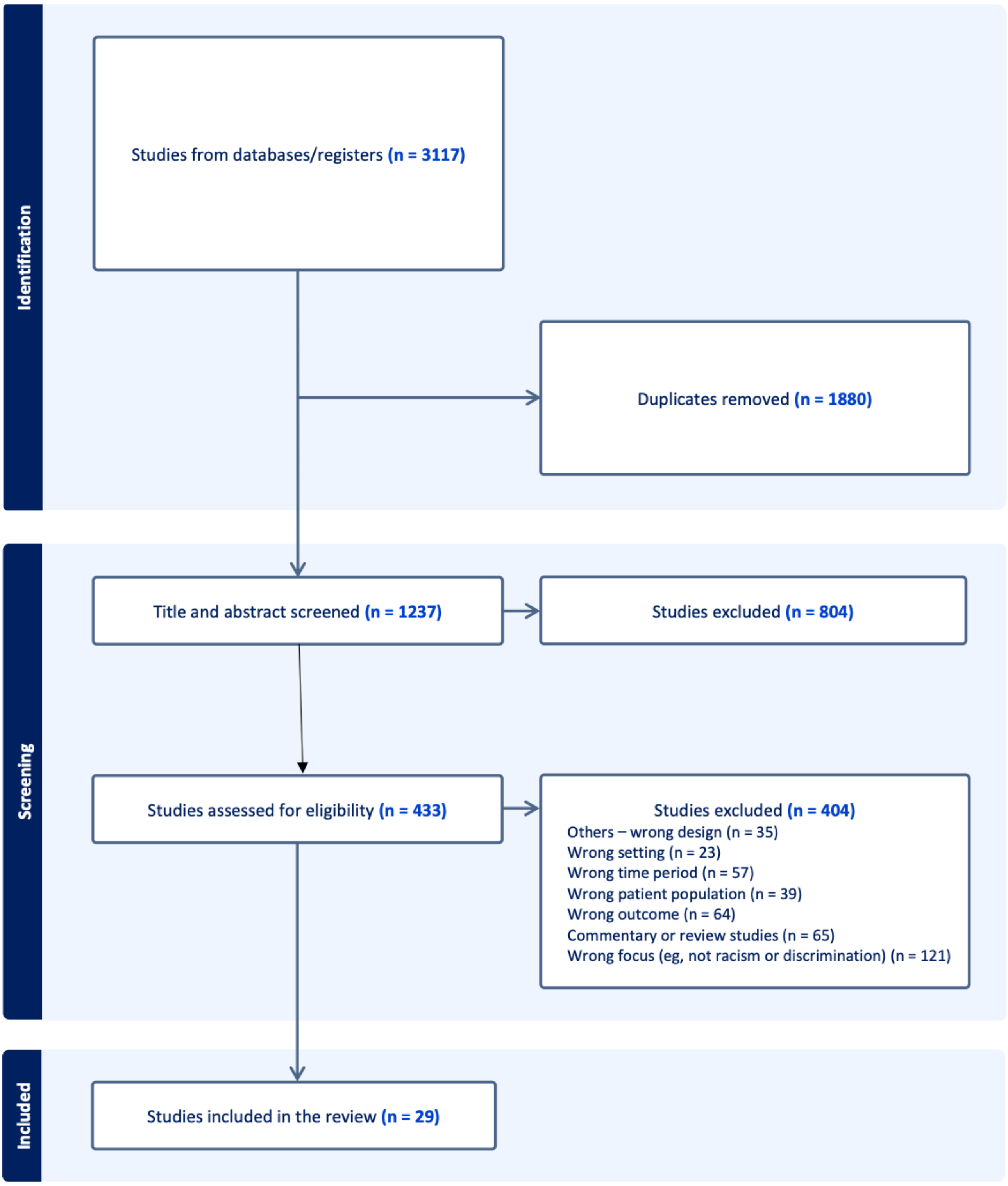
Study Selection and Inclusion and Exclusion Criteria

We searched for peer-reviewed publications of empirical literature reporting about anti-Asian sentiments and mental health and well-being among Asian Americans in the United States during the COVID-19 pandemic. Search terms used in the study were as follows: Asian Americans AND COVID-19, AND mental health–related terms (mental health OR depression OR anxiety), AND terms related to racism (racism OR model minority OR health inequity). An initial search in PubMed and CINAHL helped to identify a complete list of key search terms that accurately described our aim of identifying relevant articles. We then applied these search terms to identify references in related databases. For inclusion in this review, studies must: (1) be published in peer-reviewed research journals; (2) focus on Asian American populations; (3) report on anti-Asian sentiment, individual-level racism, or discrimination; and (4) report on mental health outcomes. We excluded the following: (1) conference abstracts, (2) opinion or discussion reports, (3) systematic reviews, (4) research not published in English, and (5) research not conducted in the United States.

Data Extraction

Figure 1 shows a flow diagram of the study screening process. From the original 3117 citations identified, 1880 duplicates were removed, with 1237 remaining. Two researchers independently reviewed titles and abstracts and agreed to exclude 804 publications because they did not include Asian Americans, were not conducted during the COVID-19 pandemic, did not measure mental health outcomes, or were commentaries. The 433 remaining articles received a full-text review by 2 independent reviewers, with a third reviewer to resolve the disagreements. A total of 404 articles were excluded.

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart: search results and study selection procedures.



Synthesis of Findings

Two authors independently reviewed 29 articles. They coded them into a table format, including details about participants' characteristics, settings, sample size, study designs, aims, statistical methods, and main results. The primary clinical outcomes investigated and reported to be associated with racism in the articles reviewed were depression and anxiety. The same 2 reviewers compared abstracted data and then discussed the data with a third reviewer to achieve consensus.

Results

Quality Appraisal

We used the Joanna Briggs Institute (JBI) guidelines for appraising cross-sectional research to assess the quality of the reports (Table 1). The JBI Critical Appraisal Checklist for Cross-Sectional Studies includes "yes" or "no" confirmation of 8 criteria regarding the overall conduct of the investigations surrounding the scientific rigors about study subjects and settings, standard condition measurement, reliable and valid outcome measurements, appropriate statistical analysis, and description of confounding factors (Table 1).

Table . Quality assessment of studies included in the review (n=29).

	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects and the setting described in detail?	Was the exposure measured in a valid and reliable way?	Were objective, standard criteria used for measurement of the condition?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was appropriate statistical analysis used?
Chae et al, 2021 [11]	Y[a]	Y	Y	Y	Y	Y	Y	Y
Cheah et al, 2020 [22]	Y	Y	Y	Y	N/A[b]	N/A	Y	Y
Cheah et al, 2023 [31]	Y	Y	Y	Y	Y	Y	Y	Y
Dhanani et al, 2022 [32]	Y	Y	Y	Y	Y	Y	Y	Y
Ermis-Demirtas et al, 2022 [33]	Y	Y	Y	Y	Y	Y	Y	Y
Fanta et al, 2023 [5]	Y	Y	Y	Y	Y	Y	Y	Y
Haft and Zhou, 2021 [34]	Y	Y	Y	Y	Y	Y	Y	Y
Huynh VW et al, 2022 [35]	Y	Y	Y	Y	N[c]	N/A	Y	Y
Huynh VW et al, 2022 [35]	Y	Y	Y	Y	N	N/A	Y	Y
Huynh J et al, 2022 [36]	Y	Y	Y	Y	Y	Y	Y	Y
Ikram et al, 2023 [37]	Y	U[d]	Y	Y	N	N/A	Y	Y
Keum and Choi, 2022 [38]	Y	U	Y	Y	Y	Y	Y	Y
Layug et al, 2022 [39]	Y	Y	Y	Y	N	N/A	Y	Y
Lee et al, 2020 [10]	Y	U	Y	Y	N/A	N/A	Y	Y
Li et al, 2023 [40]	Y	Y	Y	Y	Y	Y	Y	Y
Litam and Oh, 2022 [41]	Y	U	Y	Y	Y	Y	Y	Y
Litam et al, 2022 [41]	Y	U	Y	Y	Y	Y	Y	Y
Liu et al, 2020 [42]	Y	Y	Y	Y	Y	Y	Y	Y
Liu et al, 2022 [43]	Y	Y	Y	Y	Y	Y	Y	Y
Lu et al, 2022 [44]	Y	U	Y	Y	N	N/A	Y	Y
McGarity-Palmer et al, 2023 [45]	Y	Y	Y	Y	Y	Y	Y	Y
Oh et al, 2022 [46]	Y	U	Y	Y	N	N/A	Y	Y

	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects and the setting described in detail?	Was the exposure measured in a valid and reliable way?	Were objective, standard criteria used for measurement of the condition?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was appropriate statistical analysis used?
Oh et al, 2022 [47]	Y	U	Y	Y	Y	Y	Y	Y
Pan et al, 2020 [48]	Y	Y	Y	Y	Y	Y	Y	Y
Jun et al, 2021 [49]	Y	Y	Y	Y	Y	Y	Y	Y
Wu et al, 2021 [50]	Y	Y	Y	Y	Y	Y	Y	Y
Zhou et al, 2023 [51]	Y	Y	Y	Y	Y	Y	Y	Y

[a] Y: Yes.

[b] N/A: Not applicable.

[c] N: No.

[d] U: Unclear.

Study Characteristics

All 29 studies, with a wide range of sample sizes (from N=64 to N=7813), utilized cross-sectional survey designs conducted during the COVID-19 pandemic starting in March 2020, assessing possible associations between individual-level racism and mental health outcomes (Table 2 and Figure 1). All 29 articles received a score above 7 using the JBI Critical Appraisal tool. Three articles provided mental health outcomes of children as direct recipients of racism, directly or indirectly, through their parents [5,23,31]. These studies measured individual-level racism, focusing on direct racism; four assessed vicarious racism, and one assessed vigilance [3,9,22,23,31,39]. Five studies distinguished between online racism and in-person racism, and one differentiated the victim experience between US-born and foreign-born Asian Americans [22,23,31,33,44,48]. Our synthesis of available data revealed that racism against Asian Americans during the COVID-19 pandemic in the United States impacted the 2 mental health outcomes of depression and anxiety.

Table . Literature review matrix summary.

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
1. Chae et al, 2021 [11]	604 Asian Americans; 844 Blacks in 5 US cities	May 21, 2020, to July 15, 2020	Vicarious racism (7-item Likert); vigilance (4-item Likert)	Depression and anxiety	Racism is associated with depression (Asian Americans: *b*=1.92; Blacks: *b*=1.72); racism is associated with anxiety (Asian Americans: *b*=2.4; Blacks: *b*=1.98); vicarious racism is associated with depression (Asian Americans: *b*=1.54; Blacks: *b*=0.90); vicarious racism is associated with anxiety (Asian Americans: *b*=1.98; Blacks: *b*=1.65)	Limited to 5 US cities
2. Cheah et al, 2020 [22]	543 Chinese Americans and their 230 children	March 14, 2020, to May 31, 2020	Online direct racism; online vicarious racism; in-person direct racism; in-person vicarious racism; health-related Sinophobia; Sinophobia in media	Psychological well-being (Ryff's 18-item); GAD-7[a], Beck Depression	Prevalence of racism: online racism (31.7% adults; 45.7% youths); online vicarious racism (76.8% adults; 76.5% youths); in-person racism (50.9% adults; 50.2% youths); in-person vicarious racism (88.5% adults; 91.9% youths). Psychological well-being was negatively associated with most types of racism. Anxiety and depression were positively associated with all types of racism.	Measured 6 types of racism in Chinese Americans and their children

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
3. Cheah et al, 2023 [31]	529 Chinese American parents and their 225 children (4 - 18 years old)	2020 and 2021	Health-related Sinophobia; media Sinophobia: online direct, online vicarious, in-person direct, in-person vicarious	Psychological well-being (Ryff's 18-item); GAD-7; Beck Depression	Dimensions of racism were more strongly associated with parent anxiety symptoms (interaction effect *b* values ranging from 0.74 to 1.76; *P* values ranging from .004 to <0.001) in 2021 than in 2020. Parent online vicarious discrimination was more strongly and positively associated with parent depressive symptoms (interaction effect *b*=1.03; *P*<.001). Racism dimensions were more strongly associated with youth anxiety symptoms (interaction effect *b* ranging from 0.92 to 1.65; *P* values ranging from .013 to <.001) in 2021 than in 2020.	Demonstrated the increased gravity of the mental health issues with time
4. Dhanani et al, 2022 [32]	Asians and Asian Americans (T1 only: n=401; T1 and T2: n=311)	April 2021	Experienced discrimination (Everyday Discrimination Scale); vicarious discrimination (adapted version of 3-item Vicarious Racism Scale)	PHQ[b]-9	Significant association with increased depression (*r*=0.31, *P*<.001), physical health symptoms (*r*=0.32, *P*<.001), and increased sleep disturbances (*r*=0.23, *P*<.001). Vicarious discrimination related significantly to all outcome variables (depressive symptoms: *r*=0.25, *P*<.001; physical health symptoms: *r*=0.27, *P*<.001; sleep quality: *r*=−0.17, *P*=.003; sleep disturbances: *r*=0.20, *P*<.001).	Focused measures of discrimination that occurred during the pandemic

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
5. Ermis-Demirtas, et al, 2022 [33]	114 Asian Americans: Chinese (53.5%), Japanese (24.6%), Korean (8.8%), Vietnamese (7%), Thai (3.5%), Filipino (2.6%)	January to May 2021	COVID-19–related discrimination online; COVID-19–related discrimination offline	PHQ-Adolescents, GAD-7	COVID-19–associated discrimination online and COVID-19–associated discrimination in-person variables accounted for an additional 18% variance in the outcome variable (PHQ-Adolescents; $F_{4,109}$=60.19; P<.001; R^2=.69; adjusted R^2=.68).	It was controlled for childhood trauma.
6. Fanta et al, 2023 [5]	229 East/Southeast Asian parents of a child between 2 and 19 years. Chinese (41%), Taiwanese (27.5%), and Filipino (11.8%).	Not applicable	Discrimination subscale of the General Ethnic Discrimination Scale; COVID-19 Discrimination Fear.	Anxiety and depression subscales of DASS-21[c]	Discrimination predicted higher levels of anxiety (B=.38, P<.001) and depression (B=.23, P<.001). Fear of discrimination was positively associated with anxiety (B=.18, P=.004)	Explored moderating effects of coping styles
7. Haft and Zhou, 2021 [34]	Chinese American college students (134 before and 64 after COVID-19)	Fall semester (September 9, 2019, to December 3, 2019) versus spring semester (February 4, 2020, to March 23, 2020)	Perceived discrimination	Beck Anxiety Inventory; overall media exposure; negative Chinese media exposure	An association between racism and anxiety was found (r=0.36, P<.001). The COVID-19 pandemic moderated the relationship between racism and anxiety. Negative Chinese media exposure mediated the relationship between racism and anxiety.	Measured during the immediate COVID-19 period
8. Huynh J et al, 2022 [36]	176 Asian American young adults and adolescents from 17 Asian ethnicities, mostly: Chinese (35%), Vietnamese (27%), and Filipinx (18%)	May 2021 to March 2022	Anti-Asian violence: experienced and perceptions of safety	PHQ-9	Three-quarters and two-thirds of participants felt less safe and depressed, respectively. Feeling less safe was more pronounced (P<.01) among those who experienced racism and depression.	Youth experience with racism
9. Huynh MP et al, 2024 [6]	3508 Asian Americans: Chinese (19%), Filipino (13.4%), Indian (19.1%), Korean (6.5%), Vietnamese (8.4%), other Asian Americans (15.2%)	January-April 2021	Anti-Asian discrimination; impact of discrimination	PHQ-2, GAD-7	Facing discrimination led to increased odds of psychological distress (OR[d] 2.10, 95% CI 1.61-2.74).	Examined moderating role of social support, stratified by gender

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
10. Huynh VW et al, 2022 [35]	380 self-identified East Asian and Southeast Asian American adults: Chinese (26.3%), Japanese (12.6%), Vietnamese (8.7%), Cambodian (8.4%), Korean (7.1%), Filipino (6.1%), Thai (5.5%), Malaysian (4.2%), Taiwanese (3.9%), Indonesian (3.9%), Hmong (3.7%), Laotian (3.7%), Burmese (3.2%), Singaporean (2.6%)	Not applicable	COVID-19–associated discrimination	CES-D[e], GAD-7	Discrimination was associated with anxiety (*r*=.50, *P*<.01) and depression (*r*=.49, *P*<.01).	Included subdomain of discrimination, and across ethnic identity
11. Ikram et al, 2023 [37]	289 self-identified Asian Indians living in the United States	May 2021 and July 2021	Individual discrimination	Two items: (1) feeling down, depressed, or lonely; and (2) feeling nervous, tense, or worried	Overall, 66% and 46% reported discrimination and poor mental health, respectively. Shapley additive explanations revealed that discrimination is 1 of the 6 predictors of poor mental health.	Use machine learning for data analysis
12. Keum and Choi, 2022 [38]	139 Asian American emerging adults: Chinese (28%), Asian Indian (15%), Filipino (9%), Vietnamese (8%), Japanese (6%), Korean (2%), Thai (2%), Taiwanese (2%), Bangladeshi (1%), Indonesian (1%), Hmong (1%), Laotian (1%), Singaporean (1%), Cambodian (1%), bi/multiethnic (between Asian ethnicities) (9%), others (3%)	June to July 2021	COVID-19 racism	AUDIT[f], PHQ-9	COVID-19 racism predicted alcohol use severity (standardized effect β=.514, 99% bootstrapped CI .314-.713). Furthermore, the mediating analysis showed that racism predicted alcohol use severity through depressive symptoms and drinking to cope motives, accounting for 48% of the variance explained.	Examine mediating effects; small sample size

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
13. Layug et al, 2022 [39]	1147 adults (aged 18 years or above): White (47.86%), Latinex (11.6%), Black (9.5%), Indigenous (0.96%), mixed (2.88%), Asian Americans and Pacific Islanders (26.68%), Chinese, Japanese, Korean, Filipino, Vietnamese, Indian, Pakistani, Bangladeshi, Sri Lankan, Hmong	March 3 to 15, 2021	Online racial discrimination: individual discrimination, and vicarious discrimination	PHQ-9, GAD-7	Individual online perceived discrimination was a significant positive predictor of STS[g] (β=.52, *P*<.001), depression (β=.53, *P*<.001), and anxiety (β=.41, *P*<.001). Vicarious online perceived discrimination was positively associated with STS (β=.39, *P*<.001), depression (β=.39, *P*<.001), and anxiety (β=.33, *P*<.001). Asian Americans reported higher vicarious discrimination than Latinx and White Americans.	Explored moderator effect of racial-ethnic identity
14. Lee et al, 2020 [10]	410 Asian Americans		Impact of COVID-19; racial discrimination; social support (Multidimensional Scale of Perceived Social Support)	BAI[h], CES-D; physical health; sleep health	Asian Americans reported experiencing racism (30%), anxiety (40%), depression (53%), sleep health problems (43%), and physical health problems (15%). Social support had a buffering effect on depression.	Highlighted the buffering effect of social support in the experience of depression
15. Li et al, 2023 [40]	301 Chinese Americans	April 8 – 21, 2021	A perceived double threat, online media, and the community COVID-19 racial discrimination	Anxiety (GAD-7)	231 (76.74%) reported threats due to their Chinese ethnic background. Predictors for anxiety were racial discrimination from the local community (OR 0.47, 95% CI 0.39 – 0.71, *P*<.001), media/online (OR 0.36, 95% CI 0.26 – 0.53, *P*<.001), the perceived threat from the COVID-19 virus (OR 0.33, 95% CI 0.23 – 0.51, *P*<.001) and perceived racism threat from Chinese background related to COVID-19 (OR 0.31, 95% CI 0.21 – 0.49, *P*<.001).	The perceived double threat was explored

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
16. Litam et al, 2022	187 Asian Americans		Everyday discrimination Scale (9 items); multigroup ethnic identity; Coping Strategies Inventory-SF	Satisfaction with Life Scale; CES-D revised; BAI	Racism has a negative association with life satisfaction (b=−0.253, P<.001), and a positive association with depression (b=1.479, P<.001). Ethnic identity is a positive moderator of the relationship between racism and depression. Coping strategy is a positive moderator of the relationship between depression and life satisfaction.	Highlighted the moderating effect of ethnic identity in racism and life satisfaction association
17. Li et al, 2023 [41]	246 Filipino Americans (who experienced or witnessed COVID-19 racism)	Not indicated	COVID-19–related racial discrimination (modified Everyday Discrimination Scale)	Anxiety (Beck Anxiety Inventory), depression (CESD-R)[i]	COVID-19–related racial discrimination was significantly negatively related to life satisfaction (β=−.208, P<.001) and positively related to depression (β=.505, P<.001) and anxiety (β=.496, P<.001). Coping strategy moderated the mediated relationship of COVID-19 racial discrimination via depression with life satisfaction.	Focused on those who experienced or witnessed COVID-19 racism
18. Liu Y et al, 2020 [42]	3665 US population	March survey (March 1031, 2020) versus April survey (April 1-28, 2020)	COVID-19–associated discrimination	PHQ-4	Racism increased from March (4%) to April (10%). Non-Hispanic Blacks and Asian Americans experienced increased racism compared to other groups. People who perceived racism reported increased depression (March: OR 0.77; April: OR 1.01)	The total sample included 75% non-Hispanic White

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
19. Liu T et al, 2022 [43]	565 Asian Americans: Chinese (40%), South Asian (18.1%), Southeast Asian (20.1%), Korean (10.4%), Japanese (4.8%), others (6.6%).	June 2020	COVID-19–specific racism and internalized racism	DASS-21 and PHQ-15	Internalized racism moderated the relations between vicarious racism and psychological distress only for those who were 1.5 generations and above. Individuals who reported higher levels of internalized racism (upper 33%) had higher mean scores of both psychological distress, $F_{2,558}$=24.25, P<.001, and somatic symptoms, $F_{2,556}$=6.86, P=.001, when compared to those with low levels of internalized racism (lower 33%). Generational status moderated the relations between vicarious racism and psychological distress (DASS-21) differentially by generation, a test of three-way interactions was significant, ΔR^2=.011, $F_{1,550}$=7.53, P=.006, b=.025, t_{550}=2.74, P=.006.	Examined the complex 3-way interaction among COVID-19–related racism, generation status, and internalized racism

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
20. Liu MA et al, 2022 [52]	289 Asian Americans	Mid-July 2020	Discrimination experiences (frequency and attribution on race)	Social anxiety (Social Interaction Anxiety Scale), depression (Epidemiological Studies–Depression measure), accumulated stress (Social, Attitudinal, Familial, and Environmental Acculturative Stress Scale–Short Form)	Discrimination was significantly and positively related to depressive symptoms (*B*=7.64, *P*<.001) and alcohol use (*B*=7.05, *P*<.001). This relationship fell short of significance for social anxiety symptoms (*B*=1.55, *P*=.051). About half of the overall sample reported experiencing discrimination (51.6%). Collective self-esteem significantly moderated the relationship between attribution to race and social anxiety (*P*=.021), and internalized racism weakened the relationship between discrimination frequency and depression (*P*=.038).	Moderators were explored.
21. Lu et al, 2022 [44]	218 Asian American college students	March 27 to April 17, 2020	Direct online racial discrimination and general vicarious racial discrimination	GAD-7 and PHQ-9	Overall, 58.7% and 88.1% reported direct online and vicarious racial discrimination, respectively. Direct online racial discrimination was significantly related to depression (*r*=.29, *P*=.003) and anxiety (*r*=.25, *P*<.001). Vicarious racial discrimination also showed a significant relation with depression (*r*=.30, *P*<.001) and anxiety (*r*=.46, *P*<.001).	Examined buffering effect of social support depending on the locus of control factor

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
22. McGarity-Palmer et al, 2023 [45]	3478 Asian Americans: Chinese (19%), Filipino (13.4%), Indian (18.5%), Korean (6.4%), Vietnamese (8.4%), Pakistani (2.3%), Japanese (3.4%), Cambodian (4.3%), other (5%), multiethnic (2.2%), multiracial (16.8%)	2021	Coronavirus Racial Bias Scale; discrimination	PHQ-4	In total, 24% of Asian Americans (95% CI 21.6-25.6) reported experiencing discrimination. COVID-19–related collective racism was associated with increased psychological distress, above and beyond sociodemographic factors, and other COVID-19–related stressors (R^2=0.36, 95% CI 0.33-0.38).	Performed subgroup analyses
23. Oh S et al, 2022 [46]	270 Korean Americans	Not applicable	Everyday discrimination	BAI and CESD-R	COVID-19–related racial discrimination had significantly positive correlations with depression and anxiety (R=.73 and R=.61, respectively). Ethnic identity scores were positively correlated with scores of racial discrimination, anxiety, and depression, ranging in magnitude from r=.22 to .39.	Explored potential impacts of ethnic identity and coping strategies
24. Oh and Litam, 2022 [46]	725 Asian Americans and Pacific Islanders: Chinese (24.1%), Filipino (23.4%), Korean (17.2%), Vietnamese (7.9%), Japanese (7.0%), Thai (1.9%), other Asian ethnicities (18.3%)	Not applicable	Everyday discrimination	BAI and CESD-R	The path between experiences of racial discrimination and life satisfaction was mediated by anxiety (b=−.086, $SE\ b$=.022, t=−3.843, 95% CI −.131 to −.042) and depression (b=−.044, $SE\ B$=.017, t=−2.590, 95% CI −.077 to −.011). Coping strategies attenuated the link between discrimination and anxiety, and discrimination and depression.	Examined the role of coping in the relationship between racial discrimination and 2 mediators (anxiety and depression)

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
25. Pan et al, 2020 [48]	6707 Asian Americans	March 10-31, 2020	COVID-19 stigmatization	PHQ-4	A higher percentage of foreign-born Asian Americans experience racism than US-born Asian Americans (11.2% vs 10.9%). People who experienced COVID-19–related stigmatization reported increased psychological distress (19.9% vs 10.6%). US-born Asian Americans who experienced racism were more likely to exhibit psychological distress than non-Hispanic whites.	Included a larger population and Asian Americans
26. Jun et al, 2021 [49]	254 Asian Americans: Chinese (27.1%), Filipino (13.7%), Korean (10.8%), Vietnamese (10.8%), Japanese (8.7%), other (28.7%)	May 2020	COVID-19 discrimination (occurrence and impact); communication sources about COVID-19	CES-D (20-item)	Both COVID-19 racial discrimination (*b*=4.40, *P*<.001) and previous racial discrimination (*b*=3.05, *P*<.001) were positively associated with depressive symptoms. The negative effects of racism did not vary among different Asian American groups. Not all sources of communication help with depression. Talking with the spouse alleviated depression and interaction on social media depression.	Focused on those 254 who experienced racism

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
27. Wu et al, 2021 [50]	68,218 data points, tracking 7778 individuals over 13 survey waves	March to September 2020	Acute discrimination	PHQ-4	The mental health gap between Asian Americans and whites (gap=0.98, *P*<.000) is greater than the gap between Asian immigrants and whites (gap=0.18, *P*<.000). 11% of Whites, 22% of Asian Americans, and 21% of Asian immigrants encountered discrimination. A 1-unit within-person increase in acute discrimination leads to a within-person increase in mental disorders by 0.066 units (*P*<.001). Racism mainly explains the disproportionate mental health impact of the pandemic on Asian Americans. US-born Asian Americans experience more racism and anxiety than foreign-born Asian Americans.	Larger population and hone in on Asian American experience from a large dataset

Publication	Sample population	Time frame	Racism variables	Mental health outcomes	Main findings	Strengths/significance
28. Zhou et al, 2023 [51]	Three waves of Asian Pacific Islander students across campuses: Fall 2019 (n=3929), Spring 2020 (n=7813), and Fall 2020 (n=4804).	September-December 2019, March-May 2020, September-December 2020	COVID-19–related discrimination	PHQ-9 and GAD-7	In Fall 2020, experiencing COVID-19–related discrimination was associated with 1.90 greater odds of moderate to severe depression (95% CI 1.13-3.19; *P*=.016), 2.15 greater odds of severe depression (95% CI 1.29-3.58; *P*=.003), 1.72 greater odds of moderate to severe anxiety (95% CI 1.07-2.75; *P*=.024), and 1.77 greater odds of severe anxiety (95% CI 1.04-3.01; *P*=.035).	Large sample inclusive of young adult Asian Pacific Islanders

[a] GAD-7: General Anxiety Disorder-7.

[b] PHQ: Patient Health Questionnaire.

[c] DASS-21: Depression and Anxiety Stress Scales.

[d] OR: odds ratio.

[e] CES-D: Center for Epidemiologic Studies Depression Scale.

[f] AUDIT: Alcohol Use Disorders Identification Test.

[g] STS: Secondary Traumatic Stress.

[h] BAI: Beck Anxiety Inventory.

[i] CESD-R: Center for Epidemiologic Studies Depression Scale Revised.

Assessed Domains of Racism

As indicated in the previous section, racism encompasses multiple dimensions and forms of expression that depend broadly on social contexts and many other factors. To provide greater insights into this phenomenon as gleaned from our integrative review, a clear understanding of how the authors described various forms of racism is critical to providing a complete picture of what Asian Americans experienced during the COVID-19 pandemic.

Despite the variability in the measurements used in assessing racism among these 9 articles, the victims experienced racist expressions and acts in identifiable ways. Everyday discrimination is defined as the perception of “being treated with less courtesy and respect” [41,42,50,53]. Beyond lack of courtesy and respect, additional descriptors of racism include “receiving poor services at restaurants or stores” [42,50,53,54]. COVID-19–associated acute discrimination was captured by a shorter version of a questionnaire, including only 4 elements of racism (treated with less courtesy and respect, receiving poorer service, being threatened or harassed, and being subjected to others’ fear of COVID-19) [50]. Some victims reported exposure to more aggression, such as physical attacks or verbal attacks of “go back to your own country” [42,50,53,54]. However, some researchers captured more subtle expressions of racism described, for example, “people assume my English is poor due to my race” or “you are called names or insults” [34,55]. Specifically relevant to mental health, the concept of racial discrimination vigilance is worth considering. It is defined as “physical, behavioral, cognitive, and emotional attentiveness to the environment in anticipation of experiencing racism” due to repeated exposure to racism [11]. More subtle expressions of racism experience are described as vicarious racism, which is “indirectly hearing about or seeing racist acts committed against either a member of one’s racial group (friends or family members) personally or in the news” [11].

Assessed Domains of Mental Health

Depression

All 29 articles consistently reported depression as a primary outcome, establishing a direct link between the experience of racism and depression among Asian Americans during the COVID-19 pandemic [5,6,11,31-34,36-39,41-48,50-58]. The association between racism and depression among Asian Americans during the COVID-19 pandemic is profound, as derived from moderate sample size studies and large probability-based, nationally representative samples (Table 2) [50,55]. Most publications reported statistically significant relationships between racism and depression. Consistent with existing literature, Asian American individuals exposed to racist expressions directed at other Asian American groups (vicarious racism) were more likely to experience depression [11,22,31,36,44,48,55]. Being exposed to racism in all forms (online-direct, online-vicarious, in-person–direct, in-person–vicarious, hate-related Sinophobia [defined as fear or dislike of China], and Sinophobia in media) was significantly associated with depression, validating our understanding that social environments of hatred and stereotypes can influence the psyche and mental health of those experiencing racism [22,36,39,58]. Foreign-born Asian Americans and US-born Asian Americans experienced the highest COVID-19 stigma among eight ethnoracial groups: (1) White only, non-Hispanic; (2) White only, Hispanic; (3) Black only; (4) Asian only, foreign born; (5) Asian only, US-born; (6) Asian of mixed race; (7) non-Asian of mixed race; and (8) Indigenous only [53,59,60]. Focusing specifically on racism related to the COVID-19 pandemic, Asian Americans who experienced COVID-19 stigmatization were significantly more likely to report psychological distress (depressive symptoms) than those who did not [53]. COVID-19 stigmatization refers to describing a characteristic or a group of people in a way that shows strong disapproval related to the COVID-19 pandemic; it is a form of discriminatory expression [53]. In a large population-based study evaluating the mental health impact of the COVID-19 pandemic, US-born Asian Americans disproportionately experienced more significant levels of depression than foreign-born Asian Americans, suggesting that demographics and acculturation may explain differing racism experiences [50].

Anxiety

Researchers used various tools in multiple domains of racism and found that anti-Asian sentiments have statistically significant associations with anxiety [5,6,11,18,22,31,33-35,38-41,43,44,46,47,51,52,55,56]. Cheah et al 22found that Asian Americans who self-reported more significant vicarious racism had more symptoms of anxiety when controlling for sociodemographic characteristics. The strength of this association was higher than that measured among African Americans during the same assessment time frame around the COVID-19 pandemic, possibly suggesting that this social crisis had a more ethnic-specific impact [9]. Similar to the finding on depression, all types of racial discrimination and Sinophobia were associated with anxiety among adult Asian Americans [22]. In a survey study of 410 Asian American participants who experienced racism during the pandemic, increased incidents of discrimination significantly predicted anxiety symptoms, and social support had a buffering effect for anxiety [44]. Of interest is the damaging impact racism had on younger Asian Americans. Among Asian American youths, anxiety symptoms and internalizing problems were associated with all types of racial discrimination and Sinophobia, suggesting detrimental effects of racism experienced either directly or indirectly through their parents' experience [22,31,37]. Cheah et al [22] further highlighted that vulnerable youths may be more impacted by COVID-19–related racism because these youths are exposed not only to direct racism but also to the indirect impact of their parents' victimization experiences, which may translate into increased family stress, a hostile family environment, and negative parenting.

Potential Moderators of Depression and Anxiety

Our analysis identified potential moderating factors influencing the relationship between racism and mental health outcomes of depression and anxiety. The synthesis of the data points to the importance of social support in reducing the impact of racism; Asian Americans who experienced a greater incidence of discrimination with less social support reported significantly more depressive symptoms [6,54,55]. In addition, coping strategies and collective self-esteem moderated the relationship between COVID-19 racial discrimination and depression [41,43,46,52,56]. This relationship between racism and anxiety exists through the mediating effect of harmful Chinese media exposure, which is the exposure a person has to the negative portrayal of Chinese immigrants in the media [29,33]. Examples of negative portrayals of Asian Americans may include roles demonstrative of submissiveness, sexual fetish, perpetual foreigners, and model minority. Negative displays or mentions of Asian Americans in media have been shown to incubate and foster racist sentiments against Asian Americans throughout history, particularly during the COVID-19 pandemic, ultimately having harmful effects.

Considering the historical perspective of racism against Asian Americans in the United States, the COVID-19 pandemic intensified the impact of racism on Asian Americans' mental health, as shown in a moderating effect of the COVID-19 pandemic on the relationship between racism and anxiety [33]. A comparative assessment of social media usage before and after March 16, 2020, indicated that the number of hashtags associated with anti-Asian sentiments (eg, #Chinesevirus) increased significantly. Because of the lockdown mandate, online indirect racism became more common, translating into some challenges for accurately assessing the mental health impact each form of racism may have had on Asian American communities.

Discussion

Principal Findings

Our integrative review synthesis of the relationships between COVID-19–related racism and mental health indicates that there are positive correlations between racism, depression, and anxiety. This study represents a comprehensive, up-to-date integrative review of the impact of COVID-19–related racism on mental health outcomes experienced by Asian Americans living in the United States. We identified 2 significant mental health outcomes, including depression and anxiety. Potential factors such as the portrayal of nonstereotypical roles of Asian Americans, effective framing of news media, and social support may mitigate the impact on mental health outcomes to counteract this difficult-to-avoid exposure [29,33]. Researchers described further investigations of moderating factors such as coping style, ethnic identities, and social support to lay the groundwork for potential mitigation [5,6,43,44,56,61]. Strengthening ethnic identity and coping strategies are possible avenues to empower individuals to lessen the impact of racism on mental health.

Our original intent was also to include the impact of racism in the form of physical assaults or crimes perpetrated against Asian Americans during the COVID-19 pandemic. However, we found few that examined direct links between racism and bodily harm. According to the private organization assessment of hate crimes during the COVID-19 pandemic, physical assaults on Asian Americans and Pacific Islanders increased to 1900 cases in 2020 in the United States, coinciding with the pandemic's peak [62]. Although it is indisputable that hate crimes against Asian Americans dramatically increased during the pandemic, the limited availability of systematically collected data beyond anecdotal reports is possibly due to the lack of a standardized reporting system and the hesitancy of victims to report the crime [63].

While acknowledging that Asian Americans as a group comprise many ethnic origins and languages, this review suggests that Asian Americans experienced the impacts of racism similarly across all ethnic groups. However, it is noteworthy that the experience of racism and its effects on mental health differs between US-born Asian Americans and foreign-born Asian Americans [50,53]. The long-existing view of Asian Americans as "perpetual foreigners" may contribute to the fact that US-born Asians reported a sense of not belonging in either their native countries or the United States. Similarly, the experience of racism differs among generations (first or foreign-born vs second or US-born vs third or US-born) [3,40,43,47].

Although our integrative review revealed that depression and anxiety are significant sequelae of COVID-19–related racism among Asian Americans, some studies identified sleep disturbance as a secondary consequence of racism. Because mental health and sleep are firmly connected, and sleep disturbance can be viewed as a mental health construct (even though it is frequently measured as physiological health), we did not include this outcome as a separate category [58,61,64]. The interconnectedness of these variables emphasizes the overarching influences of racism on mental health that affect both the mind and body.

The impact of COVID-19–related racism on mental health among ethnic minority groups share similarities, yet there are some unique aspects among Asian Americans. Blacks and Latinx Americans also experienced worse depression and anxiety as COVID-19–related racism escalated [11,42,50]. Although all minority groups in the United States have experienced historical and systemic racism, COVID-19–related racism affected Asian Americans or persons who present with Asian phenotypes uniquely because they have been blamed for the origin and the transmission of SARS-CoV-2. Although comparing the deteriorating mental health experienced by Asian Americans and other minority groups is insightful, overemphasis on this difference may prove to be divisive rather than unifying. Further, within Asian American ethnic groups, differences exist in education levels, household incomes, and access to social benefits. Analyzing data as a whole without recognizing these differences may risk ignoring more profound health disparities in some subgroups. Regardless of minority group, a comprehensive approach to addressing racism should include "initiatives to raise awareness levels of the pervasiveness of inequities in health, build empathy and support for addressing inequities, enhance the capacity of individuals and communities to actively participate in intervention efforts and implement large scale efforts to reduce racial prejudice, ideologies, and stereotypes in the larger culture that undergird policy preferences that initiate and sustain inequities" [65]. All 29 articles reviewed here utilized one type of research design, cross-sectional survey study designs, and were conducted during the COVID-19 pandemic in March 2020. Most studies in our review used a small sample size, making it difficult to generalize to the larger population. Although we intended to include all Asian American groups in our original search, most studies included Chinese Americans, and some studies included participants from a single ethnicity, such as Korean, Filipino, and Asian Indians [22,31,34,37,40,41,47,56]. Since we included only studies conducted in the United States, we should avoid generalizing study findings in different geographical and cultural contexts outside the United States. Importantly, Asian Americans are nonmonolithic, with diverse socioeconomic and educational backgrounds, and it is challenging to describe precisely how racism affects each group [29].

Clinical Implications and Future Research

Overview

The act of racism (with its plethora of presentations) has a range of impacts on the victim that span from mental health deterioration, discriminatory effects (employment), and physical crime (physical assault). Our integrative review results address an essential query by summarizing how racist sentiments impact mental health and well-being among Asian Americans living in the United States during the COVID-19 pandemic. This scientific knowledge provides a foundation for further research directions and clinical implications addressing this urgent issue with the following recommendations.

Public Awareness and Individual-Level Education

Following the US Commission on Civil Rights 2023, Statutory Enforcement Report on the Federal Response to Anti-Asian Racism in the United States, there is a need to increase public awareness campaigns and education about all dimensions of racism, systemic racism, the prevalence of racism, and anti-racism initiatives [59]. Given the profound mental health impact of racism, a culturally tailored educational program should be provided to Asian Americans, their family members, and the community. Academic programs may include a clear understanding of the legal right to safety and security, with attention to social justice and equity. These public awareness campaigns and education efforts should positively impact personal and systemic changes with measurable and meaningful outcomes. In raising public awareness about anti-Asian sentiments in America, it is essential to include all types of racism. Evidence shows that subtle displays of racism are more prevalent than the overt type yet they can still potentially be harmful. Biases, left unrecognized and not dealt with, have the potential to fuse into systemic racism. The success of public awareness and education depends on financial support and advocacy for funding to build and sustain these essential initiatives and address the root causes of these acts and words.

Programs to Document Incidents of Racism and Hate Crimes

There is an urgent need to establish programs to empower Asian American community members to recognize racism and report all occurrences of racism. Ponce (2022) indicates that only 6.9% of Asian Americans reported race-based hate, and 62.4% of these reported no exposure to race-based unfair treatment [63]. This report revealed that there is discordance between reporting and actual exposure; Asian Americans were found to experience high psychological distress, forgo necessary medical care, and have personal conflicts and insecurity about safety [62]. Since racist incidents often occur among vulnerable Asian Americans (eg, females, older adults, and young victims), the provision of specific "how-to" tools for recognizing the problem and promptly filing reports is of importance. To create action plans to address racism in the United States, accurate and timely documentation of the incidents is necessary [29,49]. As announced by the Biden administration, a system for reporting hate crimes against Asian Americans was established and funded. However, a barrier to this effort may be a lack of public awareness and education programs to educate vulnerable victims about recognizing and reporting these crimes.

Intervention Programs for Mental Health

Our findings suggest a critical need to design interventions such as culturally responsive trauma-informed treatment to address the mental health needs of victimized Asian Americans. Culturally responsive, trauma-informed intervention includes the recognition that the current anti-Asian sentiment may activate intergenerational trauma, reinforce cultural mistrust, and echo centuries of historical oppression [41]. Counseling approaches and intervention programs aiming to address this traumatic psychological distress within the context of COVID-19–related racism should incorporate relevant contributing factors that may mediate or moderate the effects of racism on mental distress [54]. Culturally sensitive trauma-informed care refers to the capacity for health care professionals to provide trauma-informed assessment and intervention that acknowledges, respects, and integrates patients' and families' cultural values, beliefs, and practices.

We need to advocate for resources supporting intervention programs to address mental health that are culturally relevant and anchored in engaging family- and community-level initiatives [12,66-68]. In exploring the type of social support that may help alleviate mental health (communication method about the COVID-19 pandemic), not all communication sources help alleviate depression among Asian Americans who experienced racism [54]. Talking with a partner/spouse was shown to be the type of communication with the most positive impact on depression, suggesting family- or community-level intervention programs to be the most helpful [54]. More research is needed to understand the moderating impact of social support and ethnic identity as a possible intervention for those who experience racism-related depression.

Conclusions

This integrative review summarizes the gravity of the mental health outcomes of depression and anxiety among Asian Americans associated with a wide range of racism related to the COVID-19 pandemic. Our findings suggest a critical need to design interventions such as culturally responsive trauma-informed treatment to address various Asian American groups' urgent mental health needs. Furthermore, more research is needed to examine the long-term impact of discrimination on mental health in Asian Americans and address the ongoing health inequity in health care practice.

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Conflicts of Interest

None declared.

Checklist 1
PRISMA checklist.
[PDF File, 90 KB - apinj_v9i1e63769_app1.pdf]

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Abbreviations

JBI: Joanna Briggs Institute
OR: odds ratio
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

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Games to Improve the Clinical Skills of Nursing Students: Systematic Review of Current Evidence

Soleiman Ahmady[1*]; Hanieh Zehtab Hashemi[2,3*]; Arghavan Afra[4*]; Niloofar Attarian[5*]; Amir Tabari[5*]; Fariba Shabani[6*]; Ayoob Molla[7*]; Esmaeil Mehraeen[8*]

[1]Department of Medical Education, School of Medical Education and Learning Technologies, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[2]Department of Health Informatics, Smart University of Medical Sciences, Tehran, Iran

[3]Artificial Intelligence in Medical Sciences Research Center, Smart University of Medical Sciences, Tehran, Iran

[4]Department of Nursing, School of Nursing, Abadan University of Medical Sciences, Abadan, Iran

[5]School of Medicine, Azad University of Medical Sciences, Mashhad, Iran

[6]Department of Health Information Management, School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[7]School of Medicine, Bushehr University of Medical Sciences, Bandar Būshehr, Iran

[8]Department of Medical Education, Smart University of Medical Sciences, No.3 1st Alley, Sarafraz St, Shaheed Beheshti St, Tehran, Iran

[*]all authors contributed equally

Corresponding Author:
Esmaeil Mehraeen
Department of Medical Education, Smart University of Medical Sciences, No.3 1st Alley, Sarafraz St, Shaheed Beheshti St, Tehran, Iran

Abstract

Background: As medical education evolves, incorporating innovative teaching methods is crucial for developing nursing students' critical thinking and problem-solving skills. Game-based learning (GBL) has gained popularity, engaging students through immersive experiences and allowing personalized learning.

Objective: This systematic review aimed to investigate the impact of educational games on outcomes of clinical nursing skills.

Methods: In this study, the authors systematically searched the 4 public databases (PubMed, Embase, Scopus, and Web of Science) to investigate the role of educational games in improving the clinical skills of nursing students. This paper is based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines. We also checked the bias risk of selected studies by the Newcastle-Ottawa Scale (NOS) bias assessment tool.

Results: In this study, 801 articles were initially retrieved using a specified search strategy, with 38 remaining after applying inclusion and exclusion criteria. The final included studies published between 2017 and 2023 spanned various countries and focused on diverse learning objectives. A broad range of learning objectives, such as developing diagnostic reasoning, enhancing knowledge and cognitive skills, and improving training methods, can be supported by a game-based platform. We also showed that while many games used web-based platforms, few were conducted in person, and some were developed in app formats for smartphones.

Conclusions: GBL is transforming nursing education by enhancing student engagement and clinical skills through immersive experiences. Despite its advantages, GBL faces challenges such as development costs and the effect of expertise reversal. Developing standardized assessment tools will help unify definitions and improve the comparability of research findings, ultimately enhancing the evidence base for GBL's effectiveness.

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KEYWORDS

education; nurse education; educational games; game-based learning; simulation; clinical skills; nursing

Introduction

As medical science and medicine advance daily and continuously influence medical education, health care, and nursing must constantly seek innovative teaching and learning methods [1-3]. Nurses are the frontline of medical care and constitute the largest segment of the global health workforce. Considering this, it is more than crucial for nursing students to receive a thorough education during their training, which can be provided through advanced evidence-based educational programs that keep pace with current changes in the field [4].

Currently, medical and nursing students are required to acquire advanced skills during their educational courses, including high levels of skills in critical thinking, problem-solving, and analysis, to pave the way toward developing higher-order thinking skills [1]. Nursing education encounters several challenges, including limited training time, which restricts the ability to provide effective practical learning experiences. These obstacles underscore the necessity for innovative strategies that can complement traditional educational methods and improve the overall quality of nursing education [5]. With the emerging role of technologies in this century, it is essential to incorporate active learning methods that go beyond traditional reading, listening, or watching, enabling students to explore and integrate knowledge actively to develop these levels of skills [1].

E-learning, web-based learning, computer-based simulators, mobile devices, virtual reality modalities, and games are a few of the various information technologies and educational methodologies that have been incorporated into nursing education due to technological advancements that we are witnessing in the current era, augmenting the traditional educational curricula [4]. Among the diverse modalities of technology-enhanced learning, games serve as exemplary tools for facilitating collaborative activities, review, and evaluation within the classroom setting. They introduce an element of enjoyment and maintain a clear educational objective, resulting in positive learning outcomes. Furthermore, microlearning (the process of acquiring knowledge through small chunks of information that can be delivered via videos, articles, ebooks, audio clips, etc) strategies contribute to enhancing the effectiveness of educational experiences [6].

The application of gamification within the education of health care professionals is experiencing rapid growth [7]. Gamification is a strategic approach to enhance engagement by integrating game elements into educational settings. This methodology aims to develop specific skills, establish objectives that imbue learning with meaning, actively involve students, optimize the learning process, facilitate behavioral change, and promote social interaction [8].

In nursing education, there has been a notable increase in the adoption of innovative teaching methods to adapt to the aforementioned issues. One such approach that is becoming increasingly and significantly popular is game-based learning (GBL) [1]. GBL incorporates games or game-like elements, concepts, mechanisms, or designs into education. This approach integrates educational games into classroom instruction and self-directed learning, offering students an immersive learning experience that enhances their acquisition of knowledge and skills [9]. This method consists of enabling students to learn through personal experiences via gaming perspectives and platforms and allows them to manage their learning according to their progress and capabilities [1].

GBL research often references three key terms: “serious game,” “educational game,” and “digital educational game.” These terms overlap, but differ in specific ways. A serious game refers to games designed with an educational purpose, rather than for entertainment. Educational games are games specifically designed for education, including both physical and digital formats. Narrowly defined, they are electronic games developed for learning, while broadly defined, they encompass traditional games, educational software, and toys that combine fun with learning objectives. In addition, digital educational games refer to educational games that require digital platforms and technology. They promote understanding of educational content and come in various types, such as adventure, role-playing, business, and logic games. These games can support both single-player and multiplayer formats. This concept can integrate fun with learning, enhancing the educational experience by leveraging technology to engage learners and improve their mastery of the subject matter [9].

These approaches support learning by integrating activities like feedback, testing, and spaced repetition with active participation, autonomy, and positive experiences for students, promoting a more effective educational environment [10]. According to the literature available surrounding this matter, students who have experienced GBL are more likely to achieve significantly better cognitive learning outcomes. GBL creates an atmosphere of high enthusiasm, active participation, and great enjoyment, and the fusion of these is more likely linked to improving learning results [11].

By fully engaging in an activity, one can achieve a state of intense focus, which can aid the learning process and lead to an optimal experience of learning. This state is referred to as “flow.” GBL encompasses physical games like board games and digital formats, including virtual reality. These educational models engage students with challenges that promote exploratory behavior, allowing them to actively solve problems and reflect on their actions, drawing on the concept of “flow” [1]. The affordances identified in GBL are consistent with the principles of flow theory. It is anticipated that as players engage with the game and refine their skills, the level of difficulty will progressively increase. Consequently, flow theory is used in game studies to foster concentration among students during lectures, based on these principles [12].

Although nurse educators have been slow to embrace this concept, research shows that game-based learning frequently outperforms traditional teaching methods [1,7]. In addition, the COVID-19 pandemic emerged as a cause to force higher education institutions to rapidly shift to virtual teaching and learning, which necessitated maintaining student engagement while ensuring that the content and methods stayed relevant to their future careers [7].

A recent systematic review supports these points and emphasizes the necessity for more research on the use of specific games among nursing students [1]. Identifying and analyzing the increasing number of published studies in this area is important to develop a comprehensive evidence base. This systematic review aims to identify studies on educational games in nursing education that enhance students’ skills, summarize their impacts on learning outcomes, and explore the concept of game-based learning in nursing.

Methods

Overview

In this study, the authors systematically searched the 4 public databases to investigate the role of educational games in improving the clinical skills of nursing students. This paper is based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines (the PRISMA checklist is provided in Checklist 1). We also checked the bias risk of selected studies by the Newcastle-Ottawa Scale (NOS) bias assessment tool.

Data Sources

We searched the defined keywords in the databases of PubMed, Embase, Scopus, and Web of Science. The search was conducted on July 14, 2024, and all English-language studies were included in the screening. The PubMed search query and its combinations are as follows: (“games, experimental”[MeSH Terms] OR “gamification”[MeSH Terms] OR “game”[Title/Abstract] OR “gamification”[Title/Abstract] OR “educational game”[Title/Abstract] OR “serious game”[Title/Abstract]) AND (“Nurses”[MeSH Terms] OR “Nursing”[MeSH Terms] OR “Nurse Practitioners”[MeSH Terms] OR Nurses[Ti] OR Nursing[Ti] OR “Nurse Practitioners”[Title/Abstract]) AND (“Education”[MeSH Terms] OR “Education”[Title/Abstract] OR “Learning”[Title/Abstract] OR “Nursing education”[Title/Abstract] OR “Clinical skills”[Title/Abstract] OR “Virtual reality”[Title/Abstract] OR “Virtual learning”[Title/Abstract] OR “Virtual education”[Title/Abstract] OR “Virtualization”[Title/Abstract]). Similar structured queries were applied in Embase, Scopus, and Web of Science, adjusted for each database’s indexing system (Multimedia Appendix 1).

(“games, experimental”[MeSH Terms] OR “gamification”[MeSH Terms] OR “game”[Title/Abstract] OR “gamification”[Title/Abstract] OR “educational game”[Title/Abstract] OR “serious game”[Title/Abstract]) AND (“Nurses”[MeSH Terms] OR “Nursing”[MeSH Terms] OR “Nurse Practitioners”[MeSH Terms] OR Nurses[Ti] OR Nursing[Ti] OR “Nurse Practitioners”[Title/Abstract]) AND (“Education”[MeSH Terms] OR “Education”[Title/Abstract] OR “Learning”[Title/Abstract] OR “Nursing education”[Title/Abstract] OR “Clinical skills”[Title/Abstract] OR “Virtual reality”[Title/Abstract] OR “Virtual learning”[Title/Abstract] OR “Virtual education”[Title/Abstract] OR “Virtualization”[Title/Abstract])).

Study Selection

Articles related to the purpose of our study were screened and selected in 2 steps. In the first stage, the titles and abstracts of the studies were evaluated, and the relevant articles were selected for the second and deeper stage according to their titles and abstracts. In the second step, the authors reviewed the full texts of these articles. Publications that met the inclusion criteria were selected for data extraction (Article selection criteria Textbox 1).

Textbox 1.

Inclusion criteria:

Papers reporting educational games in nursing, published in the English language, and being original.

Exclusion criteria:

Articles without available full texts, lacking published data, duplicated articles, case series, case reports, conference abstracts, and letters to the editors.

Data Extraction

After selecting eligible articles, data extraction began. A total of 4 researchers diligently reviewed the full texts of the selected studies and pulled the required data together. Data related to the objectives of this research were extracted from selected studies. Data about the first author, country, year of publication, the aim of the study, participants, learning objectives, type and name of the game, platform, game features, and main findings of selected studies were extracted in Tables 1 and 2.

Table . Specifications of included articles.

ID	The first author (Reference)	Country (Year)	The aim of the study	Participants (number)
1	Tinoco JD [13]	Brazil (2023)	Develop and assess a board game's effectiveness for teaching diagnostic reasoning among nursing students.	19 experts and 11 undergraduate nursing students
2	Vazquez-Calatayud M [14]	Spain (2023)	To enhance postgraduate nursing students' decision-making skills using a game-based learning intervention.	66 postgraduate nursing students.
3	Morgan DJ [15]	United States (2023)	Conducting an online game-based learning (GBL) that uses natural frequencies and feedback to teach diagnostic reasoning.	90 students
4	Morrell B [16]	United States (2020)	Conducting a cardiovascular-themed educational escape room for undergraduate nursing students, outlining its goals, design, and materials for easy adaptation to other curricula.	31 to 68 students
5	Morrell B [17]	United States (2020)	A study was conducted to explore baccalaureate nursing students' perceptions of a cardiovascular-themed educational escape room.	57 students
6	Kubin L [18]	United States (2020)	Evaluation of the effectiveness of escape room activities as educational tools in nursing education.	129 students
7	Blanie A [19]	France (2018)	This trial compared the effectiveness of gaming simulation (SG) versus traditional teaching (TT) for improving clinical reasoning (CR).	146 students
8	Gómez-Urquiza JL [20]	Spain (2020)	Aimed to explore nursing students' opinions about an escape room-based game as an evaluation game	105 students
9	Baek G [21]	Korea (2023)	Development of a program regarding cardiopulmonary resuscitation training via a web-based serious game for nursing students.	A total of 44 participants
10	Farsi Z [22]	Iran (2018 ‐ 2019)	This study compared traditional mannequin-based CPR[a] training with innovative smartphone-based serious game training for nursing students.	56 nursing students
11	Fijacko N [23]	Slovenia (2023)	To assess the effectiveness of the MOBICPR game in improving nursing students' theoretical knowledge and practical skills in adult Basic Life Support (BLS).	43 nursing students participated in the study.

ID	The first author (Reference)	Country (Year)	The aim of the study	Participants (number)
12	Guti´errez-Puertas L [24]	Spain (2019)	Design and develop an app that aids nursing students in acquiring knowledge of Basic and Advanced Life Support Techniques.	184 students
13	Elzeky M [25]	Egypt (2020 - 2021)	Evaluation of the impact of gamified flipped classrooms on nursing students' competency and learning motivation	128 nursing students
14	Bayram ŞB [26]	Turkey (2021)	To improve nursing students' knowledge and understanding of tracheostomy care.	125 nursing students completed both the pretest and post-test
15	Breitkreuz K R [27]	United States (2019)	To assess the usability of the VR[b] Sterile Urinary Catheter Insertion Game (VRSUCIG) and nursing student reactions.	300 pre-licensure nursing students from nine schools.
16	Chan K [28]	China (2021 - 2022)	The study evaluated VR-Hospital's impact on nursing students' skills, satisfaction, self-confidence, and overall experience.	202 students
17	Hwang JG [29]	Taiwan (2020)	A contextual game-based flipped learning approach (GBFL)	56 students
18	Jung SY [30]	Korea (2022)	Comparing the feasibility and learning outcomes of a novel pressure ulcer management VR simulation program's feasibility with video lectures.	35 novice nurses
19	Koivisto JM [31]	Finland (2018 - 2019)	The objective was to assess the link between game metrics in a simulation and the surgical nursing knowledge of students.	280 students
20	Koivisto JM [32]	Finland (2018 - 2019)	This study aimed to assess how a simulation game impacts nursing students' surgical knowledge.	385 students
21	Lau ST [33]	Singapore (2021)	This study examines immersive virtual reality (IVR) clinical procedures on mid-career switch students' knowledge, perceptions, and experiences.	34 students
22	Kulakc N [34]	Turkey (2020)	An RCT[c] was conducted to examine the effects of a serious game-based web application on stoma care education for nursing students.	98 students
23	Nasirzade A [35]	Iran (2022)	This study compared the impact of feedback lectures and the BAM[d] Game on nursing students' knowledge and skills in burn patient assessment	42 students

ID	The first author (Reference)	Country (Year)	The aim of the study	Participants (number)
24	Karci HD [36]	Turkey (2023)	The study examines the role-play gamification’s impact on nursing students’ skills.	10 students
25	Wang Z [37]	China (2021)	Aimed to assess the effectiveness of a mobile game app in enhancing ECMO pipeline pre-flushing skills among critical care specialist nurses.	86 intensive critical care specialist nurses
26	Chang CY [38]	Taiwan (2019)	The aim was to develop an RPG (role-playing game) to enhance nursing students’ performance in Electrocardiogram training	72 4th-year nursing students
27	de Beer E.H.M [39]	Netherlands (2018‐2019)	The study explored how nursing students perceive collaborative problem-solving (CPS) skills development through assignments in the hybrid serious game Carion.	181second-year bachelor nursing students (19males and 162females).
28	Wong JYH [40]	China (2022)	To develop and evaluate a serious game, Virtual Emergency Room (ER), aimed at enhancing teamwork attitudes and clinical competency among medical and nursing students during emergency care scenarios.	62 final-year medical and nursing students.
29	Ropero-Padilla C [41]	Spain (2020‐2021)	The study aimed to explore nursing students’ experiences and perceptions of using game elements in two nursing courses through a blended-learning approach.	149 students
30	Calik A [42]	Turkey (2021)	To evaluate the effectiveness of a serious game (SG) in improving senior nursing students’ knowledge and understanding of COVID-19, including personal protective equipment (PPE) use, quarantine/isolation periods, and symptoms.	62 participants in the final analysis.
31	Wu SH [43]	Taiwan (2017‐2019)	To evaluate the effectiveness of a VR game-based training system for preventing needle stick or sharp injuries (NSI) among new nursing and medical interns.	109 participants (59 nursing interns, 50 medical interns).
32	Al-Mugheed K [44]	Cyprus (2019)	Aimed to assess the impact of online learning and game-based virtual reality apps on standard precautions.	126 students
33	Mitchell G [45]	United Kingdom (2018‐2019)	to assess how a ’serious game’ about influenza impacts nursing students’ attitudes, knowledge, and adoption of the influenza vaccine.	430 students

ID	The first author (Reference)	Country (Year)	The aim of the study	Participants (number)
34	Ma Z [46]	United States (2021)	The study aimed to assess how feasible and effective a computer role-playing game (CRPG) is for enhancing nursing students’ empathy, emphasizing immersion and perspective.	69 students
35	Rodriguez-Ferrer JM [47]	Spain (2020 - 2021)	This research evaluated escapes rooms as a strategy to reduce stigma toward serious mental disorders.	197 students
36	Chen D [48]	China (2023)	To evaluate the impact of an Escape room (ER) game on nursing students’ learning attitudes and game flow experience in a Gerontological Nursing course.	83 nursing students (41 in the test group, 43 in the control group).
37	Idrissi W [49]	Morocco (2022)	This study aims to explore how serious games affect nursing students’ learning, engagement, and motivation.	58 polyvalent nursing students
38	Labrague L [50]	United States (2023)	Teaching delegation skills, a critical competency in nursing, through interactive scenarios.	N/A

[a] CPR: cardiopulmonary resuscitation.

[b] VR: virtual reality.

[c] RCT: randomized controlled trial.

[d] BAM: burn assessment mission.

Table . Overview of the included studies that address games for nursing education.

ID	Learning objectives	Type/Name of the game	Platform	Game features	Main findings
1	Develop diagnostic reasoning in nursing	Enfermeiro Diagnosticador	N/A[a]	search and organization of clues capable of evidencing the nursing diagnosis presented by patients	“Enfermeiro Diagnosticador” is effective in supporting the teaching of diagnostic reasoning in nursing
2	Improve decision-making in clinical scenarios, particularly in conflict situations and high-risk protocols.	A combined case-based learning and escape room game	Conducted in a real-world setting with physical escape rooms	Case-based learning scenarios, escape room challenges, puzzles, and ethical dilemmas	High student engagement, improved decision-making skills, and positive feedback on learning effectiveness and enjoyment
3	Teaching diagnostic reasoning	Diagnostic reasoning game with natural frequencies feedback	Online via a web browser	Estimates diagnosis probability, provides immediate feedback, and includes a tutorial	A single GBL[b] session almost doubled diagnostic accuracy scores in medical trainees and clinicians, with lasting effects for three months
4	Enhance understanding of cardiovascular conditions and clinical reasoning through interactive problem-solving	Cardiogenic Shock Educational Escape Room	Traditional classroom setup	Nine puzzles in a mock hospital; time-limited, with feedback	This game enables students to pursue a shared objective by collaborating, providing feedback, and seeking assistance
5	Enhance understanding of cardiovascular conditions	Live-action cardiovascular critical care escape room	In person	Teams of 4 - 5 solve cardiovascular puzzles in 60 min, unlocking a final box to stop a countdown	The escape room-based learning method may be one way to enhance students’ professional practice skills
6	Enhancing clinical reasoning, problem-solving, and collaboration among nursing students	Escape Room	N/A	Solving puzzles, riddles, and NCLEX-style[c] questions	Escape rooms can be utilized as an effective augmentation to traditional learning methods
7	Improving clinical reasoning in nursing students	LabForGames Warning	Played on computers with a 3-D interactive environment	Students practice clinical scenarios, detect deterioration, and communicate using SBAR[d]	This study found no significant CR[e] difference between SG[f] and TT[g], but SG increased satisfaction and motivation
8	N/A	Nursing Escape Room	In-person escape room at the University of Granada	Find a fake nursing document in 30 min using clues and a classroom key	The escape room learning game provided a positive experience for students, noted for being enjoyable, engaging, and motivating
9	Cardiopulmonary resuscitation training in nursing students	Advanced Cardiac Pulmonary Resuscitation (ACPR)	Web-based platform hosted on Amazon Web Services (AWS)	A realistic cardiac resuscitation game with sequential learning, interactive 3D environment, and personalized feedback	The program effectively enhanced nursing students’ cardiopulmonary knowledge, confidence, problem-solving, and learning transfer

ID	Learning objectives	Type/Name of the game	Platform	Game features	Main findings
10	Improving CPR training and skills	Serious game for CPR training	N/A Using smartphones	Self-learning, step-by-step instructions, self-assessment, feedback on tasks, retry options, and communication with researchers via group chat	Both simulation and serious game training improved CPR[h] skills, suggesting a multimodal educational approach could be beneficial
11	To enhance the participants' theoretical knowledge and practical skills in adult BLS, particularly their ability to perform cardiopulmonary resuscitation (CPR[h]) and use an automated external defibrillator (AED)	MOBICPR	The game was played on a Samsung Galaxy A13 smartphone	The game simulates BLS for out-of-hospital cardiac arrest (OHCA) using gestures, scores, and 2021 European Resuscitation Council (ERC) guidelines to teach CPR[h]	MOBICPR significantly improved BLS knowledge and skills, suggesting serious games enhance nursing students' BLS training
12	Enhancing students' knowledge of Basic and Advanced Life Support Techniques	Guess It (SVUAL)	Mobile app	Phases of keyword guessing, retention testing, and knowledge reinforcement based on life support techniques	The app has demonstrated high content quality and user-friendliness, enhancing nursing students' knowledge and information retention
13	Enhance nursing students' competency and learning motivation	Gamified Flipped Classroom (FC) for Nursing Fundamentals	Moodle platform with additional gamification features	Includes quizzes with varying difficulty levels, badges, leaderboards, ranks, levels/unlocks, and points	Gamified flipped classrooms boost nursing students' motivation, preparation, skills, knowledge, and confidence in lab practice
14	Learning tracheostomy care and remember their prior knowledge	Tracheostomy care knowledge test (TCKT)	The game was available on a dedicated website [51] and could be played on a computer	The game is a 10 min interactive tool consisting of six stages. The player must complete each stage correctly to progress to the next	The game effectively improved tracheostomy care knowledge, especially for first-year students, enhancing learning enjoyment and realism
15	To practice sterile urinary catheter insertion skills using VR[i]	VR Sterile Urinary Catheter Insertion Game (VR-SUCIG)	N/A	Virtual feedback on technique, scoring, cue cards, and visual cues for contamination	The game had medium usability; students found it engaging and effective for practice
16	Enhancing nursing students' skills, satisfaction, self-confidence, and overall experience	Virtual Reality Hospital (VR-Hosp)	HTC Vive Cosmos	Single-user VR game with 3D ward, scenarios, speech recognition, randomized tasks, and NTS[j] development	The positive outcomes provide a foundation for developing IVR[k] activities in nursing education
17	Exploring the situation of intravenous injection flipped learning	Intravenous Injection Game	N/A	Game-based learning, decision-making scenarios, skills practice, and group discussions	Students using the new method excelled in intravenous injection comprehension, motivation, and critical thinking compared to conventional methods
18	Improving pressure ulcer management training	PU-VRSim[l]	Unity 3D	The game simulates pressure ulcer care, enhancing critical thinking, self-efficacy, and clinical judgment using VR	PU-VRSim enhances novice nurses' PU[m] management skills

ID	Learning objectives	Type/Name of the game	Platform	Game features	Main findings
19	Improving surgical nursing knowledge	Simulation game with surgical nursing scenarios	Desktop virtual simulation	Simulation game with realistic nursing scenarios, learning-enhancing elements, and flexible scoring system for educational research	Higher game scores correlated with better surgical nursing knowledge; time spent playing had no impact
20	Improving surgical nursing knowledge	3D simulation game developed with Unity	N/A	Includes five surgical patient scenarios, realistic graphics, animations, and interactive elements for interviewing, assessing, and implementing nursing interventions	This study demonstrates that a simulation game effectively enhances nursing students' knowledge in surgical nursing
21	Enhancing intravenous therapy and insulin therapy skills	IVR clinical procedures simulation	The participants used Meta Quest 2 VR headsets	IVR simulation for intravenous therapy and insulin with 3D avatars, practice/assessment modes, and virtual patients	IVR simulation can enhance clinical procedure knowledge in mid-career students
22	Enhancing stoma care and colostomy irrigation knowledge	N/A	Web-based application	The game allowed students to practice stoma care and colostomy irrigation skills in a simulated environment, reinforcing the theoretical knowledge they had gained	Students' knowledge and skill scores improved significantly as they spent more time with the serious game
23	Learning of burn patient assessment	BAM[n] Game	Web-based game accessible via computers or mobile devices	Interactive game: burn assessment, real images, videos, feedback, competitive scoring	Nursing students using the BAM game excelled in knowledge and skill development
24	Enhancing skills related to internal medicine	Role-Play-Based Gamification	N/A	Role-playing various medical scenarios, developing nursing skills, enhancing communication, incorporating scoring systems and symbolic rewards, and embedding fun and humor to facilitate learning	Gamification enhanced students' motivation and retention in learning nursing care and communication skills
25	improving ECMO pipeline preflushing skills	N/A	Mobile phones	Interactive stages simulating ECMO pipeline preflushing include 61 steps with real-time feedback and scoring	This study indicates that a game-based mobile app could be more effective than traditional Chinese lecture-practice methods for teaching ECMO pipeline preflushing to critical care specialist nurses
26	Enhance ECG[o] training in nursing	ECG Clinical Context Role-Playing Game	RPG[p] Maker MV by Enterbrain Incorporated	This ECG game uses RPG Maker MV to enhance learning with challenges, fights, and storylines	Students using this game outperformed those in traditional instruction in learning, attitude, and critical thinking

ID	Learning objectives	Type/Name of the game	Platform	Game features	Main findings
27	The primary learning objective was to improve students' collaborative problem-solving skills, encompassing both social and cognitive skills	The game is called Carion	The game uses multiple platforms: Wijklink (an online collaboration platform), Blackboard (the university's online learning environment), in-school learning environments, and real-life district assignments	One semester (20 wk, 840 study hours)	Students used each other's strengths to enhance teamwork and problem-solving through innovative serious games
28	(1) Competency in history taking and physical assessment skills; (2) diagnostic skills, alertness, and treatment skills; (3) clinical procedural skills and prioritization during emergency situations. (4) professionalism, responsibility, and a caring attitude	Virtual Emergency room (ER)	Web-based application created with Tumult Hype, played online on laptop	Interactive emergency care game with roles, scoring, and feedback to enhance learning and clinical skills	Virtual ER improved teamwork attitudes; activists and pragmatists benefited most; students rated it positively
29	N/A	N/A	Google Meet and Google Classroom for online sessions	Game elements in blended learning were assessed via focus groups, with online gamified activities and rewards	This study presents new findings on using game elements in blended learning, demonstrating their effectiveness in teaching key clinical and teamwork skills like creativity, communication, and responsibility
30	The learning objectives included understanding virus incubation time, recognizing COVID-19 symptoms, proper donning and removing PPE[q], and knowledge about quarantine and isolation periods	N/A	N/A	The game featured login, avatars, progress tracking, PPE, symptoms, and quarantine management, developed on Articulate	Students' knowledge improved significantly on isolation times and quarantine; PPE donning showed a non-significant increase
31	Increase familiarity and confidence, reduce anxiety in practicing universal precautions for NSI[r] prevention, and reduce NSI incidence during the internship	VR game-based training for occupational NSI prevention	Unity 3D	Immersive VR scenarios, random scenarios with safe/unsafe behaviors, real-time feedback, performance assessment, and elements of surprise and uncertainty	The VR training improved accuracy, decreased anxiety, and enhanced familiarity and confidence in NSI prevention, with better retention observed two months post training
32	Enhancing standard precautions	N/A	Mobile phones	Interactive game with scenarios, video demos, made in Adobe Flash	Online education and VR games significantly improved nursing students' performance
33	Evaluating attitudes, knowledge, and adoption of the influenza vaccine	Flu Bee Game	HTML5 web application, accessible via web browsers on any device	Interactive influenza questions, build 'honeycomb path,' myth-busting, feedback, leaderboards	The game can enhance understanding and increase the likelihood of vaccination

ID	Learning objectives	Type/Name of the game	Platform	Game features	Main findings
34	Enhancing empathy, emphasizing immersion, and perspective	That Dragon, Cancer - a narrative-focused video game	VR (Oculus Go) and non-VR (Dell laptops, iPads)	VR versus non-VR, role perspectives, interactive emotional scenarios	The results of this study demonstrate that role-playing games are viable for nursing education, with insights into empathy training
35	raising awareness about stigmatizing attitudes toward individuals with serious mental disorders	N/A	Online, using the Genial.ly digital platform	Teams of 4 solve linear puzzles in a 60 min escape room, exploring the life of a person with serious mental illness, reflecting real-life challenges like stigma and medication side effects	Virtual escape rooms can serve as an effective method for educating health sciences students
36	To improve students' attitudes towards learning and enhance their game flow experience related to safe medication use in older adults	N/A	Physical venue designed as a geriatric nursing training room	Immersive escape room experience with puzzles, time constraints, and a narrative involving medication safety for older adults	The ER game significantly improved learning attitudes and game flow experience in the test group compared to the control group
37	learning of nursing care in pediatrics	Serious game for pediatric nursing practice	VTS Editor Education version 2 (game design), VTS Player (access), VTS Perform (progress tracking)	Three scenarios (gastric feeding, peripheral venous access, bronchial aspiration), scoring system, feedback, performance tracking, attempts, and error recording	The game significantly improved clinical knowledge and motivation, with students showing high satisfaction and engagement
38	Enhancing delegation skills	Delegation Poker	Classroom-based, using physical cards and a board	Students used modified poker cards to select delegation strategies in nursing scenarios, earning competitive points	The game was an engaging and educational tool that successfully taught nursing students the nuances of delegation in a fun and interactive manner

[a] Not applicable.

[b] GBL: game-based learning.

[c] NCLEX: National Council Licensure Examination.

[d] SBAR: Situation, Background, Assessment, and Recommendation.

[e] CR: clinical reasoning.

[f] SG: serious game.

[g] TT: traditional teaching.

[h] CPR: cardiopulmonary resuscitation.

[i] VR: virtual reality.

[j] NTS: nontechnical skills.

[k] IVR: immersive virtual reality.

[l] PU-VRSim: pressure ulcer management virtual reality simulation.

[m] PU: pressure ulcer.

[n] BAM: burn assessment mission.

[o] ECG: electrocardiography.

[p] RPG: role-playing game.

[q] PPE: personal protective equipment.

[r] NSI: needle stick or sharp injuries.

Quality Assessment and Bias Risk Evaluation

To enhance the quality, 3 authors independently evaluated the eligible studies for risk of bias to minimize any probable bias risk using the NOS risk assessment tool (Table 3). Worthy to mention that a total score of 9 in 3 categories is calculated in this numerical bias assessment tool. These three categories include selection, comparability, and exposure or outcome. Numerical values of 4, 2, and 3 are attributed to these categories, respectively. A maximum scale of 9 is going to be expected for each of the included studies by summing these numbers together.

Table . Newcastle-Ottawa Scale bias risk assessment of the study. Good quality: 3 or 4 stars in selection domain AND 1 or 2 stars in comparability domain AND 2 or 3 stars in exposure or outcome domain; fair quality: 2 stars in selection domain AND 1 or 2 stars in comparability domain AND 2 or 3 stars in exposure or outcome domain; poor quality: 0 or 1 star in selection domain OR 0 stars in comparability domain OR 0 or 1 stars in exposure or outcome domain.

ID	Selection (out of 4)	Comparability (out of 2)	Exposure/Outcome (out of 3)	Total (Out of 9)
1	3	2	3	8
2	4	2	3	9
3	2	1	3	6
4	4	2	3	9
5	3	2	2	7
6	3	2	2	7
7	3	2	3	8
8	2	2	3	7
9	3	2	3	8
10	4	1	2	7
11	3	2	3	8
12	4	2	3	9
13	3	2	3	8
14	3	1	2	6
15	4	2	3	9
16	3	2	3	8
17	3	2	3	8
18	2	1	2	5
19	3	2	2	7
20	3	2	2	7
21	3	2	3	8
22	4	2	3	9
23	3	2	3	8
24	4	2	3	9
25	3	0	3	6
26	4	2	2	8
27	1	2	3	6
28	2	1	3	6
29	4	2	3	9
30	3	0	3	6
31	3	2	3	8
32	3	1	3	7
33	4	2	3	9
34	4	2	3	9
35	2	1	2	5
36	3	1	3	7
37	2	2	2	6
38	2	1	3	6

Results

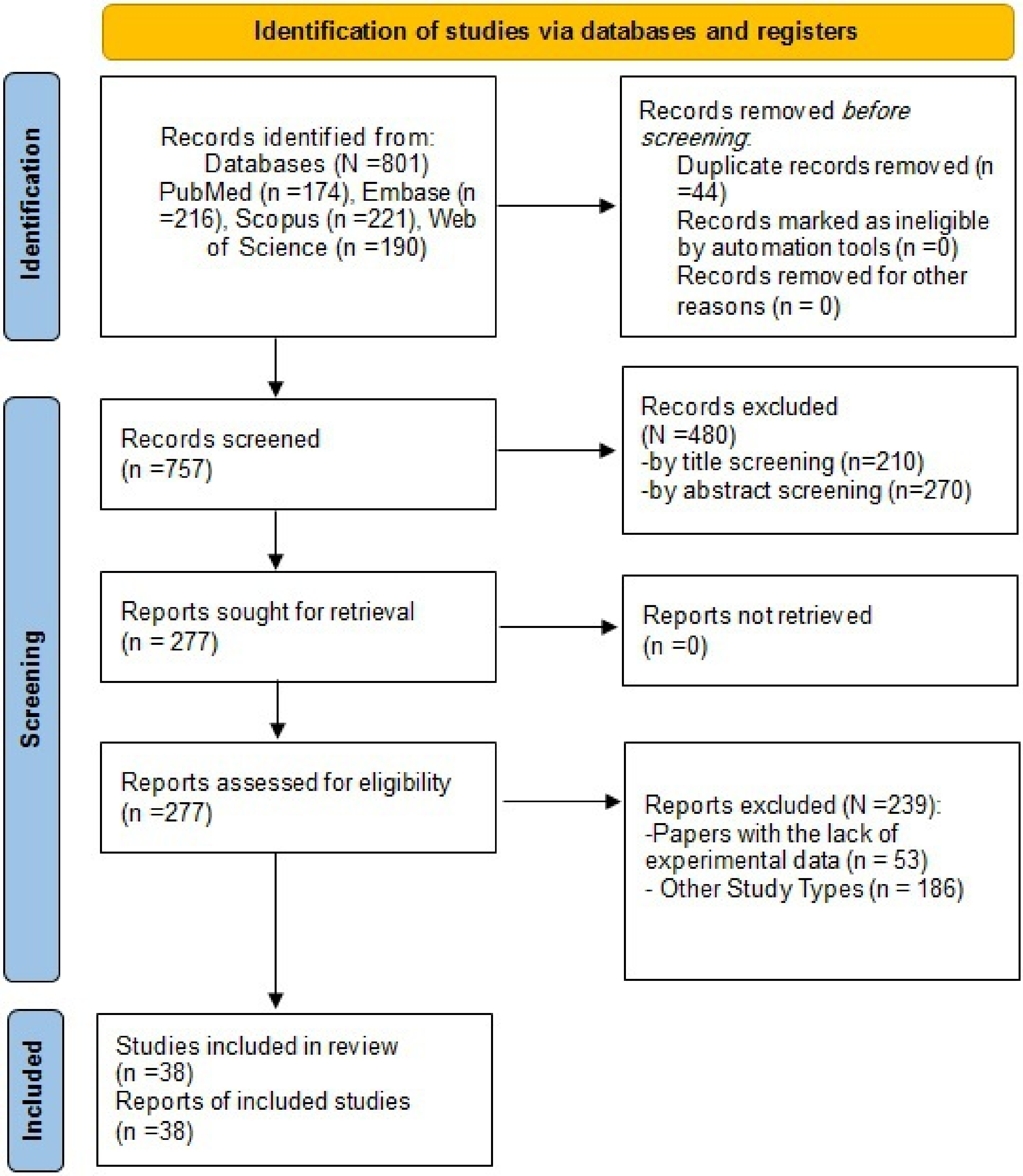
Data Sources

In this study, 801 articles were initially retrieved using the specified search strategy in the databases of PubMed, Embase, Scopus, and Web of Science.

Study Selection

In total, 44 duplicate articles were removed, and 757 studies were screened. After applying the inclusion and exclusion criteria, 719 articles were excluded, leaving 38 articles for full-text review (Figure 1).

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 flow diagram of the study retrieval process.



Data Extraction

The included articles were conducted in the countries of Brazil (n=1), Korea (n=2), Turkey (n=4), China (n=4), Netherlands (n=1), United States (n=7), Taiwan (n=3), Egypt (n=1), Iran (n=2), Spain (n=5), Morocco (n=1), Finland (n=1), Singapore (n=1), United Kingdom (n=1), France (n=1), Cyprus (n=1), and Slovenia (n=1) and were published between 2018 and 2023 (Figure 2). The final included studies were conducted over a range of years, from 2017 to 2023. Figure 3 provides a visual summary of these timeframes.

Figure 2. Geographical distribution of the countries where the studies were conducted.

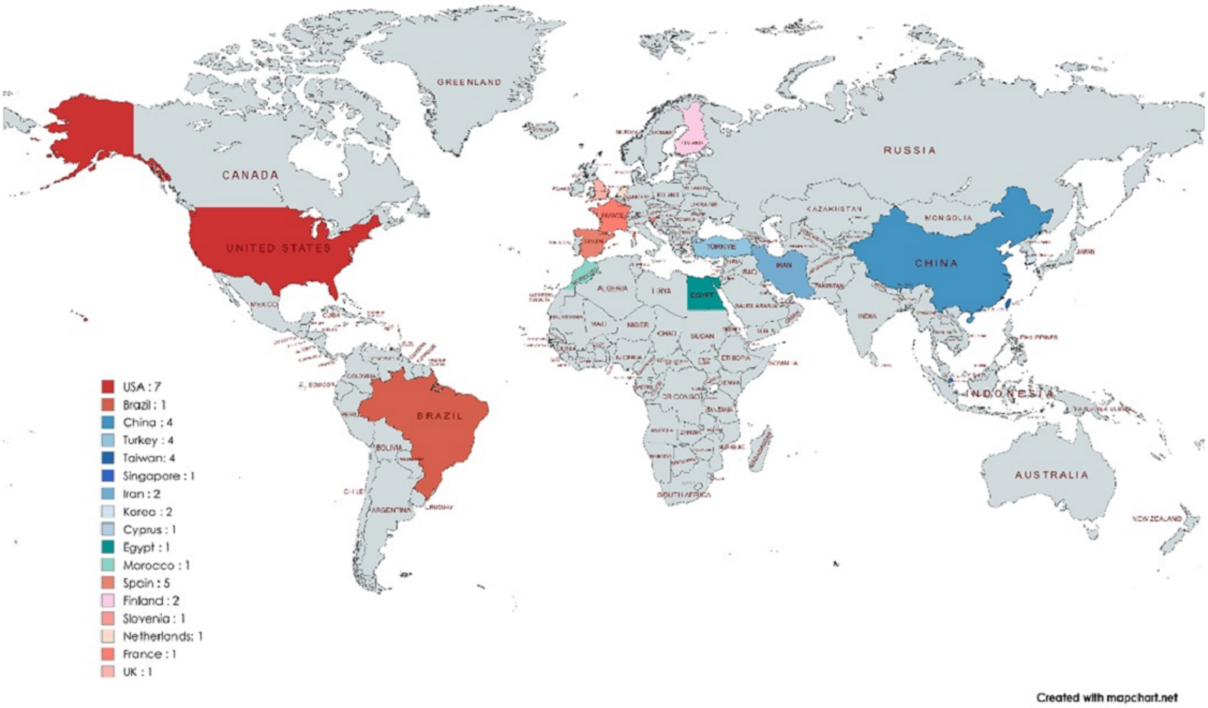
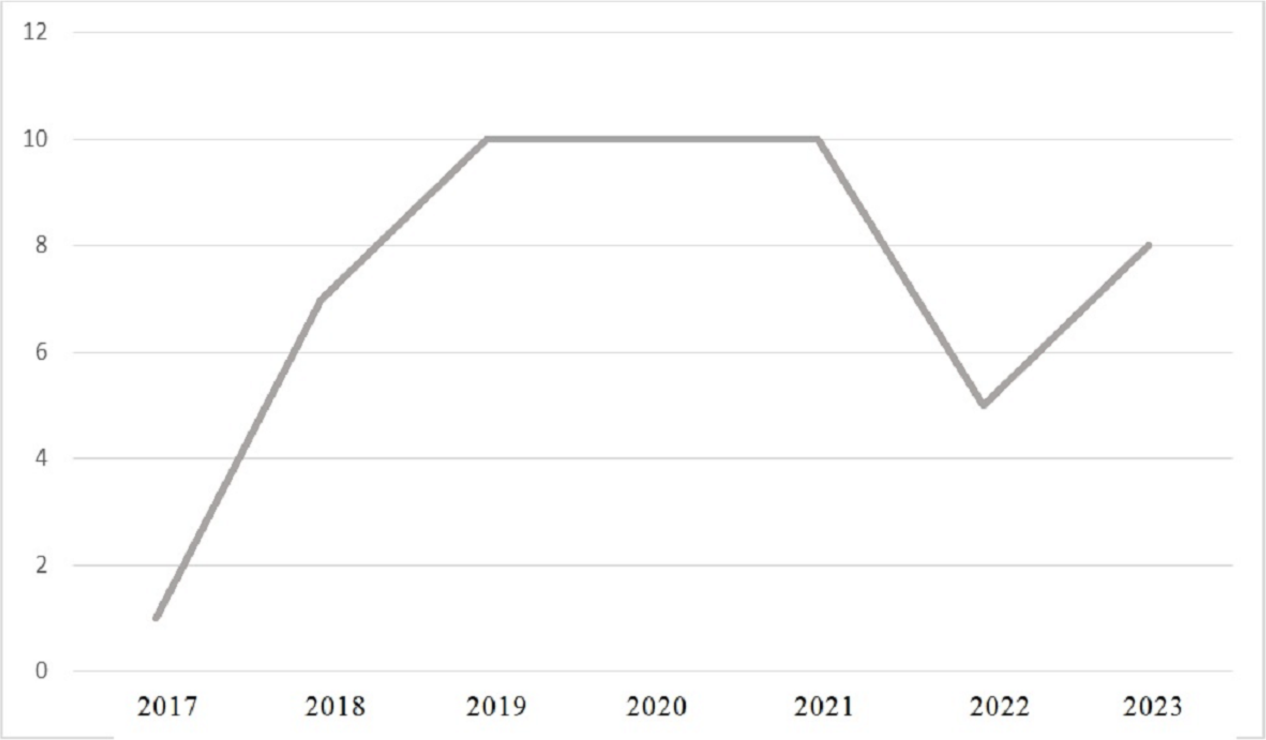


Figure 3. Overview of study conduction years.



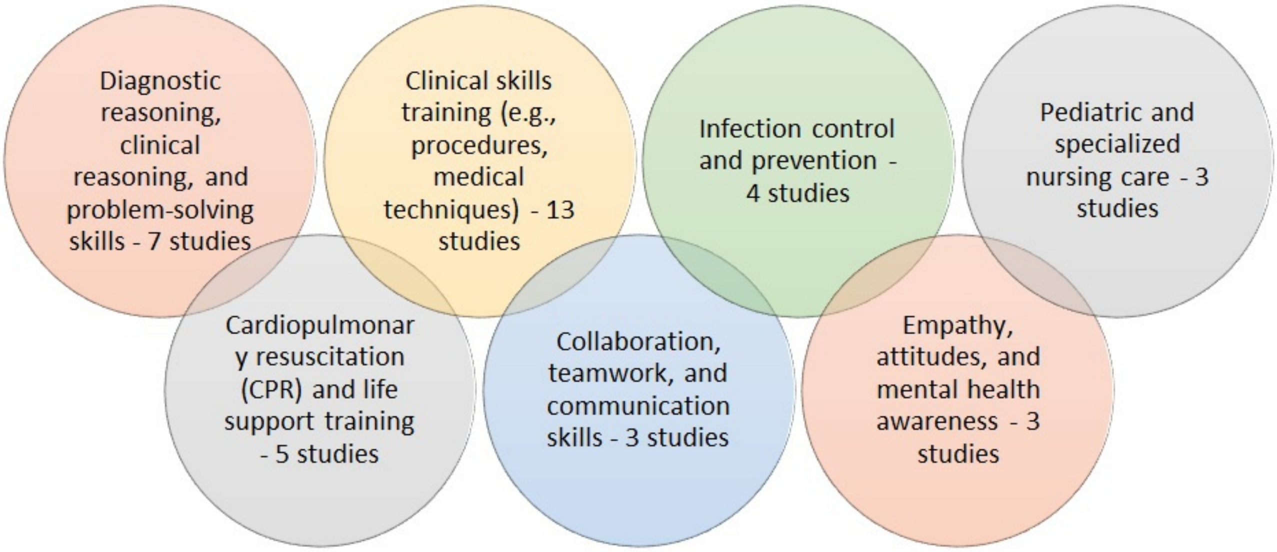
Quality Assessment and Bias Risk Evaluation

As shown in Table 3, according to the NOS risk assessment tool, out of 38 included articles, 36 articles were of good quality (≥6), 2 articles were of fair quality (5≥, >2), and none of the articles were of poor quality (2≥).

Main Findings

Our results showed that several learning objectives can be conducted by GBL. These objectives included developing diagnostic reasoning, enhancing knowledge and cognitive skills, and improving training methods (Figure 4).

Figure 4. Overview of studies’ objectives.



We also showed that different platforms were used for the games. While many games used web-based platforms, few were conducted in person, and some were developed in-app formats for smartphones. Game platforms are compiled in Figure 5, providing an overview of the different game platforms. In addition, while we summarized the 3 key terms of GBL and its benefits and limitations in Figure 6, we illustrated how various platforms and game types aligned with distinct learning objectives in nursing education in Figure 7.

Figure 5. Overview of game platforms.

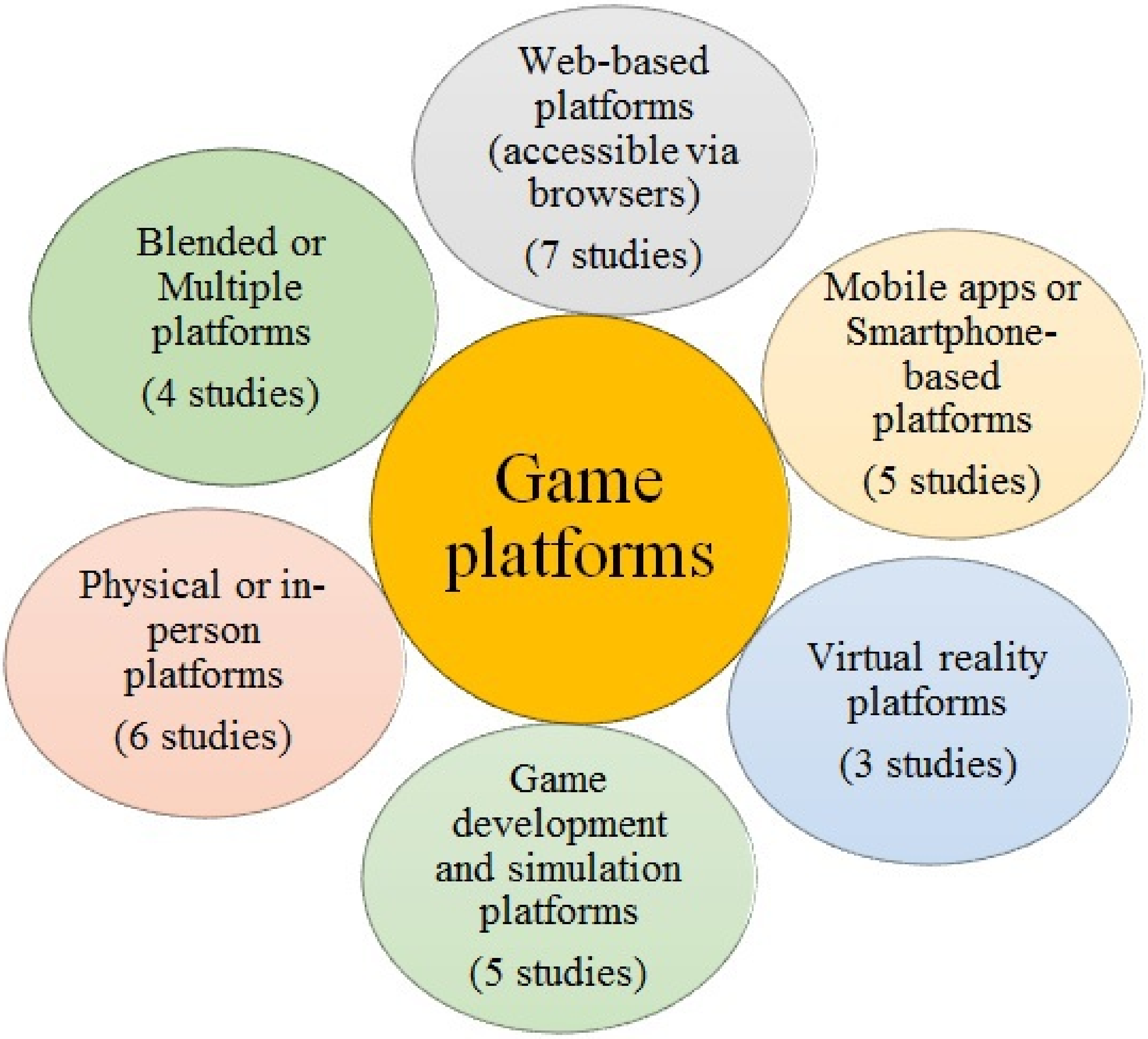
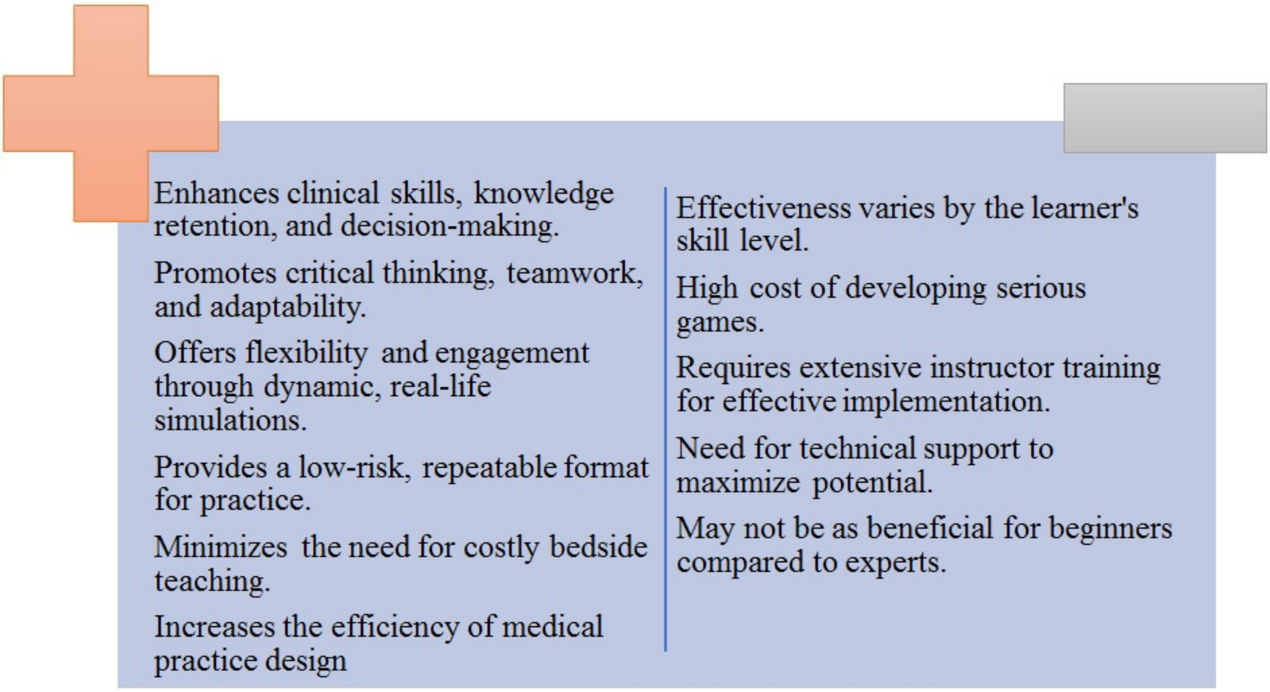


Figure 6. Summary of the benefits and limitations of game-based learning in nursing education.



Enhances clinical skills, knowledge retention, and decision-making.

Promotes critical thinking, teamwork, and adaptability.

Offers flexibility and engagement through dynamic, real-life simulations.

Provides a low-risk, repeatable format for practice.

Minimizes the need for costly bedside teaching.

Increases the efficiency of medical practice design

Effectiveness varies by the learner's skill level.

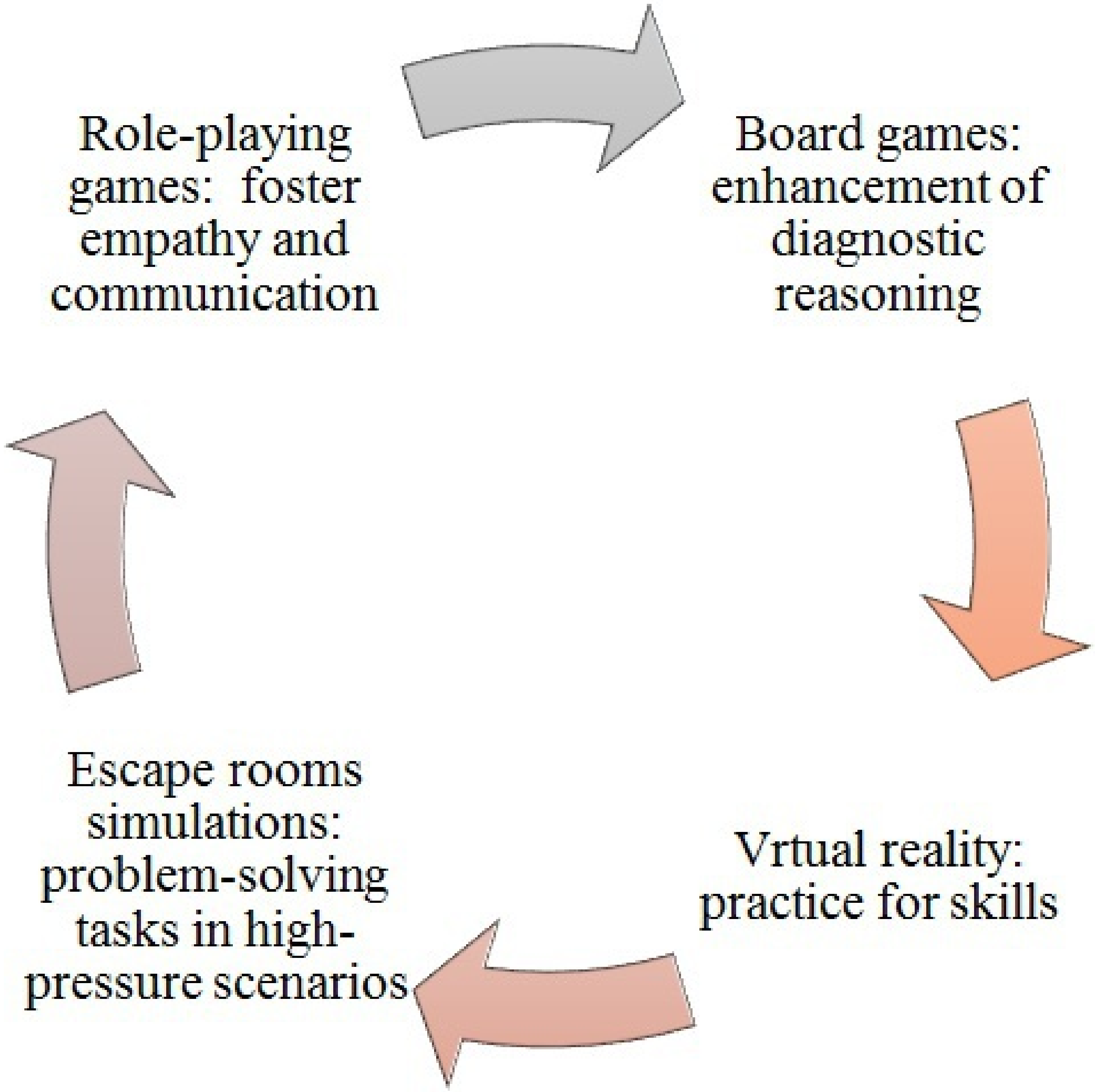
High cost of developing serious games.

Requires extensive instructor training for effective implementation.

Need for technical support to maximize potential.

May not be as beneficial for beginners compared to experts.

Figure 7. Platforms and game types associated with specific learning objectives in nursing education. VR: virtual reality.



Finally, multiple studies were conducted in the Asia-Pacific region, where we provided a more in-depth analysis of the region's unique approaches to nursing education and the integration of technology. These studies, involving Asia-Pacific Islander Nursing (APIN) student populations from countries such as Korea, China, and Singapore, highlighted strong engagement with mobile and virtual reality (VR)–based GBL tools. These studies also reported improvements in clinical skills, knowledge retention, and student motivation following the use of these technologies.

Discussion

Principal Findings

We showed that a broad range of learning objectives, such as developing diagnostic reasoning, enhancing knowledge and cognitive skills, and improving training methods, can be conducted by a game-based platform. We also showed that while many games used web-based platforms, few were conducted in person, and some were developed in app formats for smartphones. The emergence of game-based learning in recent years has led to significant changes in the health education system and curricula [52]. These methods are gaining considerable attention for their potential to boost student motivation and engagement in the learning process. The educators are offered new novel methods to enhance the education process, specifically medical education, by the premise of using serious games and gamification of the learning processes.

Overview of Studies and Learning Objectives

After a thorough evaluation of 38 studies, our results indicated that the most frequent year for conducting studies was 2023, with contributions from countries like Brazil, Korea, and the

United States. The United States contributed the most studies, covering topics such as sterile catheter insertion, diagnostic reasoning, and empathy training. The main learning included developing diagnostic reasoning, enhancing nursing knowledge and cognitive skills, and improving practical training methods such as cardiopulmonary resuscitation (CPR) and tracheostomy care. In addition, a focus on fostering student engagement, motivation, critical thinking, and collaborative problem-solving. Various platforms were used, ranging from web-based applications like Moodle and Amazon Web Services to advanced VR tools such as HTC Vive Cosmos and mobile apps. The key findings demonstrated that serious games and VR simulations were highly effective in boosting nursing students’ knowledge, practical skills, and confidence. These techniques also enhanced collaborative problem-solving, critical thinking, and motivation, with significant improvements in clinical reasoning and knowledge retention.

GBL and the Range of Targeted and Enhanced Skills

Studies from Brazil and Korea demonstrate that GBL effectively enhances diagnostic reasoning and CPR skills through more engaging and interactive approaches than traditional methods [19,21]. These findings are reinforced by research across countries, including Turkey, where games improved tracheostomy care, and the Netherlands, which highlighted the development of collaborative problem-solving skills through serious games [26,39]. For developing skills for high-risk medical procedures, such as extracorporeal membrane oxygenation pipeline handling and pressure ulcer management, the eligible studies used serious games [30,37]. VR-based learning, as studied in the United States and China, enables students to practice sterile techniques and clinical care in immersive environments, boosting their confidence and competence [27,38]. In addition, studies have shown how serious games can rapidly adapt to global challenges, such as improving COVID-19 protocols [42]. Finally, escape-room games have proven effective in fostering clinical reasoning, collaboration, and reducing stigma toward mental health disorders [47].

Overall, the range of skills enhanced through educational games in nursing includes technical procedures, cognitive decision-making, communication, teamwork, and professional empathy, demonstrating the broad and versatile impact of GBL. Although some of these studies were conducted in western contexts, the core educational benefits are equally relevant and transferable to Asia-Pacific nursing students.

Platforms’ and Game Types’ Association With Learning Objectives

According to our results, the following platforms and game types are linked to distinct learning objectives in nursing education:

1. Diagnostic reasoning skills games: Board games like “Enfermeiro Diagnosticador” and web-based tools enhance diagnostic reasoning [13].
2. CPR and life support training: Web-based and mobile games like mobile CPR improve CPR training through interactive simulations [13,15,23]. In addition, mobile apps like Guess It and gamified flipped classrooms enhance knowledge retention in life support and nursing fundamentals with features such as quizzes and leaderboards [24,25].
3. Clinical procedural skills: Virtual reality platforms, such as virtual reality sterile urinary catheter insertion game and pressure ulcer management virtual reality simulation, offer immersive practice for skills like catheter insertion and pressure ulcer management [27,30].
4. Teamwork, clinical competency, and emergency skills: Escape rooms and virtual emergency room simulations focus on teamwork and clinical competency by presenting problem-solving tasks in high-pressure scenarios [20,40,48].
5. Specialized skills: Role-playing games improve specialized skills, such as electrocardiogram interpretation, and foster empathy and communication [36,38].

These diverse platforms effectively align with educational goals, combining interactive, scenario-based learning with feedback and collaboration to enhance student engagement, clinical skills, and decision-making. Figure 7 illustrates how various platforms and game types align with distinct learning objectives in nursing education.

Depending on the game formats, these games show strong potential for adaptation across Asia-Pacific contexts. While VR and web-based platforms suit technologically advanced regions and might require more complex infrastructure, mobile games and gamified classrooms may be more feasible for underresourced regions of APIN settings.

Impact of GBL on Learning Outcomes and Their Broader Discussion in Nursing Education

The comparative value of simulation-based gaming versus traditional teaching methods in nursing education demonstrates the significant benefits of serious games in enhancing clinical skills, knowledge retention, and decision-making, which aligns with the previously mentioned facts from the available literature in this sector. These studies demonstrate that simulation-based gaming provides a dynamic, effective alternative to traditional methods, offering nursing students not only technical proficiency but also the critical thinking, teamwork, and decision-making skills needed in modern health care environments. These games offer flexibility, engagement, and the ability to simulate real-life scenarios in a low-risk, repeatable format, making them a valuable tool in nursing education. Ultimately, this novel method has significant potential to minimize costly bedside teaching and enhance the efficiency of medical practice design [1]. Ultimately, GBL represents a novel and transformative method that has the potential to enhance the efficiency and effectiveness of nursing education globally. Furthermore, for APIN students, GBL can offer an effective way to bridge gaps caused by limited clinical placements or cultural and language barriers. Their adaptability makes them especially valuable in diverse Asia-Pacific settings.

Challenges

Although GBL methods emerge as effective and beneficial methods, there are still significant challenges and limitations to their use [1]. One major issue is the “expertise reversal effect,” which highlights how the effectiveness of serious games varies based on the learner’s skill level. For instance, while these games may be beneficial for experts, they may not be as useful for beginners. Ensuring that new learners can still benefit from the game is crucial to their success [53]. Developing adaptive games that can adjust difficulty level according to player level can emerge as an effective solution to this challenge. Another challenge is the high cost of developing serious games, which can run into thousands of dollars. Creating these educational tools requires careful consideration of both cost and efficiency to ensure they remain feasible for widespread use [1]. Creation of games in collaboration with institutes and seeking sponsorship or grants can reduce the development costs. In addition to financial constraints, the need for training instructors to effectively implement the games and providing adequate technical support are common hurdles. Without proper training and support, the potential of serious games may not be fully realized [54]. Establishment of technical support teams and training standardized instructors can maximize the benefits of these games.

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In addition to financial constraints, the need for training instructors to effectively implement the games and providing adequate technical support are common hurdles. Without proper training and support, the potential of serious games may not be fully realized [54]. Establishment of technical support teams and training standardized instructors can maximize the benefits of these games.

Limited funding and access to professional developers, along with a lack of trained educators, can complicate these issues further and lead to a much more challenging situation in underresourced Asia-Pacific regions. Addressing these challenges is essential to making serious games a more practical and accessible tool in educational settings, particularly in medical training, where their application has the potential to significantly enhance learning outcomes if used correctly. Figure 6 provides a summary of the discussed benefits and limitations. Finally, it is noteworthy to mention that game-based learning in nursing is a novel and beneficial method, and by addressing its limitations, we hope it becomes more widespread in the future. Finally, it is noteworthy to mention that game-based learning in nursing is a novel and beneficial method, and by addressing its limitations, we hope it becomes more widespread in the future.

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Asia-Pacific Approaches to Technology-Enhanced Nursing Education

One group of the included studies was conducted in Asia-Pacific countries, which mainly originated from Korea, Taiwan, China, and Singapore, alongside Iran. These studies highlight a regional trend of incorporating advanced digital technologies in nursing education. A wide range of platforms was used in this section of the literature, including VR technologies, web-based platforms, mobile apps, and virtual environments. The primary goals of these studies encompassed a wide range of areas, including clinical skills development, critical thinking enhancement, infection control practices, CPR training, and emergency care [21,22,29,30,33,35,37,40,43,48,55]. According to these findings, in this region, there is a strong emphasis on innovation, rapid adoption of new technologies, and a cultural value placed on education and professional development. Understanding these dynamics highlights the region’s distinct approach to advancing nursing education through technology-driven methods. However, the development, adoption, and effectiveness of GBL can be influenced by cultural factors prevalent in the Asia-Pacific context. One issue is that in collectivist societies, common in many parts of Asia, students may prioritize group harmony and respect for authorities, which can affect their engagement in interactive and competitive learning environments like GBL [56,57]. Since Western GBL approaches often emphasize individualism and assertiveness, they may not fully align with the values common in Asia-Pacific contexts. Adapting game content to focus more on collaboration, respect for authority, and cultural relevance can improve acceptance among APIN students. While this situation provides a challenging base for the implementation of GBL, the acceptance of these learning methods also varies across different cultures of Asia-Pacific countries, necessitating culturally sensitive designs and strategies. Ultimately, in low-resource regions of this area, limited access to technological infrastructure can pose challenges to the widespread adoption of GBL [58].

Limitations and Future Prospects

This study has several limitations. First, it only included English-language publications, potentially omitting valuable insights from non-English studies, which may affect the comprehensiveness of our findings. Including multilingual studies can highlight local innovations in many aspects, such as region-specific game designs or unique instructional methods. In addition, publication bias could skew results since positive studies are more likely to be published. Variability in definitions and classifications of GBL and a lack of standardized measurement tools complicate data interpretation. Finally, our research did not explore the long-term effects of GBL on nursing competencies and patient outcomes, which necessitates longitudinal studies for a comprehensive understanding. Looking ahead, future research should aim to include multilingual studies to broaden perspectives on GBL in nursing education. Longitudinal studies are essential to assess the enduring impacts of GBL on clinical competencies and patient care outcomes. In addition, developing standardized assessment tools will help unify definitions and improve the comparability of research findings, ultimately enhancing the evidence base for GBL’s effectiveness.

Conclusion

To conclude, the premise of GBL and its infiltration into nursing education represents a novel yet challenging approach that enhances student engagement, motivation, and clinical skills. The feasibility and benefits of this method lead to educators creating immersive learning environments that promote critical thinking and collaborative problem-solving. However, like any other new approach, it introduces a few challenges to the education system. Addressing these limitations is crucial for maximizing the potential of GBL in nursing education. As the field continues to evolve, future research should aim to broaden perspectives through multilingual studies and assess the long-term impacts of GBL on nursing competencies and patient care outcomes. Overall, the promising benefits of GBL could significantly enhance the quality of nursing education and ultimately improve health care delivery. In the APIN, implementing GBL requires sensitivity to cultural values. Educators should design collaborative, culturally aligned approaches and strategies, plus ensure accessibility despite resource limitations.

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Data Availability

The authors stated that all information provided in this article could be shared.

Authors' Contributions

Conceptualization: EM, SA. Data curation: AM. Formal analysis: FS. Supervision: SA. Writing – original draft: HZH, AA, NA, AT, FS, AM, EM. Writing – review & editing: SA, HZH, AA, EM.

Conflicts of Interest

None declared.

Multimedia Appendix 1
Search query of databases.
[PDF File, 68 KB - apinj_v9i1e70737_app1.pdf]

Checklist 1
PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 checklist.
[DOCX File, 33 KB - apinj_v9i1e70737_app2.docx]

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Abbreviation

APIN: Asia-Pacific Islander Nursing
GBL: game-based learning
NOS: Newcastle-Ottawa Scale
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
VR: virtual reality
VRSUCIG: virtual reality sterile urinary catheter insertion game

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Original Paper

Evaluating the Quality, Content Accuracy, and User Suitability of mHealth Prenatal Care Apps for Expectant Mothers: Critical Assessment Study

Fateme Asadollahi[1], MSc; Samira Ebrahimzadeh Zagami[2], PhD; Saeid Eslami[3], PhD; Robab Latifnejad Roudsari[4], PhD

[1]Department of Midwifery, Student Research Committee, Mashhad University of Medical Sciences, Mashhad, Iran
[2]Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[3]Department of Medical Informatics, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
[4]Department of Midwifery, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran

Corresponding Author:
Robab Latifnejad Roudsari, PhD
Department of Midwifery
School of Nursing and Midwifery
Mashhad University of Medical Sciences
Qarashi Building, Central Office of the University
Daneshgah Street
Mashhad, 91388-13944
Iran
Phone: 98 9370400607
Email: rlatifnejad@yahoo.com

Abstract

Background: The proliferation of health apps in the digital health landscape has created significant opportunities for health promotion, particularly during pregnancy. However, despite the widespread distribution and popularity of pregnancy mobile apps, there are limited data on their quality and content.

Objective: This study aimed to evaluate the quality, content accuracy, and suitability of the most popular and freely available Persian mobile health (mHealth) apps for prenatal care in expectant mothers.

Methods: Through a systematic search, a total of 199 apps were screened from available app stores using the search term “pregnancy app” until July 2023. Inclusion criteria were apps in the Farsi language, freely available, downloaded more than 10,000 times, and designed for pregnant women. Ultimately, 9 apps met these criteria. These apps were downloaded onto mobile phones and assessed by 2 independent reviewers using the Mobile App Rating Scale (MARS), the Coverage and Depth of Information Checklist, and the Suitability Assessment of Materials (SAM). Statistical analyses explored relationships between app quality metrics and user ratings.

Results: The 9 apps evaluated had an average MARS score of 3.55 (SD 0.61) out of 5. Aesthetics (mean 4.02, SD 0.45) and Functionality (mean 4.11, SD 0.36) scored the highest, followed by Engagement (mean 3.29, SD 0.53) and Information (mean 3.09, SD 0.48). User star ratings did not strongly correlate with MARS scores (r=0.38, P>.05). Regarding health information coverage, 6 out of 9 (66.7%) apps were rated as poor, and 3 (33.3%) as adequate. For SAM, 4 (44.4%) apps were rated as superior and 5 (55.6%) as adequate. No app received a poor score.

Conclusions: The study underscores the need for improved standards in pregnancy app development to enhance educational efficacy and user satisfaction. Health care providers should recommend high-quality pregnancy apps with appropriate content to ensure effective health promotion. These findings contribute to understanding the current landscape of pregnancy apps and highlight areas for future research and regulatory attention.

Trial Registration: PROSPERO CRD42023461605; https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=461605

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KEYWORDS

pregnancy; prenatal care; mobile health apps; mHealth; women's health; health care providers; quality assessment; content evaluation; suitability assessment; digital health; smartphones; eHealth; telehealth; telemedicine; health promotion; technology; functionality; systematic search

Introduction

eHealth represents an innovative approach within the health care sector, using information and communication technology to enhance access to health care services and improve their quality [1]. eHealth encompasses various digital technologies, including telemedicine, mobile health (mHealth) apps (MHAs), electronic health records, and health information systems. These technologies aim to bridge the gap between health care providers and patients by enabling remote access to health care services, improving communication, and enhancing the overall quality of care [2].

MHAs are an integral part of the broader digital health ecosystem, including wearable technologies, virtual reality, telemedicine, and eHealth. These apps significantly enhance the accessibility and delivery of health services, especially with the increasing demand for smartphones and other digital devices driven by rapid technological advancements [3]. These apps empower individuals to participate in symptom control and identification, receive treatment, and obtain personal feedback and motivational support [2,4,5]. Pregnancy apps, in particular, have become popular resources for expectant mothers, offering functionalities ranging from fetal development tracking to health tips and educational content [6,7]. However, the reliability of health recommendations provided by pregnancy apps remains a significant concern. For instance, a study found that 89.7% of Chinese mobile apps for pregnancy and postpartum care did not provide safety statements or supporting evidence, and 68% of US apps similarly lacked evidence-based content [8]. Also, a systematic review of sexual and reproductive health apps revealed that, while a variety of apps exist, only a few meet high-quality design standards or demonstrate effectiveness in real-life settings [9]. These findings emphasize the critical need for research into the usability and evidence-based development of MHAs, particularly those targeting pregnancy care.

It is crucial for these apps to provide accurate and reliable evidence-based content that considers the cultural and linguistic needs of the target audience, including information on cultural practices and traditions related to pregnancy and childbirth [10].

While the quantity and user acceptance of Iranian pregnancy apps have grown significantly, the credibility of the information within these apps remains invalidated. A study conducted in Iran found that only 1.3% of pregnancy-related mobile apps were developed with the participation of obstetricians, and only 5% used reliable information resources [11]. This lack of professional input may affect the accuracy and reliability of the information these apps provide.

Despite the proliferation of pregnancy apps, there is a notable lack of research evaluating Persian-language apps. Existing studies on digital health tools in Persian often overlook the unique challenges faced by expectant mothers, such as the need for culturally relevant information and user-friendly interfaces that accommodate varying levels of comprehension and accessibility requirements specific to their needs [12]. Furthermore, data on the effectiveness of these apps in delivering evidence-based health information and supporting positive health outcomes is scarce [11].

The aim of this study is to assess MHAs for Iranian pregnant women by evaluating them across three key aspects: (1) quality assessment; (2) content accuracy via assessing coverage and depth of information, which assesses how thoroughly the app addresses relevant health topics, including work and rest practices during pregnancy, nutrition education, stress management, interpersonal relationships, and pregnancy care instructions, with significant implications for maternal health and well-being; and (3) user suitability of materials, which examines the quality of the app's content to ensure it is accurate, reliable, and user-friendly. Specifically, this study seeks to answer the following questions:

1. What apps are available?

2. What is the quality of these apps, as measured by the Mobile App Rating Scale (MARS)?

3. How comprehensive is the content provided by these apps?

4. How suitable are these apps for expectant mothers based on their design and cultural relevance?

Methods

Study Design and Protocol Registration

This study used a systematic approach to identify, select, and evaluate Persian-language pregnancy apps available up to July 2023. The methodology was designed to ensure a rigorous and transparent evaluation process. A detailed protocol for the review was developed and registered with the International Prospective Register of Systematic Reviews (PROSPERO; ID CRD42023461605).

Search Strategy and Inclusion Criteria

The app search was conducted between June 1, 2023, and July 31, 2023, focusing on major platforms commonly used by Persian-language app users. Searches were performed on Google Play Store, Cafebazaar App Store, Myket Market, Kandoo, Iran Apps, Avval Market, and Pars Hub. To enhance comprehensiveness, an internet-based search via Google was also conducted as a supplementary measure to identify apps not listed on these platforms.

Given the dynamic nature of search results on the Google Play Store, the search was conducted manually to ensure relevance. The Apple App Store is not officially accessible in Iran due to regional restrictions. However, using a virtual private network is legal in Iran, and Iranian users frequently use virtual private networks to connect to the store and download apps. Apps were identified by sequentially navigating through search results. We screened all results until no new eligible apps were identified, which required reviewing up to 10 pages per platform. No web crawler was used, but search results were manually exported by recording app details (eg, name, description, and download count) directly into a predesigned data extraction form.

The search was conducted using a combination of Persian keywords related to pregnancy and their English equivalents. Search terms included were “pregnancy,” “prenatal care,” “motherhood,” “pregnant,” and “mother and baby.” Apps were considered eligible if they met the following criteria: the app must be in Persian, freely available, with or without in-app purchases, compatible with the Android operating system, having more than 10,000 downloads, designed for pregnant women, provided information on at least one of the following topics: work and rest practices during pregnancy, nutrition education, stress management, interpersonal relationships, or pregnancy care instructions.

Apps were excluded from the analysis if they met any of the following criteria: inaccessibility due to dead or broken links, duplication, design as e-books, news sources, magazines, podcasts, blogs, games, or gaming-related content. In addition, apps were excluded if their primary function was monitoring or timing without providing educational content, or if they required paid subscriptions or included freemium content that limited access to essential features.

Screening Process and Data Extraction

In order to determine eligibility, two independent reviewers (FA and SEZ) screened the titles, images, and descriptions of the identified apps during the search. In cases of disagreement, a third senior reviewer (RLR) was consulted to reach a consensus.

Data from eligible apps were extracted systematically by two reviewers (FA and SEZ) who were trained to ensure consistency and accuracy.

Eligible apps were downloaded and tested on a Xiaomi Mi Mix 3 device running Android 12. Extracted data included app name, version, developer, cost, in-app purchases, user rating, number of ratings, and last update date.

App Features and Quality Assessment

Using 3 primary assessment tools, 2 reviewers with expertise in midwifery and reproductive health independently evaluated the apps.

The MARS

MARS evaluates app quality across 4 dimensions including (1) engagement to assess fun, interest, adaptability, interactivity, and target group relevance; (2) functionality to examine performance, usability, navigation, and gestural design; (3) aesthetics to evaluate layout, graphics, and visual appeal; and (4) information quality to review the accuracy, goals, credibility based on the evidence and quality, and quantity of information, including visual information.

Apps were rated using a 5-point scale (1=inadequate to 5=excellent). A mean score was calculated to determine overall quality. Disagreements were resolved by involving a third assessor.

The validity of the Persian (Farsi) version of the MARS questionnaire, translated and culturally adapted from the original scale, was rigorously assessed and confirmed through various psychometric measures. The fit indices demonstrated strong construct validity for each dimension (root-mean-square error of approximation [RMSEA]=0.074, Tucker-Lewis index [TLI]=0.922, comparative fit index [CFI]=0.940, and standardized root-mean-square residual [SRMR]=0.059). Reliability was reported as good to excellent across domains, with Omega coefficients ranging from 0.79 to 0.93, indicating high internal consistency. Furthermore, the instrument exhibited strong interrater reliability, with an intraclass correlation coefficient of 0.82, demonstrating a high level of objectivity [13].

Coverage and Depth of Information Checklist

This researcher-developed tool assessed educational content based on guidelines by Iran’s Ministry of Health [14], which are provided in Multimedia Appendix 1. The checklist used in this study was developed and validated to ensure its reliability and suitability for evaluating MHAs designed for Iranian pregnant women. The development process began with an extensive review of the literature, expert consultations, and adherence to relevant maternal health guidelines to identify key topics and items for inclusion. These topics covered essential domains such as pregnancy care, stress management, nutrition education, and exercise practices during pregnancy. Coverage was scored as follows: correct and sufficient (2 points), partially correct or insufficient (1 point), and incorrect or not addressed (0 points). The total score categorized app content as Superior (41-46 points, 90%-100%), Adequate (23-40 points, 50%-89%), or Poor or Low (<23 points, ≤49%). The resulting checklist was structured with clear, measurable items to evaluate the quality, coverage, and depth of information provided by the apps.

To ensure the checklist was a reliable and effective evaluation tool, it underwent a pilot testing phase. A sample of 5 MHAs was selected for this pilot, chosen to represent a variety of features and content typically found in apps targeting pregnant women. Two independent reviewers with reproductive health specialists having experience in the evaluation of health apps assessed the apps using the checklist. This process served two primary purposes: to evaluate the internal consistency of the checklist items and to measure interrater reliability.

The checklist showed strong internal consistency (Cronbach α=0.85) and substantial interrater reliability (Cohen κ=0.80), confirming its alignment and consistency in measuring information coverage and quality. Minor ambiguities identified during pilot testing were revised, resulting in a robust and validated tool used to evaluate the MHAs comprehensively (Multimedia Appendix 2).

Suitability Assessment of Materials

The authors conducted a suitability assessment of patient education material using the Suitability Assessment of Materials (SAM) tool. Each item was rated as superior (2 points), adequate (1 point), or not suitable (0 points). The SAM consists of 22 items grouped under four categories: literacy demand, layout and type, learning stimulation and motivation, and cultural appropriateness. Apps featuring content that lacked cultural alignment, such as multimedia showcasing non-Iranian contexts or dietary advice incompatible with local practices, were found to be less effective in addressing user needs. In contrast, apps that included culturally tailored recommendations, such as adherence to Islamic dietary guidelines or the use of culturally familiar imagery, were more favorably received. Scores were categorized as follows: 0%-39% (not suitable), 40%-69% (adequate), and 70%-100% (superior).

A study assessing SAM's interrater reliability for written stroke education materials showed that most individual SAM items had high interrater reliability, with 17 out of 22 items achieving substantial, almost perfect, or perfect weighted κ values (≥0.60), with a total agreement of 96% [15].

Data Analysis

Data analysis was conducted based on the extracted data from the included apps. The extracted data were first tabulated across all studies, and then the collected data were analyzed using IBM SPSS Statistics (version 25.0). Descriptive statistics, including mean and SD, were calculated for the app ratings from the MARS, Coverage and Depth of Information Checklist, and SAM. This analysis provided a comprehensive overview of app quality, content coverage, and suitability. The research team adhered to ethical principles, including honesty and trustworthiness, in data analysis and when presenting the study's findings. To protect the rights of the app developers, the names of the apps were identified by codes in this systematic evaluation.

Ethical Considerations

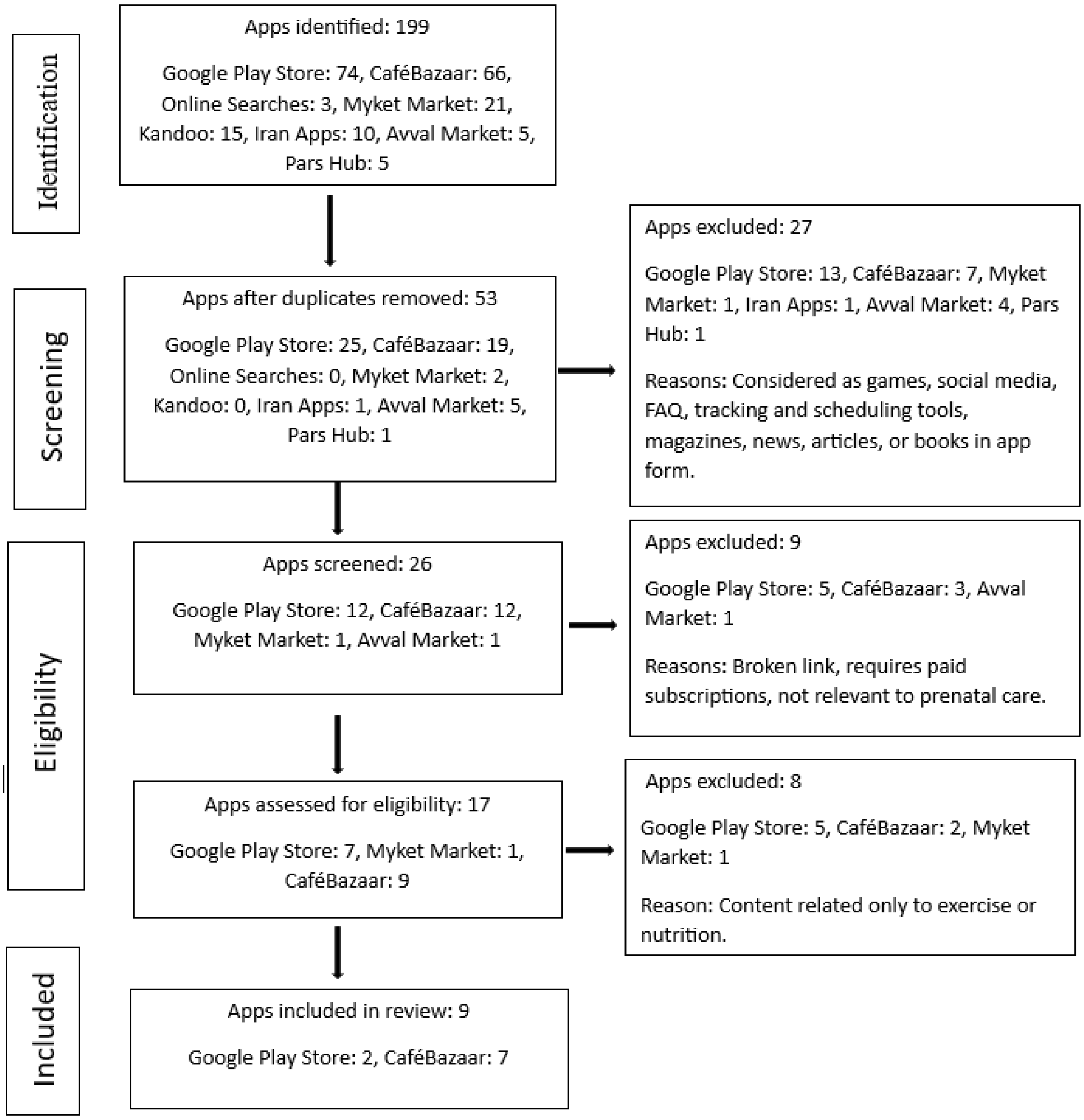
The research study was approved by the Research Ethics Committees of Mashhad University of Medical Sciences, Mashhad, Iran (IR.MUMS.REC.1400.179). Since the study involved the assessment of publicly available MHAs, no personal data or identifiable participant information were collected. The apps evaluated are commercially available and publicly accessible, ensuring user privacy and confidentiality. No compensation was provided or required for this study as it involved the assessment of publicly available MHAs and not the participation of individuals.

Results

App Selection Process

The app selection process for this study is outlined in Figure 1. A comprehensive search identified 199 pregnancy-related apps from multiple sources, including internet-based databases, major app stores, and local markets, using the keywords "Pregnancy," "Pregnant," "Pregnancy care," and "Prenatal care." During the initial screening, 146 duplicate entries were removed. For apps found on multiple platforms, the version from the platform with the higher download count was retained for evaluation, ensuring only one version of each app was included. This process left 53 unique apps for further evaluation. These apps were screened for relevance to pregnancy and availability in the Persian language. During this screening process, 27 apps were excluded because they either did not focus on pregnancy or were not available in Persian, leaving 26 apps for further review. The remaining 26 apps were then assessed against the study's predefined inclusion criteria, which considered factors such as app functionality, comprehensiveness of content, and language suitability. In this phase, 9 apps were excluded for failing to meet these criteria. This left 17 apps for a detailed eligibility assessment, during which 8 additional apps were excluded for not fully aligning with the requirements. Ultimately, 9 apps (2 apps were available on the Google Play Store, and 7 apps were available on CaféBazaar) met all criteria and were selected for a comprehensive evaluation regarding their quality, content, and suitability for Persian-speaking pregnant women.

Figure 1. Flow diagram for apps' selection.



Description of the Selected Apps

Of the 9 apps reviewed, 2 were sourced from Google Play and 7 from CaféBazaar. All selected apps were freely available for download. These apps were commercially developed and lacked affiliations with government agencies, academic institutions, or clinical trials. None had associated scientific publications.

A total of 2 apps had substantial user bases with more than 500,000 downloads each, while 3 apps had more modest download numbers of over 10,000. User ratings ranged from 2.9 to 4.7 stars, with most apps (7 out of 9) receiving ratings of 4.2 or higher. We considered the star ratings that appeared on the platform where the app had the highest number of downloads. In these platforms, the star rating system ranges from 1 star (the lowest rating) to 5 stars (the highest rating).

In total, 5 apps required in-app purchases for full functionality. Notable features across the apps included personal profile creation (6 apps), multilingual support (1 app), and offline functionality (2 apps). Only 2 apps provided transparency about their development and scientific teams. Table 1 summarizes these characteristics. Multimedia Appendix 3 provides the original ratings for all included apps.

Table 1. Summary of app characteristics.

App Code[a]	Downloads	Star rating	In-app purchases	Offline functionality	Language	User interaction	Scientific team
APP N1	>500,000	4.5	Yes	No	Persian	Yes	Yes
APP N2	>500,000	4.7	Yes	No	Persian	Yes	No
APP N3	>10,000	4.2	No	Yes	Persian	No	No
APP N4	>10,000	4.3	Yes	No	Persian	Yes	No
APP N5	>10,000	4.7	Yes	No	Persian	Yes	No
APP N6	>50,000	4.7	No	Yes	Persian	No	No
APP N7	>100,000	2.9	No	No	Persian	Yes	No
APP N8	>100,000	4.5	Yes	No	Persian	Yes	Yes
APP N9	>50,000	4.5	No	No	Persian or English	Yes	No

[a] APP N refers to the app code number (eg, APP N1 refers to app code number 1).

App Quality Assessment

The MARS tool evaluation revealed varying quality levels across the 9 apps. The scores ranged from 2.1 to 3.75 out of 5, with most apps (7 out of 9) scoring above 3. Reviewer-specific scores are presented in Multimedia Appendix 3.

Looking at the subscales, Aesthetics and Functionality emerged as the strongest domains, with median scores of 4. Engagement showed moderate performance, with a median score of 3, while Information quality was generally lower, with a median score of 2.8.

APP N4 demonstrated the strongest performance in three domains (Engagement: 4.2, Functionality: 5, Aesthetics: 4.6), while APP N8 led in Information quality (3.5). The lowest-performing app across most domains was APP N3, as shown in Table 2.

Relationship between app features examining the data qualitatively reveals several patterns. First, apps with higher MARS scores (above 3.5) generally received better user ratings, with most having ratings of 4.5 stars or higher. However, this trend was not consistent for all apps. For instance, APP N2 received high user ratings (4.7 stars) despite having a relatively low score in the information quality domain (2.8).

Second, the two most downloaded apps, with more than 500,000 downloads each, shared specific features. These included in-app purchases, user interaction capabilities, and regular content updates. Nevertheless, a higher number of downloads did not necessarily correlate with higher MARS scores, suggesting that download numbers alone are not a reliable indicator of app quality.

Finally, apps developed by teams with scientific expertise (2 out of 9) tended to score higher in the information quality domain, with scores exceeding 3.2. Conversely, apps with offline functionality (2 out of 9) tended to have lower overall MARS scores compared with apps with internet-based functionality, suggesting that offline accessibility may be associated with compromises in other quality domains such as engagement or information quality.

Table 2. MARS scores for antenatal apps.

App code[a]	Overall MARS score	Engagement	Functionality	Aesthetics	Information
APP N4	3.75	4.2	5	4.6	2.2
APP N2	3.62	3.6	4.1	4	2.8
APP N9	3.62	3.8	4.1	4.1	2.8
APP N1	3.57	3.4	3.8	3.9	3.2
APP N8	3.55	3.6	3.8	4	3.5
APP N5	3.35	3.5	4.2	3.9	1.8
APP N7	3.1	2.9	2.5	3.2	3.5
APP N6	2.27	1.7	2.5	2	2.6
APP N3	2.1	1.6	3	1.3	2

[a] APP N refers to the app code number (eg, APP N1 refers to app code number 1).

Coverage and Depth of Information

Most apps provided relatively poor coverage and depth of health information. Table 3 summarizes the completeness of the content.

None of the apps addressed all the essential training subjects recommended by the Deputy Minister of Health. A total of 6 apps were rated as poor for coverage and depth of health information and 3 apps were rated as adequate. Topics such as sexual health, oral health, immunization, substance avoidance, stress management, and prenatal classes were either poorly covered or entirely neglected. Furthermore, none of the apps provided references for the educational content, raising concerns about the accuracy and reliability of the information.

Table 3. Coverage and depth of information in apps.

App code[a]	Overall coverage rating	Key topics covered	Missing topics
APP N1	Adequate	Pregnancy changes, fetal growth, physical activity	Sexual health, immunization, stress management
APP N2	Adequate	Nutrition, common complaints, warning signs	Oral health, prenatal classes, substance use
APP N3	Poor	Pregnancy changes, physical activity	Comprehensive information on health subtopics
APP N4	Adequate	Fetal growth, physical activity, nutrition	Sexual health, immunization, substance use
APP N5	Poor	Common complaints, warning signs	Oral health, prenatal classes, stress management
APP N6	Poor	Basic pregnancy changes	Comprehensive coverage on health subtopics
APP N7	Poor	Common complaints	Sexual health, immunization, substance use
APP N8	Adequate	Physical activity, nutrition, common complaints	Sexual health, prenatal classes, stress management
APP N9	Adequate	Pregnancy changes, fetal growth, physical activity	Oral health, immunization, substance use

[a] APP N refers to the app code number (eg, APP N1 refers to app code number 1).

Suitability of Information

The SAM assessment revealed varying levels of content suitability across apps. A total of 4 apps achieved superior ratings (>70%), while 5 were rated as adequate (40%-70%) as shown in Table 4.

In terms of Literacy and Layout, high-performing apps (SAM>70%) consistently showed strong literacy demand scores, with layout quality typically aligning with overall suitability ratings. Learning stimulation emerged as the most challenging domain, being consistently the lowest-scoring area across all apps. Even apps with superior overall performance demonstrated significant room for improvement in user engagement strategies.

Cultural appropriateness presented a particularly interesting dimension, with scores ranging widely from 35% to 95%. Notably, apps with superior overall ratings typically exhibited more refined cultural adaptation, suggesting a strong correlation between cultural sensitivity and overall app quality. Apps with culturally misaligned content, such as multimedia depicting non-Iranian contexts or dietary advice unsuitable for local practices, were noted as less effective in meeting user needs. Conversely, apps incorporating culturally aligned recommendations, such as content adhering to Islamic dietary laws or featuring culturally relevant imagery, were better received.

Diving deeper into the quality patterns, apps with superior SAM ratings (>70%) shared several common characteristics. These apps distinguished themselves through comprehensive content organization, clear visual hierarchies, consistent cultural adaptation, and robust interactive elements. This suggests that successful pregnancy apps go beyond mere information delivery, focusing on user experience and cultural relevance.

Conversely, most apps revealed consistent areas requiring improvement. These included enhancing learning stimulation features, developing original educational media, ensuring cultural consistency, and providing authoritative reference citations. These gaps highlight the potential for future app development in the pregnancy support digital ecosystem, pointing to opportunities for creating more engaging, culturally sensitive, and scientifically grounded mHealth resources.

Table 4. SAM scores for suitability of app information.

App code[a]	Total score (%)	Literacy demand (%)	Layout and type (%)	Learning stimulation and motivation (%)	Cultural appropriateness (%)
APP N1	81.25% (Superior)	90% (Superior)	85% (Superior)	55% (Adequate)	95% (Superior)
APP N2	75% (Superior)	88% (Superior)	82% (Superior)	50% (Adequate)	80% (Superior)
APP N3	42% (Adequate)	48% (Adequate)	30% (Not suitable)	30% (Not suitable)	60% (Adequate)
APP N4	84.25% (Superior)	92% (Superior)	90% (Superior)	75% (Superior)	80% (Superior)
APP N5	70% (Superior)	85% (Superior)	70% (Superior)	65% (Adequate)	60% (Adequate)
APP N6	44 % (Adequate)	40% (Adequate)	35% (Not suitable)	25% (Not suitable)	35% (Not suitable)
APP N7	48.75 % (Adequate)	75% (Superior)	50% (Adequate)	30% (Not suitable)	40% (Adequate)
APP N8	67.5 % (Adequate)	75% (Superior)	80% (Superior)	50% (Adequate)	65% (Adequate)
APP N9	68.75 % (Adequate)	80% (Superior)	75% (Superior)	55% (Adequate)	65% (Adequate)

[a] APP N refers to the app code number (eg, APP N1 refers to app code number 1).

Discussion

Principal Findings

This study evaluated the quality, content accuracy, and user suitability of 9 popular Persian MHAs designed for prenatal care, using standardized assessment tools. The findings revealed that while the apps generally performed well in aesthetics and functionality, they showed notable deficiencies in information quality and coverage. Only a third of the apps achieved adequate health information standards, and none excelled in this category. Despite moderate user ratings, the results highlight significant gaps in the educational and informational content of these apps, underscoring the need for improved standards in app development to better serve expectant mothers.

App Availability and Characteristics

Based on the results, no apps were found with any background of scientific documents or being based on the evidence, including the results of the clinical trials. All reviewed apps lacked transparency regarding affiliations and were set up to be commercial rather than as an intervention to change health behavior. All included apps were mostly commercial and were not designed by university academics or research staff. In line with the results of our study, Musgrave et al [16] also indicated that, in their review study of pregnancy apps available in Australia, the affiliations and sources of funding information indicated that all apps were commercially developed and the scientific reviewer teams were not introduced. As a result, this is one of the weaknesses of apps because in order to increase their reliability, the scientific staff or resources for training must be specified [17]. This finding is particularly concerning given the critical role of accurate and comprehensive health information in antenatal care. The qualitative study on mothers' views on mHealth in self-care for pregnancy identified the need for reliable and trustworthy information in pregnancy apps [12]. Pregnant women were found to be interested in using apps for self-care, but they required reliable and accurate information to make informed decisions about their health [12]. Research highlights the importance of reliable content in health apps. They report that only 5% of the examined apps used reliable information resources, which is a significant concern given the importance of accurate information for pregnant women [11].

In our study, of the 6 apps scoring highest for quality, only 2, APP N7 and APP N9, did not contain in-app purchases. This finding aligns with another review article investigating nutrition-based pregnancy apps, which reported that highly rated MARS apps often required in-app purchases and could not be operated without internet access [18]. Concurrently, recent data suggest that only 5%-10% of app users are willing to pay for in-app purchases [19]. Furthermore, in our study, most applications could not be used without internet access, with only 2 apps offering plain textual information available offline. Similarly, the study by Musgrave et al [16] identified the lack of access to app content without an internet connection as a limitation of mHealth.

App Quality Assessment

The MARS tool revealed a nuanced quality landscape. With an average score of 3.55 out of 5, the apps demonstrated moderate quality. Aesthetics and Functionality emerged as the strongest domains, while Information quality consistently scored lower. The high user ratings and significant download numbers of apps such as APP N4 and APP N1 reflect their popularity and perceived utility among users. These apps scored well in terms of user engagement, functionality, and aesthetics, as evidenced by their high MARS scores. This aligns with the general trend observed in health app evaluations where engaging, visually appealing, and easy-to-use apps tend to garner higher user satisfaction [20]. For instance, APP N4 excelled in the engagement and functionality domains with scores of 4.2 and 5, respectively. This suggests that users value interactive and well-designed interfaces that enhance their overall experience. This finding is consistent with studies noting that apps with high engagement features often receive favorable user feedback and higher ratings, even if their informational content is not comprehensive [21].

However, despite their high user ratings, these apps often fall short of delivering thorough educational content. This discrepancy between user satisfaction and content quality highlights a critical issue in the design and development of health apps [22]. Users may prioritize user experience and accessibility over the depth and accuracy of information, which can lead to gaps in the provision of comprehensive health education [23].

Content Comprehensiveness

Our study found significant deficiencies in the coverage and depth of information provided by most apps. Despite their high engagement scores, many apps scored poorly in the information domain of MARS and lacked comprehensive coverage of essential pregnancy-related topics. For example, none of the apps covered all the crucial educational topics outlined by the Deputy Minister of Health, and several key areas, such as sexual health and prenatal classes, were consistently neglected. Also, the lack of verifiable sources for the educational content in the reviewed apps further exacerbates this issue, as it raises questions about the accuracy and credibility of the information disseminated to users.

While some apps offered a higher percentage of educational content coverage needed for pregnancy, they were inadequate or neglectful in more than half of the apps on topics such as sexual health, immunization, stress management, and introducing prenatal classes. This observation aligns with findings from another review, which reported that only 16 (31.4%) apps contained information on appropriate pregnancy weight gain as defined by the Institute of Medicine guidelines [18].In addition, a previous study by Tinius et al [24] on apps related to physical activity during pregnancy found that none of the included apps incorporated goal-setting in alignment with the American College of Sports Medicine (ACSM) and American College of Obstetricians and Gynecologists (ACOG) guidelines. The most frequently covered topics in the apps were changes during pregnancy, fetal growth, physical activity, nutrition, common complaints, and warning signs, consistent with other reviews [25]. Overall, reviewers noted that nearly half of all apps were poor or inadequate for recommending to others.

Suitability and Cultural Relevance

The evaluation of the apps using the SAM tool revealed mixed results regarding the suitability of health information. While 4 out of 9 apps (APP N1, APP N2, APP N4, and APP N5) were rated as superior in terms of suitability, the majority were merely adequate, and none were found to be unsuitable. This suggests that while some apps do meet the basic requirements for suitable health information materials, there is substantial room for improvement.

Notably, APP N1 and APP N4 received the highest scores in the SAM evaluation, reflecting their superior suitability for the intended audience. These apps likely benefited from their engaging and user-friendly design, which aligns with findings from previous studies indicating that well-designed health information materials are more likely to be effective [12].

Although many apps were evaluated as good to excellent on the SAM score across dimensions such as literacy demand, layout, and type, they received lower scores in the areas of graphics and illustrations and learning stimulation motivation. Similarly, a review of apps for infant feeding reported that 42% of the apps were rated as superior, 54% as adequate, and 3% as unsuitable [26]. However, Cheng et al [26] noted lower scores for readability and cultural appropriateness, which contrasts with our results. Our study determined that most programs were culturally appropriate for Iranian users. This discrepancy may be attributed to the fact that many of the apps in the study by Cheng et al [26] were developed outside of Australia, specifically in America, the United Kingdom, and the European Union, where cultural differences are expected. In contrast, the apps examined in our study were all designed by Iranian teams, which likely contributed to their relative cultural appropriateness.

A unique strength was the cultural appropriateness of these Iranian-developed apps. Unlike international apps that may struggle with cultural adaptation, these apps demonstrated a strong understanding of local user needs. However, areas for improvement included original educational media and interactive elements. These insights underscore the need for app developers to focus on comprehensive design and cultural considerations to enhance both the quality and user experience of pregnancy apps [27].

The study reveals a critical gap between app popularity and quality. High download numbers and user ratings do not guarantee comprehensive or reliable health information. This underscores the urgent need for rigorous content development standards, transparent scientific affiliations, comprehensive educational coverage, and enhanced user engagement strategies.

Strengths and Limitations

The study had several strengths. It used a comprehensive evaluation framework using 2 independent reviewers, which enhanced the reliability of the assessments. Concentrating on Persian MHAs for prenatal care, the study filled a significant gap in the literature and highlighted areas for improvement, particularly regarding the coverage and depth of health information. However, our study had several limitations. The evaluation was restricted to apps available on Android Play stores available in Iran, potentially excluding other resources on different platforms or less accessible databases. In addition, a key limitation is the rapidly evolving MHA market. Some apps included in this review may no longer be available, and new apps may have emerged since the data collection, which could affect the relevance of our findings. Our study also did not explore the long-term user engagement or the impact of these apps on user health outcomes, which could provide deeper insights into their effectiveness.

Implications of Findings

The implications of these findings are significant for both app developers and health care providers. High user engagement and aesthetic appeal are crucial for attracting users, but the ultimate value of antenatal apps lies in their ability to deliver reliable, comprehensive health education. Given the increasing reliance on digital tools for health information, ensuring that apps provide accurate, well-rounded educational content is essential. Our study underscores the need for more rigorous standards and oversight in the development and evaluation of health apps to ensure they meet the informational and usability needs of their users. For health care providers, these results suggest caution when recommending apps to expectant mothers. Providers should consider not only the popularity and user ratings of an app but also its content quality and the credibility of the information it provides.

Future Research Directions

Future research should expand the scope to include a wider range of platforms and perhaps a broader geographic scope to capture a more comprehensive view of available antenatal apps. Further studies should also look into the longitudinal impact of these apps on maternal health outcomes and user behavior. In addition, exploring user feedback and integrating it into apps' evaluation could provide a more nuanced understanding of app performance and areas for improvement. Given the rapid evolution of digital health tools, continuous monitoring and evaluation are necessary to keep up with emerging trends and ensure that these tools remain relevant and useful for their intended audiences.

Conclusion

A systematic evaluation of MHAs for prenatal care in Iran revealed a critical need for stricter quality control. While numerous pregnancy apps exist, many lack the quality and comprehensive content mandated by the Ministry of Health. Furthermore, the accuracy of educational content is questionable due to the absence of reliable references or involvement of health care professionals. This research highlights the importance of evaluating app quality and suitability for user navigation while also emphasizing the need to assess the use of behavioral change techniques like goal setting and self-monitoring. By identifying these gaps and deficiencies, researchers can recommend improvements and integrate evidence-based strategies to enhance the effectiveness of pregnancy apps in promoting healthy behaviors and ultimately improving maternal and infant health outcomes.

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Data Availability

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Authors' Contributions

FA and RLR contributed to conceptualization and methodology. FA and SEZ performed data curation. FA conducted formal analysis. RLR performed project administration and supervision. FA assisted with writing-original draft. FA, RLR, and SEZ contributed to investigation and writing-review and editing.

Conflicts of Interest

None declared.

Multimedia Appendix 1
Clinical Standards and Guidelines by Iran's Ministry of Health.
[PDF File (Adobe PDF File), 751 KB - apinj_v9i1e66852_app1.pdf]

Multimedia Appendix 2
Checklist for Evaluating Mobile Health Applications for Pregnant Women.
[DOCX File , 17 KB - apinj_v9i1e66852_app2.docx]

Multimedia Appendix 3
Original ratings for mobile health app evaluation.
[DOCX File , 27 KB - apinj_v9i1e66852_app3.docx]

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Abbreviations

ACOG: American College of Obstetricians and Gynecologists
ACSM: American College of Sports Medicine
CFI: comparative fit index
MARS: Mobile App Rating Scale
MHA: mobile health app
mHealth: mobile health
PROSPERO: International Prospective Register of Systematic Reviews
RMSEA: root-mean-square error of approximation
SAM: Suitability Assessment of Materials
SRMR: standardized root-mean-square residual
TLI: Tucker-Lewis index

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Pediatric Sleep Quality and Parental Stress in Neuromuscular Disorders: Descriptive Analytical Study

Sajjad Khaksar[1]; Mehdi Jafari-Oori[2]; Forogh Sarhangi[2]; Malihe Sadat Moayed[2]

[1]Student Research Committee, Baqiyatallah University of Medical Sciences, Tehran, Iran

[2]Nursing Care Research Center, Clinical Sciences Institute, Nursing Faculty, Baqiyatallah University of Medical Sciences, Vanak Square, Tehran, Iran

Corresponding Author:
Malihe Sadat Moayed
Nursing Care Research Center, Clinical Sciences Institute, Nursing Faculty, Baqiyatallah University of Medical Sciences, Vanak Square, Tehran, Iran

Abstract

Background: Neuromuscular disorders (NMDs) constitute a heterogeneous group of disorders that affect motor neurons, neuromuscular junctions, and muscle fibers, resulting in symptoms such as muscle weakness, fatigue, and reduced mobility. These conditions significantly affect patients’ quality of life and impose a substantial burden on caregivers. Spinal muscular atrophy (SMA) is a relatively common NMD in children that presents in various types with varying degrees of severity.

Objective: This study aimed to evaluate the sleep quality of children with NMDs, particularly SMA types 1, 2, and 3 and assess the stress levels experienced by their parents.

Methods: A descriptive analytical study was conducted from February to October 2023, in selected hospitals and dystrophy associations in Tehran and Isfahan, Iran. A total of 207 children aged 1 - 14 years with various NMDs were included in the study. Data were collected using a web-based questionnaire with 3 parts: demographic information, the Children’s Sleep Habits Questionnaire to assess children’s sleep, and the Stress Response Inventory to measure parental stress. Statistical analyses were performed using SPSS version 22, with an α level of .05.

Results: Significant differences in sleep quality were found among SMA types, with mean scores of 74.76 (SD 7.48) for SMA type 1, 76.4 (SD 7.29) for SMA type 2, 72.88 (SD 6.73) for SMA type 3, and 75.87 (SD 5.74) for other NMDs (P=.02). A correlation was found between sleep and length of hospital stay (r=0.234, P<.001)and between sleep and the child’s sex (r=−0.140, P=.04). Parental stress scores averaged 95.73 (SD 32.12). There was not a statistically significant difference in parental stress scores among the 4 groups (P=.78). This suggests that parental stress levels were similar across different NMD groups.

Conclusions: Sleep disorders are prevalent among children with NMDs, especially SMA. Parents experience high levels of stress that can affect the care they provide. Therefore, interventions to improve children’s sleep and address parental stress are crucial. Regular screening, counseling, and tailored support are recommended to enhance the well-being of children with NMDs and their families.

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KEYWORDS

spinal muscular atrophy; neuromuscular disorders; sleep quality; pediatrics; parental stress; children; parents; muscular atrophy; muscular disorders

Introduction

Neuromuscular disorders (NMDs) are a diverse group of disorders that affect motor neurons, neuromuscular junctions, and muscle fibers, resulting in various disease onsets, presentations, and prognoses. Examples of NMDs include spinal muscular atrophy (SMA), Charcot-Marie-Tooth disease, congenital myasthenia gravis, and Duchenne muscular dystrophy [1,2]. Children with NMDs can also develop central nervous system disorders such as cerebral palsy and spinal cord injury [3]. Common symptoms of NMDs include muscle weakness, fatigue, reduced mobility, and decreased physical performance. Additionally, these patients may experience orthopedic, cardiac, infectious, and respiratory problems, which can negatively impact their quality of life [4].

The global prevalence of neuromuscular diseases, as estimated through a systematic reviews of studies, ranges from 16 per 10,000 to 25.1 per 100,000 individuals and affects people of all ages [5]. The most common autosomal recessive disorder in children with NMDs is SMA, and it affects approximately 1 in 10,000 individuals and has a carrier frequency of 1 in 50 in certain populations [4]. Despite this, there have been no comprehensive epidemiological studies conducted on children with NMDs, particularly SMA, in Iran. Only one study in Iran identified Duchenne muscular dystrophy as the most prevalent NMD, with no comprehensive data available on SMA or other NMDs [6].

Many NMDs, including SMA, cause progressive muscle weakness that affects the respiratory system, leading to reduced upper airway function, impaired coughing and secretion clearance, and weakened chest wall support [7]. As a result, children with NMDs, particularly SMA, are at high risk for upper airway obstruction, pulmonary aspiration, frequent respiratory infections, sleep-disordered breathing (SDB), hypoventilation, and respiratory failure [8,9].

SDB is a prevalent complication in children with advanced NMDs [10]. It occurs intermittently due to partial or complete upper airway obstruction, leading to disrupted sleep patterns and ventilation [11]. The prevalence of SDB in healthy children is approximately 1%, while up to 70% of children with NMDs experience it [12]. The common issues faced by these children include sleep disturbance, drowsiness, night sweats, nausea, morning headaches, fatigue, and poor academic performance. Therefore, effective management of SDB is crucial to reduce complications and enhance the quality of life for children with NMDs [13,14]. According to research, sleep disorders in children can result in sleep problems for their parents. When children struggle to fall asleep, their parents also have difficulty sleeping, which can cause stress and lead to missed workdays [15]. In a recent study, the mental health of parents of a child with a NMD was assessed using the Psychological Adaptation Scale questionnaire, which revealed high levels of mental health problems among parents [16].

Stress and anxiety among parents and caregivers can also have negative effects on children, potentially leading to a lack of support from mothers. Confusion in parental behavior, particularly from mothers, can be harmful to their children [17]. Furthermore, research has indicated that changes in a mother's psychological functioning, such as increased stress and anxiety, can influence her perception of her child's sleep problems [18]. Despite numerous studies highlighting the association between parental stress and sleep quality in children with NMDs, comprehensive research specifically focusing on a large cohort of patients with SMA remains limited. Globally, existing studies have primarily concentrated on genetic, laboratory, and epidemiological aspects with small sample sizes and a restricted focus on a few NMDs [6,12,19].

This study aimed to bridge this knowledge gap by examining various aspects of sleep in Iranian children with NMDs, with a particular emphasis on SMA. Using child-specific sleep assessment tools, this study sought to identify the correlation between sleep disturbances and parental stress in this population. The findings of this study can increase our understanding of the sleep experiences of children with NMDs and their parents' stress levels. Eventually, these findings can be used to formulate approaches that enhance the well-being of such children and minimize emotional strain on parents in various cultural environments.

Methods

Study Design and Participants

This descriptive analytical study was conducted as part of a larger study in selected hospitals in Tehran and Isfahan, as well as the dystrophy association of these centers, from February to October 2023, in Iran. The study included a sample of 207 children diagnosed with a NMD, with inclusion criteria of having any muscular dystrophy with an unknown cause and being between preschool and school age (1 to 14 years old). The exclusion criterion was an incomplete questionnaire.

Data Collection

A cross-sectional web-based survey was conducted using the SurveyHeart platform [20] to collect data from caregivers of children with NMDs. Participants were recruited through convenience sampling at selected hospitals and centers in Tehran and Isfahan, Iran. To optimize participation, caregivers were informed about the aims of the study and the significance of sleep for children with NMDs. Data were gathered using a 3-part web-based questionnaire. The initial section captured the demographic information using closed-ended questions. Subsequently, children's sleep habits and parental stress levels were assessed using the Children's Sleep Habits Questionnaire (CSHQ) and the Stress Response Inventory (SRI), respectively, and both used Likert scale items.

Web-Based Questionnaire

Demographic Characteristics

The demographic data examined in this study included the child's sex and age, number and length of hospitalizations, use of specific medications for treatment, parents' educational levels, parents' job, recruitment organization (military or civilian), and number of children in the family.

Children's Sleep Habits Assessment

The CSHQ, which was reviewed and designed by Owens et al [21], was created to assess the sleep habits of 623 preschool- and school-aged children. They showed that the CSHQ was an effective tool for evaluating sleep quality in children. The questionnaire consisted of 35 statements rated on a 3-choice Likert scale across 8 categories: sleep resistance, sleep anxiety, parasomnia, breathing disorders during sleep, waking up at night, sleepiness during the day, sleep duration, and sleep onset delay. Statements 1, 2, 9, 10, and 28 were scored in reverse order. The total score ranged from 33 to 99, with a higher score indicating poorer sleep quality (score ≥41) [21]. In a previous study, the homogeneity of the questionnaire was determined to have a Cronbach α of 0.8 [22]. The validity of the children's sleep habits questionnaire was assessed based on content validity, and its internal consistency has been found to be 0.82 [15]. In another study, the Cronbach α was 0.816 [23].

Parental Stress Assessment

To assess parental stress levels, the SRI scale developed by Koh et al [24] was used. This questionnaire was designed to explore the emotional, physical, cognitive, and behavioral aspects of stress responses. It was a self-reported measure, requiring participants to indicate the extent to which they experience each symptom on a 5-point Likert scale ranging from "not at all" (0 points) to "completely" (4 points). The stress response questionnaire consisted of 39 items and 7 subscales: tension (6 items), aggression (4 items), somatization (3 items), anger (6 items), depression (8 items), fatigue (5 items), and frustration (7 items). The following points were assigned to calculate the score for each tension subscale: 16 for aggression, 12 for somatization, 24 for anger, 32 for depression, 20 for fatigue, and 28 for frustration. The minimum and maximum scores were 0 and 156, respectively. The reliability of the SRI tool was examined, resulting in a Cronbach α of 0.97, with a 3-week interval between assessments [24]. The validity of the Persian version of the SRI tool in Iran was confirmed, with an α coefficient of 0.963. Validity was further assessed through factor analysis using the principal parts method and Varimax rotation [25]. In the present study, the Cronbach α for this tool was 0.941.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The study protocol was approved by the Ethics Committee of the Baqiyatullah University of Medical Sciences (code IR. BMSU. BAQ. REC.1401.129). Written informed consent was obtained from the guardian or legal guardian of each child participant. Participants (or their legal representatives) had the right to withdraw from the study at any time without any consequences. All data collected during this study was anonymized to ensure participant privacy.

Statistical Analysis

For statistical analyses, mean tests with SDs and nonparametric tests (Spearman, Kendall τb, and Kruskal-Wallis) were used to measure qualitative and quantitative variables and determine their relationship with the types of dystrophy, respectively. All analyses were considered statistically significant at an α level of .05. The statistical data were analyzed using SPSS version 22 (IBM Corp).

Results

Demographic Characteristics

This study aimed to investigate the demographic and clinical characteristics of children with NMDs. Of the 207 children enrolled, 50 (24.2%) had SMA type 1, 95 (45.9%) had SMA type 2, 54 (26.1%) had SMA type 3, and only 8 (3.9%) had other NMDs. Specifically, 4 children had Duchenne muscular dystrophy and 4 children had Becker muscular dystrophy. Regarding sex, 114 participants (55.1%) were boys and 93 (44.9%) were girls. Those with SMA type 1 included 20 boys (9.7%) and 30 girls (14.5%). The children with SMA type 2 group included 50 boys (24.2%) and 45 girls (21.7%), and those with SMA type 3 included 36 boys (17.4%) and 18 girls (8.7%). Additionally, for children with other NMDs, there were 8 boys (3.9%). The mean age of the children was 7.14 (SD 4.41) years. Additionally, out of 207 families, 49 (23.7%) were military, while 158 (76.3%) were civilians (Tables 1 and 2).

Furthermore, we examined the clinical characteristics of these children. Children with SMA type 1 had the longest average length of hospitilization and the highest average number of hospitalizations among the 4 groups. There were significant differences in both the length of stay and number of hospitalizations among the 4 NMD groups (*P*<.001). Conversely, no significant correlations were found between the other demographic variables and the different NMD groups, suggesting that the length of hospital stay varied significantly (Table 2). Additionally, this study assessed the use of specific medications to treat these children. Of the children enrolled in the study, 70% (35/50) with SMA type 1, 63% (60/95) with SMA type 2 (63%), 52% (28/54) with SMA type 3, and 50% (4/8) with other NMDs received disease-specific treatment.

Table . Demographic characteristics of the study participants (n=207).

Characteristics	SMA[a] type 1	SMA type 2	SMA type 3	Other NMD[b]	Total
NMD of the child, n (%)	50 (24.2)	95 (45.9)	54 (26.1)	8 (3.9)	207 (100)
Father's education, n (%)					
Less than a diploma	18 (8.7)	16 (7.7)	19 (9.2)	0 (0)	53 (25.6)
Diploma	16 (7.7)	31 (15)	17 (8.2)	6 (2.9)	70 (33.8)
Bachelor's degree	12 (5.8)	26 (12.6)	13 (6.3)	2 (1)	53 (25.6)
Graduate	4 (1.9)	18 (8.7)	5 (2.4)	0 (0)	27 (13)
No answer	0 (0)	4 (1.9)	0 (0)	0 (0)	4 (1.9)
Mother's education, n (%)					
Less than a diploma	12 (5.8)	24 (11.6)	22 (10.6)	0 (0)	58 (28)
Diploma	26 (12.6)	33 (15.9)	24 (11.6)	2 (1)	85 (41.1)
Bachelor's degree	10 (4.8)	29 (14)	8 (3.9)	4 (1.9)	51 (24.6)
Graduate	2 (1)	9 (4.3)	0 (0)	2 (1)	13 (6.3)
Father's job, n (%)					
Recruitment	14 (6.8)	30 (14.5)	24 (11.6)	4 (1.9)	72 (34.8)
Part-time	21 (10.1)	38 (18.4)	14 (6.8)	4 (1.9)	77 (37.2)
Home	0 (0)	2 (1)	0 (0)	0 (0)	2 (1)
Unemployed	13 (6.3)	10 (4.8)	15 (7.2)	0 (0)	38 (18.4)
Vacation	2 (1)	15 (7.2)	1 (0.5)	0 (0)	18 (8.7)
Mother's job, n (%)					
Recruitment	2 (1)	20 (9.7)	5 (2.4)	2 (1)	29 (14)
Part-time	0 (0)	10 (4.8)	2 (1)	0 (0)	12 (5.8)
Home	44 (21.2)	57 (27.5)	43 (20.8)	6 (2.9)	150 (72.5)
Unemployed	2 (1)	0 (0)	0 (0)	0 (0)	2 (1)
Vacation	2 (1)	6 (2.9)	4 (1.9)	0 (0)	12 (5.8)
Recruitment organization, n (%)					
Military	11 (5.3)	23 (11.1)	13 (6.3)	2 (1)	49 (23.7)
Civilian	39 (18.8)	71 (34.3)	41 (19.8)	6 (2.9)	158 (75.8)
Number of children in the family, n (%)					
1	17 (8.2)	44 (21.2)	17 (8.2)	4 (1.9)	82 (39.6)
2	21 (10.1)	34 (16.4)	22 (10.6)	4 (1.9)	81 (39.1)
3	12 (5.8)	15 (7.2)	13 (6.3)	0 (0)	40 (19.3)
4	0 (0)	2 (1)	2 (1)	0 (0)	4 (1.9)

[a] SMA: spinal muscular atrophy.

[b] NMD: neuromuscular disorder.

Table . Demographic characteristics of the study participants.

Variable	SMA[a] type 1, mean (SD)	SMA type 2, mean (SD)	SMA type 3, mean (SD)	Other NMD[b], mean (SD)	*P* value[c]
Sleep score[d]	74.76 (7.48)	76.40 (7.29)	72.88 (6.73)	75.87 (5.74)	.03
Parental stress score[e]	94.72 (28.83)	98.81 (30.76)	94.89 (33.69)	91.25 (45.03)	.78
Length of stay (days)	1.76 (0.71)	1.03 (0.19)	1.58 (0.69)	1 (0.00)	<.001
Number of hospitalizations	2.16 (0.87)	1.55 (0.83)	2.09 (0.87)	1 (0.00)	<.001
Age of the child (years)	4.32 (3.65)	9.75 (4.86)	6.25 (4.62)	8.25 (4.62)	.02

[a] SMA: spinal muscular atrophy.

[b] NMD: neuromuscular disorder.

[c] Kruskal-Wallis test.

[d] Total sleep score: mean 74.37, SD 7.14.

[e] Total stress score: mean 95.73, SD 32.12.

Sleep Habits of Children

The mean sleep score for each group was 74.76 (SD 7.48) for SMA type 1, 76.4 (SD 7.29) for SMA type 2, 72.88 (SD 6.73) for SMA type 3, and 75.87 (SD 5.74) for other NMDs. There was a statistically significant difference in the sleep scores among the 4 groups (P=.02). This indicated that at least 1 group had a significantly different mean sleep score than the other groups (Table 2). Pediatric sleep was influenced by various demographic variables, some of which had significant correlations while others did not. A significant positive correlation was observed between sleep score and the length of hospital stay (r=0.234, P<.001), suggesting that longer hospital stays were associated with a decrease in the quality of pediatric sleep. Furthermore, a significant negative correlation was found between sleep and sex (r=−0.140, P=.04), suggesting that sex differences affected pediatric sleep patterns. However, the correlations between sleep and NMD (r=0.121, P=.08) and the father's education (r=−0.119, P=.08) were weak and nonsignificant. Similarly, the correlation between sleep and the number of children (r=.025, P=.72) was very weak and nonsignificant, indicating little to no association (Table 3).

Table . Correlation analysis between pediatric sleep, parental stress, and demographic variables.

Variable	NMD[a]	Length of stay	Parental stress	Father education	Sex	Child number
Pediatric sleep						
r[b]	0.121	0.234	0.454	–0.119	–0.140	0.025
P value	.08	<.001	.53	.08	.04	.72
Parental stress						
r	0.231	–0.049	—	–0.061	–0.017	0.032
P value	.46	.48	—	.38	.80	.65

[a] NMD: neuromuscular disorder.

[b] Spearman rank correlation coefficient.

Parental Stress

The parents of children with SMA type 2 reported the highest mean stress score of 98.81 (SD 30.76), followed by the parents of children with SMA type 3 (mean 94.89, SD 33.69), SMA type 1 (mean 94.72, SD 28.83), and other NMDs (mean 91.25, SD 45.03). There was not a statistically significant difference in parental stress scores among the 4 groups (P=.78). This suggests that parental stress levels were similar across the different NMD groups (Table 2). No significant correlations were found between parental stress and the demographic variables examined (Table 3).

Discussion

Principal Findings

This study found that children with NMDs, especially those with SMA, had significantly lower sleep quality according to the CSHQ. Frequent sleep disturbances in children with NMDs can significantly increase the overall disease burden for patients and their caregivers [26]. As a result, parents of children with NMDs can experience high levels of stress. However, sleep disorders in people with NMDs, especially in children with SMA, have not been well studied. Therefore, it is necessary to evaluate sleep in patients with NMDs [27,28]. Our study is the first to examine a large group of children with NMDs, particularly SMA, in Iran. One notable difference between our study and others [29-33] was the number of patients with SMA. In this study, we assessed the sleep of 199 children with SMA using the CSHQ. The results of our study, demonstrating reduced sleep quality in children with SMA, align with those of Chiang et al [33], who reported significantly lower mean sleep scores in this population compared to healthy controls [34]. These findings are consistent with those of a study on children with SMA type 1 [35], a study of 85 children with SMA type 1 and 2 in Italy [29], a study on 31 children with SMA type 1, 2, and 3 [30], and a study on children with myotonic dystrophy [36].

Furthermore, the results of our study showed that the mean score of sleep disorders in children with SMA type 2 was higher than that of other types of NMDs, although there was not a statistically significant relationship between individual and family factors. However, in contrast to the study by Pera et al [29], sleep disorders were reported more frequently in children with SMA type 2 compared to other children. Additionally, Chacko et al [30] reported fewer sleep disorders in children with SMA type 3. This discrepancy may be attributed to sample size, as the studies done by Chacko et al [30] and Pera et al [29] included only 9 and 13 children with SMA type 3, respectively. Another difference between our study and the aforementioned studies was the use of a sleep assessment tool. Chacko et al [30] used polysomnography, whereas Pera et al [29] used the Sleep Disturbance Scale for Children. However, further research and evaluation are necessary to gain a better understanding of the sleep disorders in children with NMDs.

Sleep problems are common in childhood and adolescence and are related to various factors, such as learning, memory, and emotional and behavioral problems [37-39]. This study aimed to investigate the individual and family factors that influence children’s sleep. The study examined the child’s age, the number and duration of hospitalizations, the parents’ education and occupation, their employing organization, and the number of children in the family. In this study, no significant relationship was found between parents’ education and their children’s sleep. However, a study on children with NMDs found that higher levels of parental education and income were associated with a reduced care burden for parents. This, in turn, led to improved sleep quality and a better overall quality of life for their children [40]. Furthermore, a study conducted on healthy children showed that children whose parents had a university education were more prone to experiencing sleep issues than children whose parents did not graduate from high school [41].

The child’s age was taken into consideration when studying childcare outcomes. This is because as a child with a NMD ages, parents’ caregiving responsibilities become more challenging due to the progression of the disease. For example, a study conducted in Brazil examined 31 caregivers of children with Duchenne and found that older boys were more likely to be better understood by their caregivers in terms of their needs and care [42].

Another result of this study was the difference among various groups of patients with NMDs in terms of sleep examination, age, duration, and number of hospitalizations. The results of Chacko et al [30] also corroborate our findings in a sleep study of children with SMA types 1, 2, and 3. They demonstrated that sleep quality was lower in children with SMA type 1 than those with SMA type 2 and SMA type 3 [30]. The length of stay and number of hospitalizations varied among children with different types of SMA and NMDs in general. The findings of Lin et al [43] also support the results of this study. In terms of hospitalization, Chan et al [44] revealed that patients with SMA type 1 had more than 10 visits per year, patients with SMA type 2 had 8 - 23 visits, and patients with SMA type 3 had 12 - 28 visits annually. Regarding hospital stays, the average stay length for patients with SMA type 2 was longer than patients with SMA type 3 but shorter than patients with SMA type 1. The results from Chan et al [44] also confirmed the difference in the duration and number of hospitalizations among these children. Additionally, there was a significant relationship between the duration of hospitalization and sleep in children. When children are hospitalized, they tend to sleep less and have lower quality sleep [42]. A study also found that children admitted to general pediatric and intensive care units slept an average of 2 hours less than they did at home before hospitalization, according to their parents’ reports [42]. It is important to note that admitting a child to a hospital is a stressful experience that can increase parental anxiety.

Parents of a child with a chronic disease often experience significant stress that impacts various aspects of their lives [45]. This study aimed to investigate the stress levels of parents of children NMDs by using 7 subscales: tension, aggression, somatization, anger, depression, fatigue, and frustration. The results indicated that parents of children with NMDs experience varying levels of stress, with parents of children with SMA type 2 experiencing higher levels. This aligns with a study that found no significant difference in stress levels among parents of children with NMDs such as Williams syndrome, Down syndrome, and autism spectrum disorder [46]. This study also stated that the similarity in parental stress levels across different NMD groups suggests that the specific type of disorder may not be the main cause of stress [46]. Additionally, a study reported that parents of children with NMDs experienced high levels of stress, with no significant difference between mothers and fathers [47]. Another study examined emotional distress symptoms among mothers of sons with Duchenne and Becker muscular dystrophy, comparing them to a control group of women matched for sex and age. The study found that these mothers reported a lower quality of life and more emotional distress, depression, stress, and clinical anxiety symptoms compared to the women in the control group [48]. Given the consistent reports of higher stress levels among parents of children with NMD, it is crucial to focus on implementing adaptive strategies for families and parents. Screening and intervention measures for families of children with NMDs are essential steps to support these families. NMD associations that provide assistance to these patients should consider implementing measures to screen and support parents of these families. It would also be beneficial to identify centers that offer mental health services and refer families based on their health insurance coverage.

In addition, we expected to observe a significant correlation between children’s sleep and parents’ stress levels. However, this relationship was not statistically significant, despite several studies indicating a connection between children's sleep and parents' stress [18,49,50]. Perhaps this difference can be attributed to the numerous and diverse factors that impact the sleep of children with NMDs and the stress experienced by their parents. Additionally, the intermittent nature of medication administration, frequently resulting from drug supply constraints, can further compromise the sleep quality in this patient population.

Another study aimed to assess the level of stress experienced by parents of children who were hospitalized. The study included 352 parents whose children were hospitalized, and it was found that these parents generally experienced mild-to-moderate levels of stress. Interestingly, the study also revealed that parents who reported lower stress levels tended to feel more satisfied. This study identified several factors that predicted higher levels of stress among parents. These factors included having a low level of education, having a child hospitalized for more than 14 days, and having a child who had visited the hospital frequently in the past [51]. These findings can be generalized to other children with neurodevelopmental disorders because parents of such children often experience higher levels of stress, due to the frequent hospitalizations that their children require. As the duration of their child's hospitalization increases, parents are more likely to report higher levels of stress.

This study, along with others that emphasize sleep disturbances in children with NMDs and the stress experienced by their parents, highlight the urgent need for comprehensive interventions. In this context, studies by Bedi et al [52] and Mellies et al [53] demonstrated that noninvasive ventilation normalizes nocturnal gas exchange and improves diurnal gas exchange, respiratory disturbance index, arousals from sleep, nocturnal heart rate, sleep architecture, and overall quality of life in children with NMDs by reducing symptoms and enhancing daily functioning. However, adherence to noninvasive ventilation, especially in rapid eye movement–related SDB, remains unclear. For instance, nocturnal bilevel positive airway pressure treatment has been shown to help individuals with limb-girdle muscular dystrophies return to their usual daily activities [54]. In addition to noninvasive ventilation, other interventions such as pharmacological treatments, behavioral strategies, and sleep health literacy are also important [55-57]. Implementing these interventions can be challenging; however, they are crucial for improving sleep quality and overall health. It is essential to understand which patients are at a higher risk of developing sleep dysfunction and should be actively monitored. Moreover, more rigorously designed studies are needed to evaluate the long-term benefits and cost-effectiveness of various sleep interventions for children with NMD.

Limitations

One limitation of this study was its methodology. The findings reported here were correlational, not causal, and they do not imply causality. Data were collected using self-reported web-based questionnaires. The extensive sample size necessitated the use of this method; however, it limited control over response conditions, thereby introducing potential biases and reducing the reliability of the findings. Our current methodology does not thoroughly evaluate various factors, such as environmental, psychological, physiological, and social influences on sleep quality. Future research should employ a multidimensional approach, incorporating objective sleep measurements and detailed clinical evaluations to gain a more comprehensive understanding of the sleep disorders in this population.

Conclusions

The results of our study indicate that sleep disorders, particularly SMA, are common in children with NMD. Furthermore, our examination of parental stress levels revealed a high level of stress among these parents, which can affect the quality of care for their children. Therefore, interventions should be implemented to improve the sleep of these children. Additionally, due to the high level of stress experienced by parents, it is necessary to implement measures for screening, identification, and referral for counseling. These families should be regularly evaluated and supported, and interventions should be tailored based on the intensity of their stress.

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Conflicts of Interest

None declared.

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Abbreviations

CSHQ: Children’s Sleep Habits Questionnaire
NMD: neuromuscular disorder
SDB: sleep-disordered breathing
SMA: spinal muscular atrophy
SRI: Stress Response Inventory

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Differential Impact of eHealth Literacy on Wellness Behaviors of Iranian Nurses: Descriptive Correlational Cross-Sectional Study

Behnam Moradi[1], MSc; Mohammad Javad Hosseinabadi-Farahani[1], PhD; Mohammadreza Dinmohammadi[1,2], PhD; Mohammad Saatchi[3,4], PhD

[1]Department of Nursing, School of Behavior Sciences, University of Social Welfare and Rehabilitation Sciences, Velenjak, Daneshjo Blvd, Kadayar Dead End, Tehran, Iran

[2]Social Determinants of Health Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[3]Health in Emergency and Disaster Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[4]Department of Biostatistics and Epidemiology, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

Corresponding Author:
Mohammad Javad Hosseinabadi-Farahani, PhD
Department of Nursing, School of Behavior Sciences, University of Social Welfare and Rehabilitation Sciences, Velenjak, Daneshjo Blvd, Kadayar Dead End, Tehran, Iran

Abstract

Background: Nurses play a pivotal role in health care delivery and health education. However, their demanding work environments, characterized by irregular shifts and high stress, often hinder their ability to adopt healthy lifestyles, compromising both their well-being and their effectiveness as role models for health promotion. With the rise of digital health technologies, eHealth literacy—the capacity to seek, evaluate, and apply online health information—has emerged as a critical factor influencing health-promoting behaviors among health care professionals.

Objective: This study aims to examine the association between eHealth literacy and healthy lifestyle behaviors among Iranian nurses, focusing on nutrition, physical activity, stress management, health responsibility, interpersonal relations, and spiritual growth.

Methods: We conducted a cross-sectional descriptive-analytical study in Tehran, Iran, from November 2024 to February 2025. A total of 334 registered nurses from 7 public and teaching hospitals participated. Data were collected via the eHealth Literacy Scale and the Health-Promoting Lifestyle Profile II. Spearman correlation and multivariate linear regression analyses were performed, with statistical significance set at $P<.05$.

Results: Of 334 nurses, 234 (70.1%) had moderate eHealth literacy, 178 (53.3%) had good healthy lifestyle scores, and none scored low. A significant positive correlation was found between eHealth literacy and overall healthy lifestyle ($r=0.565$; $P<.001$), with the strongest associations observed for spiritual growth ($r=0.537$), health responsibility ($r=0.437$), and interpersonal relationships ($r=0.467$). Associations with stress management ($r=0.318$), nutrition ($r=0.321$), and physical activity ($r=0.289$) were weaker but remained statistically substantial.

Conclusions: Higher eHealth literacy is associated with healthier lifestyles, particularly in the areas of spiritual growth and health responsibility. Workplace barriers, such as rotating shifts, limit physical activity and stress management. Targeted eHealth training and wellness programs are needed.

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KEYWORDS
eHealth literacy; healthy lifestyle; nurses; health-promoting behaviors; digital health

Introduction

Background

In recent decades, the global shift in disease patterns has led health care systems to transition their focus from treatment to prevention and health promotion [1]. In 2016, it was estimated that 40.5 million (71%) of the 56.9 million deaths worldwide were due to noncommunicable diseases (NCDs), and projections suggest that by 2030, these diseases will account for more than 75% of the global mortality [2-4]. Research indicates that the majority of NCDs are rooted in unhealthy behaviors and lifestyle factors, including poor nutrition, physical inactivity, chronic stress, and tobacco use [5-8]. Nurses, as the cornerstone of health care systems, play a pivotal role in promoting preventive behaviors to combat NCDs, yet their own lifestyle practices warrant closer examination due to their unique occupational challenges [9,10].

According to the World Health Organization, a healthy lifestyle is defined as a set of everyday behaviors and routines that, by reducing risk factors, promote physical, mental, and social well-being and improve quality of life [11]. In this context, nurses—who constitute the largest caregiving group within Iran's health care system and play a vital role in both care delivery and health education—are simultaneously considered health services providers and role models for the community [12,13]. However, owing to irregular work shifts, persistent occupational stress, and physical and emotional exhaustion, nurses are especially vulnerable to the negative outcomes of unhealthy lifestyles [14,15].

Although nurses play an active role in educating patients about healthy lifestyle practices [13], research indicates that a considerable number of nurses face challenges in sustaining health-promoting behaviors within their personal lives [16,17]. For example, a study by Priano et al [18] reported that fewer than 5% of nurses adhered to a healthy lifestyle, which includes components such as proper diet, regular physical activity, maintaining a healthy weight, and abstaining from smoking. The same study revealed that 72% of nurses did not engage in physical activity, and 61% reported poor dietary patterns. Such deficiencies may adversely affect the quality of care and nurses' professional functioning, as unhealthy lifestyle behaviors have been associated with increased job stress, higher levels of burnout, and reduced quality of working life, which can in turn compromise patient care and caring behaviors [19-21].

While previous research has examined a variety of individual, social, and environmental factors affecting nurses' lifestyles, the emergence of eHealth literacy has recently drawn attention as a potential determinant of health-promoting behaviors [22]. eHealth literacy refers to individuals' ability to search, evaluate, and apply health information obtained from digital environments [23,24], and it plays a vital role in self-management, informed decision-making, and preventive behavior engagement [25,26].

Recent studies have revealed significant associations between eHealth literacy and various dimensions of a healthy lifestyle, including nutrition, physical activity, and stress management [25,27-29]. For example, research conducted among adult internet users in Japan indicated that certain health behaviors, such as physical activity and balanced nutrition, were independently associated with higher levels of eHealth literacy [30]. In contrast, a study among hospital nurses in South Korea revealed weak relationships between eHealth literacy and several lifestyle dimensions, such as exercise and diet, suggesting a gap between health knowledge and actual behavior [27]. These heterogeneous findings highlight the need for further investigation.

Moreover, while studies in Western and East Asian contexts have explored eHealth literacy among nurses [25,27,31], limited research has addressed this topic in the Middle Eastern context, particularly among Iranian nurses, where cultural and professional factors may uniquely influence health behaviors [32]. Given the unique sociocultural and occupational challenges faced by Iranian nurses, such as high workloads [33,34] and limited access to digital health resources [35], investigating eHealth literacy in this population is critical for developing targeted interventions.

Considering the critical importance of healthy lifestyle behaviors for nurses' health and professional functioning [17] and the increasing role of digital health technologies in modern health care delivery [36], it is important to examine the interaction of these factors.

Objectives

This study aimed to investigate the association between eHealth literacy and healthy lifestyle behaviors among Iranian nurses, focusing on specific dimensions such as nutrition, physical activity, stress management, health responsibility, interpersonal relations, and spiritual growth.

Methods

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki [37] and approved by the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences (IR.USWR.REC.1403.174). All participants provided written informed consent after receiving comprehensive information about the study's purpose, confidentiality protocols, and their right to withdraw at any time without consequences. To ensure privacy and confidentiality, the questionnaires were completed anonymously without collecting names or personal identifiers. Each questionnaire was assigned a code number, and the completed forms were stored in a locked cabinet accessible only to the research team. Electronic data were kept on a password-protected computer. No compensation or monetary incentives were provided to participants. The study posed no significant risks and offered potential benefits through insights for improving nursing services and patient satisfaction.

Study Design, Setting, and Participants

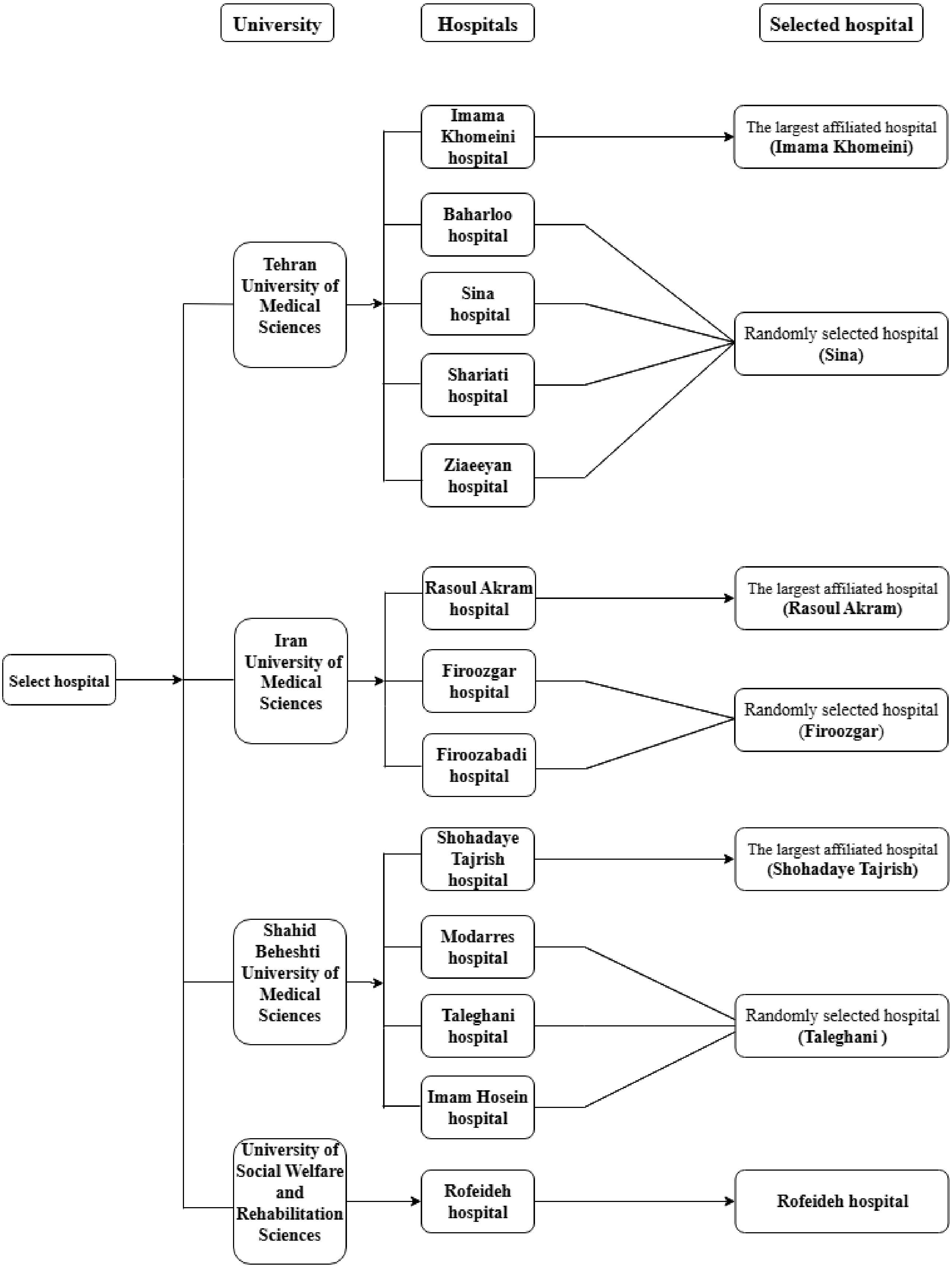
This cross-sectional descriptive-analytical study was in Tehran, Iran, over a 4-month period from November 2024 to February 2025. The target population consisted of all 10,971 registered nurses [38] working in public and teaching hospitals affiliated with the Ministry of Health and Medical Education, including those under the supervision of Tehran University of Medical Sciences, Iran University of Medical Sciences, Shahid Beheshti University of Medical Sciences, and the University of Social Welfare and Rehabilitation Sciences.

The eligibility criteria included holding a bachelor's degree in nursing, having at least 1 year of clinical experience, being employed in any formal capacity (permanent, contractual, agreement-based, or project-based), and not having any physical limitations that would impair job performance. Participants who submitted incomplete responses were excluded from the study.

Sampling

A flowchart illustrating the participant selection process is provided in Multimedia Appendix 1. The sampling strategy followed a multistage approach. Tehran's 4 main universities cover distinct geographic areas of the city: Shahid Beheshti (north, northeast, and east), Tehran (center and south), Iran (west and northwest), and the University of Social Welfare and Rehabilitation Sciences (southeast). On the basis of this regional division, 2 general hospitals from each university were selected. Hospital selection was conducted via cluster random sampling, with one being the largest general teaching hospital and the other chosen randomly from the remaining eligible hospitals through a simple lottery. Single-specialty hospitals were excluded from the sample, and in total, 8 hospitals were included (Figure 1).

Figure 1. Selection of the hospital flowchart.



The sample size was calculated on the basis of parameters derived from the study by Cho et al [27], which investigated associations between eHealth literacy and health-promoting behaviors among hospital nurses in South Korea. A correlation coefficient of 0.2 was used as the estimated effect size, corresponding to a small-to-moderate association based on the Cohen criteria [39]. This value was selected because Cho et al [27] reported a standardized regression coefficient (β approximately 0.20) for the association between eHealth literacy and overall health-promoting behavior, which aligns with our target analysis. Assuming a power of 80%, an α of .05, and a design effect of 1.2 to account for cluster sampling, the minimum required sample size was calculated to be 334 via STATA software (StataCorp LLC).

On the basis of the estimated sample size (N=334), the plan was to recruit at least 100 nurses from each of the 3 main universities—Tehran University of Medical Sciences, Iran University of Medical Sciences, and Shahid Beheshti University of Medical Sciences. The remaining participants were drawn from a single eligible hospital affiliated with the University of Social Welfare and Rehabilitation Sciences. Nurses at each hospital were selected via convenience sampling, considering their work shifts and availability. While the goal was to enroll approximately 50 nurses per selected hospital, the actual number of nurses varied slightly due to sampling constraints.

Data Collection Process

Questionnaires were distributed by the researcher during shift breaks or staff meetings at the selected hospitals. More questionnaires were distributed than the final number of participants to account for potential nonresponses. Nurses were invited to participate voluntarily after providing informed consent. To minimize missing data, the researcher immediately reviewed each completed questionnaire and asked participants to clarify any unanswered or ambiguous items. This procedure yielded 334 fully completed questionnaires for analysis.

Instruments

The instruments used in this study consisted of 3 main sections: (1) demographic Questionnaire, (2) eHealth Literacy Scale (eHEALS), and (3) Health-Promoting Lifestyle Profile II (HPLP-II).

Demographic Questionnaire

This section gathered information on participants' age (categorized as 20 - 29, 30 - 39, 40 - 49, and ≥50 y), gender (man and woman), marital status (married and unmarried), education level (bachelor's, master's, and PhD), work experience (1 - 5, 5 - 10, 10 - 15, and 15 - 20 y), work shift (morning, evening, night, and rotating), and affiliated university (Tehran University of Medical Sciences, Iran University of Medical Sciences, Shahid Beheshti University of Medical Sciences, University of Social Welfare and Rehabilitation Sciences).

eHealth Literacy Scale

eHEALS is a standardized tool that includes 8 items rated on a Likert scale from 1=very low to 5=very high, producing a total score ranging from 8 to 40 [23]. In a cross-sectional study by Bazm et al [40], the Persian version of the eHEALS was validated among 525 young individuals in Yazd, Iran, yielding a Cronbach α of 0.933. Scores are interpreted as follows: low (8-22), moderate (23-32), and high (33-40) [23,33-36,38-42].

Health-Promoting Lifestyle Profile II

HPLP-II scale comprises 49 items across 6 subdomains: nutrition (dietary habits and food choices), physical activity (engagement in regular exercise), health responsibility, stress management (recognizing stressors and applying coping strategies), interpersonal relations (fostering close and supportive relationships), and spiritual growth or self-actualization (developing purpose, self-awareness, and personal growth). Responses are rated on a 4-point Likert scale: 1=never, 2=sometimes, 3=often, and 4=usually. Subscale scores are interrelated and collectively contribute to a total score, which ranges from 49 to 196. Total scores were categorized as low (49-98), moderate (99-147), good (148-171), and excellent (172-196) [43]. The questionnaire's validity and reliability were supported by a study conducted by Mohammadi Zeidi et al [44], reporting a Cronbach α of 0.82.

Data Analysis

The data obtained from the questionnaires were statistically analyzed via SPSS software (version 24; IBM Corp) in 3 sections: descriptive statistics (frequencies, percentages, means, and SDs) were calculated for demographic variables (age, gender, marital status, education, work experience, work shift, and affiliated university), eHealth literacy (eHEALS scores), and healthy lifestyle (HPLP-II scores and subscales). The Kolmogorov-Smirnov test assessed normality for eHealth literacy and healthy lifestyle scores. Due to the nonnormal distribution of eHealth literacy scores ($P<.001$), the Spearman correlation was used to examine associations between eHealth literacy and healthy lifestyle subscales (nutrition, physical activity, health responsibility, stress management, interpersonal relations, and spiritual growth).

To compare demographic characteristics across eHealth literacy and healthy lifestyle scores, Mann-Whitney *U* tests were used for binary variables (eg, gender and marital status), and Kruskal-Wallis tests were applied for categorical variables with more than 2 levels (eg, age groups, education level, work experience, and work shift).

Multivariate linear regression with backward elimination identified confounders (eHealth literacy: age, work experience, and work shift; healthy lifestyle: work experience and work shift). Linear regression was then used to assess the association between eHealth literacy and healthy lifestyle scores, while controlling for these confounders. A *P* value of<.05 was considered to indicate statistical significance.

Results

Demographic Characteristics of the Study

The results indicated that the majority of participants were aged 20 to 29 years. The gender distribution was nearly equal, with most participants being single. In terms of educational attainment, the largest proportion held a bachelor's degree, while the most common work experience ranged from 5 to 10 years. With respect to work shifts, 55.9% (187/334) of the participants worked rotating shifts (Table 1).

Table . Frequency distributions and percentages of demographic variables among nurse participants (N=334).

Demographic variables	Participants, n (%)
Age (y)	
20 - 29	195 (58.4)
30 - 39	100 (29.9)
40 - 49	39 (11.7)
≥50	0 (0)
Gender	
Man	148 (44.3)
Woman	186 (55.7)
Marital status	
Married	114 (34.1)
Unmarried	220 (65.9)
Work shift	
Morning	47 (14.1)
Evening	16 (4.8)
Night	84 (25.1)
Rotating	187 (56)
Education level	
Bachelor’s degree	286 (85.6)
Master’s degree	45 (13.5)
PhD	3 (0.9)
Work experience (y)	
1-5	95 (28.4)
5-10	124 (37.1)
10-15	92 (27.5)
15-20	23 (6.9)
≥20	0 (0)
Affiliated university	
Iranian Medical Sciences	120 (35.9)
Tehran Medical Sciences	91 (27.2)
Shahid Beheshti Medical Sciences	96 (28.7)
Social Welfare and Rehabilitation Sciences	27 (8.1)

eHealth Literacy and Healthy Lifestyle Outcomes

The overall scores for eHealth literacy and healthy lifestyle among nurses were moderate and good, respectively. The eHealth literacy levels were distributed as follows: 19.4% (65/334) nurses had poor levels, 70.1% (234/334) nurses had moderate levels, and 10.5% (35/334) nurses had strong levels. With respect to healthy lifestyle scores, 44.6% (149/334) nurses were at moderate levels, 53.3% (178/334) nurses were at good levels, and 2.1% (7/334) nurses were at excellent levels. No nurses in this study were found to have low healthy lifestyle scores.

The Kolmogorov-Smirnov test was used to check univariate normality, and only healthy lifestyle scores were normally distributed (*P*=.20). In contrast, eHealth literacy scores were nonnormally distributed (*P*<.001).

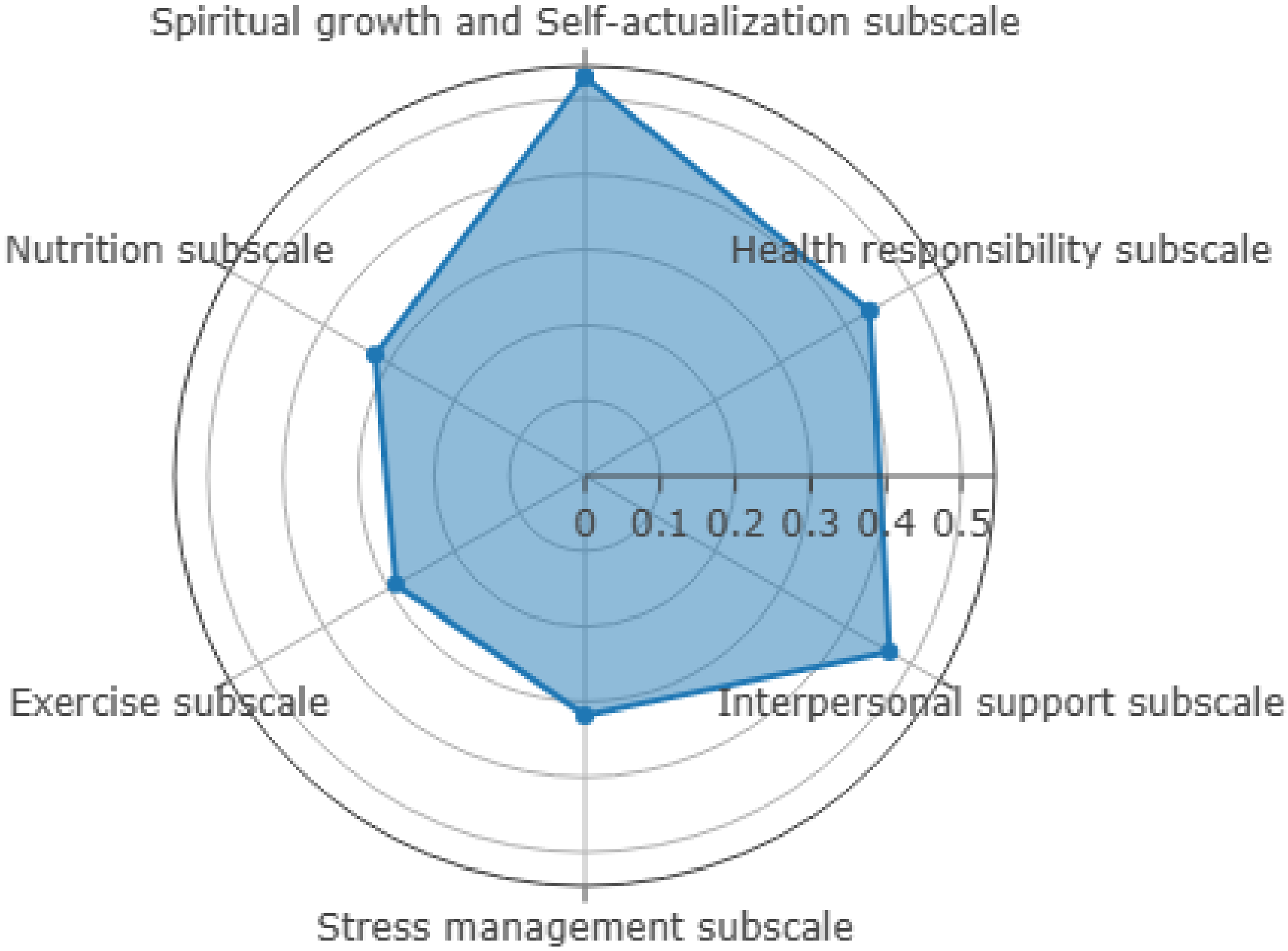
The results revealed a significant positive correlation between eHealth literacy and healthy lifestyles among nurses, as determined by the Spearman correlation coefficient (Table 2 and Figure 2).

Table . Spearman correlation coefficients between eHealth literacy and healthy lifestyle among nurses (N=334)[a].

Variables	eHealth literacy	
	r	*P* value
Healthy lifestyle	0.565	<.001
Spiritual growth and self-actualization subscale	0.529	<.001
Health responsibility subscale	0.437	<.001
Interpersonal support subscale	0.467	<.001
Stress management subscale	0.318	<.001
Exercise subscale	0.289	<.001
Nutrition subscale	0.321	<.001

[a] *P*≤.05 was considered statistically significant.

Figure 2. eHealth literacy and healthy lifestyle dimension.



Multivariate linear regression analysis was used to identify factors influencing nurses' eHealth literacy and healthy lifestyles. The initial model included age, gender, education level, work shift, and work experience. With backward elimination, nonsignificant variables were progressively removed. The final eHealth literacy model identified age group, work experience, and work shift as the most influential factors. For healthy lifestyles, however, only work experience and work shifts were significant predictors (Table 3).

The results of the ANOVA indicated that the overall regression model predicting a healthy lifestyle based on eHealth literacy was statistically significant ($F_{3,3}$=86.030; *P*<.001), suggesting a good model fit. The mean square for the regression source was 1110.673, whereas the mean square for the residual was 12.810. This confirms that the model significantly explains a substantial portion of the variance in healthy lifestyle scores among nurses.

As shown in Table 4, the results of the multiple linear regression analysis indicated that eHealth literacy was a statistically significant predictor of healthy lifestyle scores among nurses, even when controlling for work shift and experience variables.

Table . Multiple linear regressions to determine confounders between the main and dependent variables[a].

Variables	Coefficient (SE)	*P* value
eHealth literacy		
Age (y)		
30-39	−0.41 (0.84)	.63
40-49	−7.55 (1.28)	<.001
Work experience (y)		
5 - 10	−0.34 (0.66)	.61
10-15	2.46 (1.08)	.02
15 - 20	1.66 (1.56)	.29
Work shift		
Evening	−8.19 (1.55)	<.001
Night	−3.39 (0.95)	<.001
Rotating	−3.02 (0.86)	0.001
Healthy lifestyle		
Work experience (y)		
5 - 10	−4.86 (2.04)	.02
10 - 15	1.31 (2.19)	.55
15 - 20	−2.01 (4.18)	.63
Work shift		
Evening	−16.42 (4.37)	<.001
Night	−2.46 (2.98)	.41
Rotating	−3.36 (2.81)	.23

[a] *P*≤.05 was considered statistically significant.

Table . Multiple linear regression coefficients for predicting healthy lifestyles on the basis of eHealth literacy, controlling for work experience and shift type.

Variable	*P* value	*t* test (*df*)	Standardized coefficient β (SE)	Unstandardized coefficient (B)
Constant	<.001	14.208 (333)	—[a] (4.901)	69.635
eHealth literacy	<.001	15.914 (333)	0.663 (0.132)	2.096
Work experience	.04	–1.791 (333)	–0.355 (0.234)	–0.558
Shift type	.05	–1.677 (333)	–0.300 (0.254)	–0.748

[a] The empty cell in "Constant" indicates that β is not calculated for the regression intercept.

Discussion

Principal Findings

This study investigated the association between eHealth literacy and multiple dimensions of a healthy lifestyle among Iranian nurses. The findings revealed a statistically significant and positive correlation between eHealth literacy and overall healthy lifestyle scores. Notably, the strongest associations were observed in the domains of spiritual growth, health responsibility, and interpersonal relationships, whereas weaker correlations were found in physical activity and stress management.

The high prevalence of moderate eHealth literacy (234/334, 70.1%) and healthy lifestyles (178/334, 53.3%) among participants suggests that while Iranian nurses possess a reasonable baseline of eHealth literacy and wellness behaviors, there remains substantial room for improvement. The positive association identified in this study is consistent with prior research, including studies by Cho et al [27], Gartrell et al [25], and Yogurtcu et al [45], which reported that higher eHealth literacy levels were linked to more frequent engagement in health-promoting behaviors such as exercise, healthy eating, and stress reduction.

Among the different lifestyle dimensions, spiritual growth emerged as the dimension most strongly linked to eHealth literacy. This suggests that nurses who are more digitally literate may be more inclined to engage in self-reflection, pursue personal development, and find purpose in life. Such tendencies are often supported by digital access to motivational content, mindfulness resources, and health-oriented communities. In the Iranian sociocultural context, where spirituality plays an important role in both personal and professional life [46,47], this relationship may be especially pronounced. Health responsibility was also notably associated with eHealth literacy. Nurses with stronger digital skills, such as seeking reliable online health information, monitoring personal health indicators, and engaging in preventive actions, are more likely to take an active role in managing their own health. This finding aligns with previous studies by Cho et al [27], Wilandika et al [48], and Yogurtcu et al [45], which emphasized the role of digital health literacy in facilitating self-care and proactive health behavior.

The association between eHealth literacy and interpersonal relationships suggests that digital competencies may enhance nurses' ability to sustain meaningful personal and professional connections. Such skills can support emotional resilience and social cohesion, particularly in high-stress clinical settings such as hospital wards. Maintaining strong social relationships is vital for nurses' psychological well-being and overall quality of life. These findings are in line with the studies conducted by Cho et al [27] and Gartrell et al [25], which indicated that higher levels of eHealth literacy among nurses are significantly linked to better interpersonal relationships and improved nursing performance.

In contrast, the association between eHealth literacy and the dimensions of stress management, physical activity, and nutrition was less prominent. These results indicate that possessing the knowledge and skills to access digital health information does not automatically translate into effective behavioral change in all areas. For stress management, even well-informed nurses may struggle to implement coping strategies due to demanding workloads, emotional fatigue, and limited institutional support. Likewise, physical activity and healthy eating habits may be hindered by long shifts, time constraints, or a lack of access to nutritious food and exercise facilities within the workplace. These observations are consistent with the findings of Cho et al [27] and Yogurtcu et al [45], who reported similar patterns in their studies.

These findings underscore the need for multidimensional interventions that enhance eHealth literacy while addressing workplace barriers. For instance, tailored eHealth training programs can improve nurses' ability to access reliable digital health resources [25,31,49]. In addition, flexible scheduling and on-site wellness facilities (eg, exercise spaces or nutrition counseling) can mitigate barriers such as rotating shifts, enabling nurses to adopt healthier behaviors [17,50,51].

Strengths and Limitations

This study used self-administered questionnaires to collect data, with participants encouraged to provide responses as accurately and honestly as possible. Nonetheless, this approach is subject to potential biases stemming from factors such as participants' emotional states or inherent cognitive distortions. However, immediate review of responses by research assistants minimized missing data. The convenience sampling approach limits generalizability to broader nursing populations, but the inclusion of nurses from multiple hospitals in Tehran enhances representativeness within this context. Furthermore, the cross-sectional nature of the study design limits the ability to infer causal associations among the examined variables; future longitudinal studies could address this.

Despite these limitations, the study's strengths include a robust sample size (N=334), the use of validated instruments (eHEALS and HPLP-II), and a comprehensive analysis of multiple lifestyle dimensions, providing valuable insights into eHealth literacy among Iranian nurses.

Conclusions

This study highlights the important role of eHealth literacy in promoting healthy lifestyle behaviors among nurses. While certain dimensions, such as spiritual growth and health responsibility, appear to be more strongly influenced by digital competence, others require additional institutional and environmental support to translate awareness into sustained action. Strengthening eHealth literacy should therefore be viewed not as a stand-alone solution but as one element within a comprehensive strategy to enhance the health and well-being of the nursing workforce.

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Data Availability

The datasets generated or analyzed during this study are not publicly available to protect participants' privacy but are available from the corresponding author on reasonable request.

Authors' Contributions

All authors contributed to the study’s conception and design. BM handled conceptualization, data management, formal analysis, investigation, methodology, drafting the original manuscript, and coordinating participant recruitment and data collection. MJH-F, as the corresponding author, oversaw supervision, validation, project administration, resource management, and manuscript review and editing. MD contributed to methodology support, visualization, and manuscript revision. MS was responsible for statistical analysis, data validation, and formal analysis. All authors reviewed and approved the final manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1

This flowchart illustrates the study process, starting with a statistical population of 109,711 nurses. It outlines the population assessment, inclusion/exclusion criteria (eg, at least 1 year of nursing degree, no work-limiting illness), and sample size determination (n=334) based on Cho et al [27] and STATA software. The sampling method, involving 8 hospitals and 4 medical universities, and the analysis using SPSS v24 for descriptive, Spearman correlation, and linear regression tests are also depicted. [PNG File, 172 KB - apinj_v9i1e80792_app1.png]

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Abbreviations

eHEALS: eHealth Literacy Scale
HPLP-II: Health-Promoting Lifestyle Profile II
NCD: noncommunicable disease

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Exploring a Shared History of Colonization, Historical Trauma, and Links to Alcohol Use With Native Hawaiians: Qualitative Study

Cynthia Taylor Greywolf[1*], PhD, DNP; Donna Marie Palakiko[1*], PhD; Pallav Pokhrel[2*], PhD; Elizabeth A Vandewater[3*], PhD; Merle Kataoka-Yahiro[1*], PhD; John Casken[1†], PhD

[1]School of Nursing and Dental Hygiene, University of Hawai'i at Mānoa, 2528 McCarthy Mall, Room 439, Honolulu, HI, United States
[2]University of Hawai'i at Mānoa Cancer Center, Honolulu, HI, United States
[3]Cain Center for Nursing Research, School of Nursing, University of Texas at Austin, Austin, TX, United States
[†]deceased
[*]these authors contributed equally

Corresponding Author:
Cynthia Taylor Greywolf, PhD, DNP
School of Nursing and Dental Hygiene, University of Hawai'i at Mānoa, 2528 McCarthy Mall, Room 439, Honolulu, HI, United States

Abstract

Background: Most studies using historical trauma theory have focused on American Indian tribes. There remains a dearth of research exploring historical trauma and substance use among Native Hawaiians. Native Hawaiians and American Indians experience a startlingly high degree of physical and mental health disparities and alcohol and other substance misuse. Indigenous scholars posit that historical trauma is intergenerationally transmitted to subsequent generations and is the primary cause of today’s health and substance use disparities among these Indigenous populations.

Objective: This study aimed to explore the lived experiences of colonization, historical trauma, and alcohol use among Native Hawaiians living in rural Hawaii.

Methods: This qualitative study was guided by Husserl’s transcendental phenomenological design. The historical trauma conceptual framework and story theory guided the study. The Native Hawaiian Talk-Story method was used to collect data from 10 Native Hawaiian adult participants in one-to-one interviews. The modified Stevick-Keen-Colaizzi method was used for data analysis.

Results: In total, four themes emerged: (1) alcohol did not exist in Hawaii before European explorers arrived; (2) alcohol helped expand colonialism in Hawaii; (3) alcohol is used today as a coping strategy for feelings of grief and anger over losses (land, people, cultural traditions, and language); and (4) the kupuna (elders) teach the younger generations to drink alcohol.

Conclusions: Native Hawaiians, like American Indians, experienced historical trauma, which is transmitted intergenerationally, resulting in mental and physical health disparities, substance misuse, and feelings of discrimination. The introduction of alcohol by European explorers provides the foundation for problematic alcohol use among Native Hawaiians today.

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KEYWORDS

historical trauma; intergenerational trauma; Indigenous health; alcohol use; substance misuse; health disparity

Introduction

Background

Alcohol was the first psychoactive drug introduced to Native Hawaiians in 1778 by European explorers. The introduction of other varieties of alcohol quickly followed as the foreigners arrived and settled in Hawaii [1]. Historical accounts reveal that alcohol was weaponized and used as a tool against Indigenous populations during the colonization of Indigenous lands. The introduction of alcohol resulted in cultural shifts to alcohol use where it once did not exist and where it has now become normalized [2]. Due to its addictive and intoxicating properties, alcohol had devastating consequences among Indigenous peoples [1,3-6]. Historically traumatic events leading to the loss of people, land, traditions, and language that occurred during the colonization of Indigenous lands left in its wake mass group trauma experiences and psychological wounds among Indigenous people, the consequences of which continue today. The introduction of alcohol to Indigenous people by early European explorers and colonizing settlers provided the foundation for problematic alcohol use among them today [1,3,5].

Today’s Native Hawaiians, American Indians, and Alaska Natives are the contemporary descendants of the original Indigenous peoples who occupied lands before the arrival of European explorers and settlers and the establishment of the United States. American Indians and Alaska Natives are defined explicitly as citizens of sovereign federally recognized tribes and groups with nation-to-nation relationships with the US government. Notably, Indigenous peoples, before colonization, were healthy [7,8]. However, Native Hawaiians, American Indians, and Alaska Natives in the United States today experience disproportionately higher rates of physical and mental health disparities and significantly higher rates of cigarette smoking, alcohol, and other substance use, suicide rates, and traumatic exposure than other ethnic groups in the state [2,3,6,9-15].

In Hawaii, Native Hawaiians are at significantly greater risk for adverse health outcomes and high-risk health behaviors as compared with other ethnic groups [6,9]. Recent reports highlight high rates of substance use; 47% of Native Hawaiian adults report current alcohol and tobacco use, and 35% report lifetime substance use, including cannabis and opioids. Rates of alcohol use disorder, depression, and generalized anxiety disorder prevalence have been reported as 27%, 27%, and 19%, respectively. Finally, approximately 30% of Native Hawaiian adults report past-year treatment needs for lifetime illicit substance abuse [14]. Despite the high risk for alcohol and substance use, little is known about the risk factors leading to alcohol use and misuse that are unique to Native Hawaiians today [1,3].

Indigenous scholars have hypothesized that historical trauma is a primary cause of social stress, mental health disparities, and problems with alcohol and substance use among Indigenous peoples today [3,6,9,11,16-23]. Much research has focused on the links between historical trauma and its impacts. However, these studies have focused mainly on American Indians. There is a need to fill the gap in research by exploring whether these links are present in the Native Hawaiian populations. There is scant research specifically on Native Hawaiians’ experiences related to historical trauma [3,6]. Although there is cultural diversity among Indigenous tribes and groups, significant similarities exist in the events that led to historical trauma and the ways that the historical trauma response manifests [2,3,6,24]. Problematic alcohol use among American Indians has been defined as a historical trauma response to the emotional and psychological stressors resulting from colonization [2]. To address this gap in the literature, historical trauma theory was used as a conceptual model for this study [17,24].

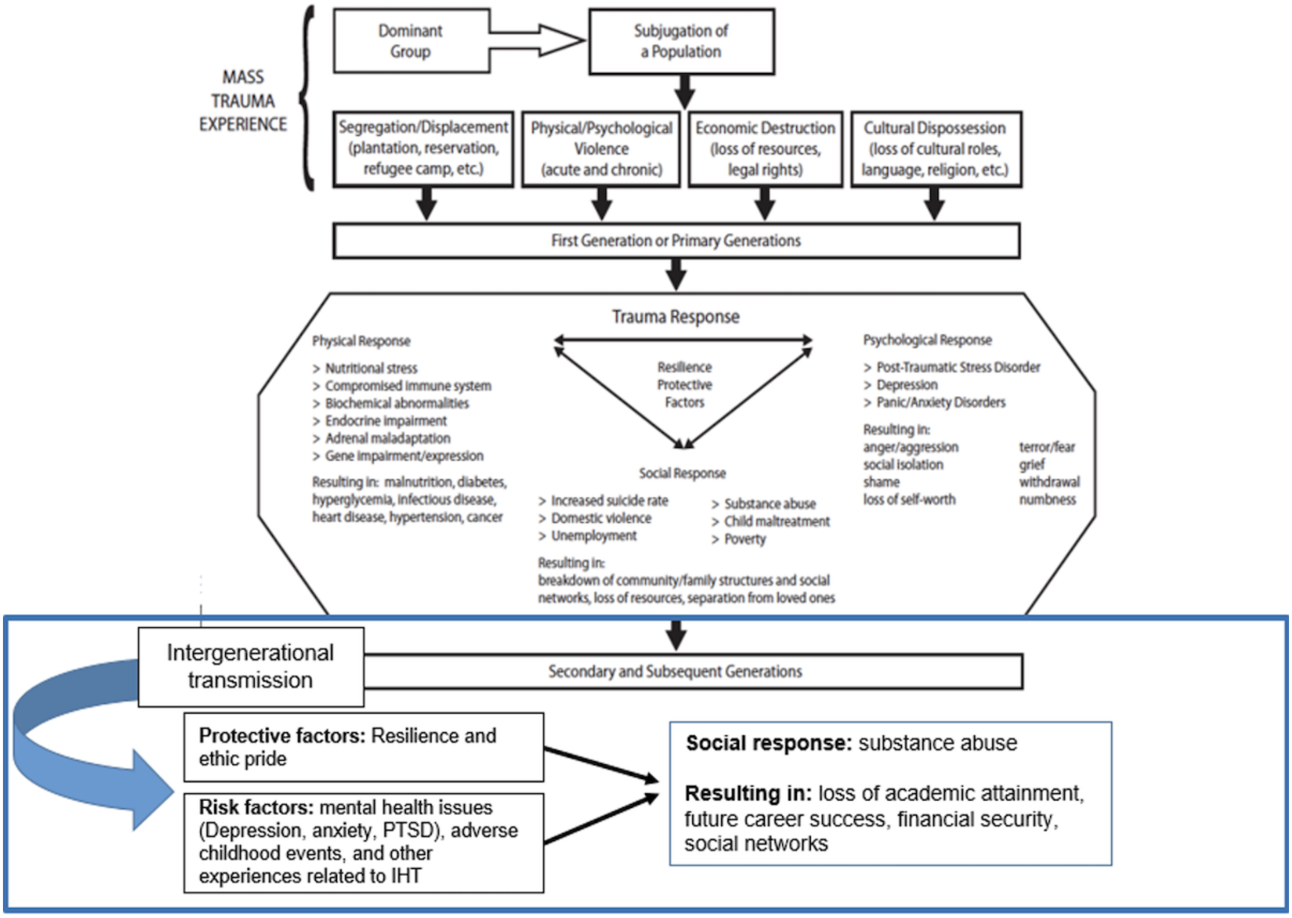
Historical Trauma

Historical trauma is defined as the emotional and psychological wounding over the lifespan and across generations from mass group trauma experiences that are associated with the historical losses of land, people, language, and culture of colonization by an outside group. What is unique about historical trauma is its widespread impact on Indigenous populations, which was done with a purposeful and destructive intent that resulted in the collective suffering of the primary generation and then transmitted to present-day descendants, making this a form of trauma exceptionally devastating for individuals, families, and communities [2,16,23,24]. The historical trauma response is a constellation of physical, psychological, and sociological symptoms experienced by the descendants [16,17]. At the individual level, it includes adverse childhood events, mental health disparities, and problematic alcohol use; at the familial level, parental stress and problematic alcohol use; and at the community level, the breakdown of cultural customs and traditions and problematic alcohol use in the community [2,16,17]. The consequences of the historical trauma response can be transmitted intergenerationally as descendants continue to identify with ancestral pain [16,17]. Historically unresolved grief is an element of this response. It is the profound, unsettling grief resulting from cumulative losses that are compounded by the prohibition of Indigenous cultural traditions and practices [23]. The aim of this qualitative study was to explore the impact of historical trauma on the lived experiences of Native Hawaiians and the use of alcohol in a rural setting.

Historical Trauma Conceptual Model

The historical trauma conceptual framework provides an explanatory model of how historical trauma originated and was transmitted through intergenerational transmission to succeeding generations and links to mental health disparities (risks and protective factors) and problematic alcohol use, which is the focus of this study (Figure 1) [17].

Figure 1. Conceptual model adapted from Sotero’s historical trauma conceptual model [17]. PTSD: post-traumatic stress disorder.



Methods

Study Design

Considering Indigenous ontology and epistemology, a qualitative transcendental phenomenological approach was identified as the best for this study as it empowered the Native Hawaiian participants to share their day-to-day experiences of historical trauma’s impact on their daily lives [25]. This approach is grounded in Edmund Husserl’s philosophy and was founded on comprehensive descriptions of meanings, perceptions, and experiences of the phenomena under study and was selected by the principal investigator (CTG) who was able to describe her own experiences with the phenomenon under study through the same process as all of the participants. This process revealed any underlying biases and established the ability to look at the data with a fresh, unbiased eye.

Sample and Procedure

A local Native Hawaiian community member assisted with the recruitment of the 10 Native Hawaiian adult participants, which involved purposive nonprobability sampling in a single rural community. The study was not advertised but was disseminated by word of mouth. The participants did not want to publicly disclose their location in Hawaii for fear of identification and stigmatization. The inclusion criteria were (1) Native Hawaiians living in Hawaii who self-identify as full or part Native Hawaiian, (2) aged 30 to 60 years, (3) able to speak fluent English, (4) willing to have a face-to-face interview that was audio-recorded and, (5) willing to provide perspectives related to the topics under study. The generations between 30 and 60 years of age were selected as they could reflect on both the children and grandparent generations’ perceptions of colonization, historical trauma, and problematic alcohol use. Individuals younger than 30 years and older than 60 years were excluded. Data saturation was reached with 10 participants, which was determined to be an adequate sample size for the following reasons: (1) the analysis was able to reveal clear interpretations of the data, (2) there were no new findings with further interviews, and (3) the narratives became redundant [26,27]. The sample size for this study was large enough to acquire enough data to describe the phenomenon of interest sufficiently and to address the research questions. This was in keeping with the suggestion by Glaser and Strauss [27] that saturation is a criterion for determining the appropriate sample size in a qualitative study.

The study’s trustworthiness was established using credibility, transferability, dependability, and confirmability [28]. The principal investigator (CTG), a Cherokee Nation citizen who lived in the community, was invited to meet with the kupuna (elders) weekly at a local community health center to talk about the cultural and health-related similarities and differences between the Cherokee and Native Hawaiians. These meetings continued for 2 years before the study was conducted and helped to establish a relationship with the Native Hawaiian community. These relationships ensured the cultural validity of the research findings and prevented any further harm that previous researchers within this community may have caused in the past.

A semistructured script of open-ended questions was used to conduct the interviews (Multimedia Appendix 1). Interviews were conducted using the Talk Story methodology—a culturally specific storytelling method used by Native Hawaiians [22,29]. Individual face-to-face interviews were chosen because it is more likely that the participants would be forthcoming in face-to-face interviews. The interviews took place in August 2019 at mutually agreed-upon private, comfortable, and quiet locations. As the interviews were conducted, no time restraints allowed the participants to tell their stories. The interviews lasted from 60 minutes to 80 minutes. At the beginning of each interview, information was given about why the research was being conducted, along with biases and assumptions. The participants were compensated with a US $25 gift card. The interviews were recorded and transcribed verbatim using NVivo version 10 (Lumivero). The guiding interview questions included, (1) can you share any stories about alcohol use in Hawaii before Captain Cook arrived in Hawaii, (2) can you share any stories about the kupuna (elders) and alcohol use when they were growing up and you were growing up, and (3) can you share any stories of how alcohol is used by Native Hawaiians in your area currently?

Data Analysis

The first and sixth authors (CTG and JC) analyzed the transcripts independently and agreed greater than 80% of the time. Thematic analysis was used to interpret the transcripts using the Modified Stevick, Colaizzi, Keen method, which dictates that the researcher collecting the data should be one of the participants of the study [25]. The principal investigator (CTG) described her own experiences with the phenomenon under study through the same process as all of the participants described below. This process revealed any underlying biases and established the ability to look at the data with a fresh, unbiased eye. This method followed an inductive approach, forming theoretically driven interpretations of the meanings identified in each transcript. This method allowed for the in-depth exploration of all participants' subjective experiences of the phenomenon of interest of the study. Each transcript was reviewed many times to determine the unchanging horizons, the invariant constituents, and the meaning units to identify the initial codes and, finally, the significant core themes. Triangulation was achieved by comparing the participants' transcripts to one another and the literature review. The rigor of the study was enhanced by triangulation and member checking. Then, the analyses established associations and patterns of meaning across the initial notes within each transcript, contributing to the initial codes and themes.

The initial steps of the analysis included epoche or bracketing, which is temporarily suspending assumptions and biases in order to focus on the phenomenon of interest, and reduction of the data including (1) horizonalization or the determination of the unchanging horizons, the invariant constituents, or the meaning units, (2) identification and clustering of core themes, and (3) the construction of core themes using verbatim dialogue from the participants' stories. The final steps of the analysis included, first, the construction of individual textual descriptions (what occurred) from the stories of the participants. Second, the construction of an individual composite textural description from the stories of all of the participants. Third, the construction of individual and composite structural descriptions (how it occurred) underlying the participants' experiences, including the following structures: (1) universal structure of time, (2) universal structure of space, (3) universal structure of bodily concerns, (4) universal structure of materiality, (5) universal structure of causality, (6) universal structure of self-in-relation, and (7) universal structure of relation-to-others. Finally, it included the synthesis of meanings and the construction of a universal or a composite textural and structural description of the participants' experiences. In conclusion, a universal or composite textural-structural description from all of the participants' stories was completed through imaginative variation by synthesizing and integrating the individual textual-structural descriptions into a universal or composite description of the participants' experiences represented as a whole [25].

Ethical Considerations

The University of Hawai i at Mānoa Institutional Review Board approved the protocol for this study (protocol 2019 ‐ 00414). Each participant was informed of the purpose of the study before any interviews were conducted. All of the participants provided written informed consent to participate. Efforts were undertaken to maintain the participants' privacy and confidentiality. The consent was explained in detail, outlining the risks and benefits of the study and that they were participating in the study voluntarily and could withdraw their consent at any time.

Results

Overview

The participants primarily identified as female, aged 50-59 years, were married or partnered, and were employed (Table 1).

Table . Demographic information of participants (N=10).

Characteristic	Value
Race or ethnicity, n (%)	
Native Hawaiian	10 (100)
Age (years), mean (range)	38 (30-59)
Age (years), n (%)	
30-39	3 (30)
40-49	2 (20)
50-59	5 (50)
Identified gender, n (%)	
Male	2 (20)
Female	8 (80)
Marital status, n (%)	
Divorced	2 (20)
Married or partnered	8 (80)
Employment status, n (%)	
Employed for wages	7 (70)
Self-employed	3 (30)

The final qualitative themes that emerged from the analysis included: (1) alcohol did not exist in Hawaii before European explorers arrived, (2) alcohol helped expand colonialism in Hawaii, (3) alcohol is used today as a coping strategy for feelings of grief and anger over losses (land, people, cultural traditions, and language), and (4) the kupuna teach the younger generations to drink alcohol. Rich descriptions and illustrative quotes are provided further in this study and in Multimedia Appendix 2.

Theme 1: Alcohol Did Not Exist in Hawaii Before Explorers Arrived

The participants described their perceptions related to when Native Hawaiians were first exposed to alcohol. One participant reported:

> *The thing I know is, I don’t think we had alcohol before Captain Cook.*

Other participants noted:

> *Alcohol was introduced by Europeans. The historical accounts are that it was deliberately introduced once its impact on Indians was understood.*

Several other participants described how okolehao (a mildly alcoholic brew made from the ti plant native to Hawaii) was introduced to Native Hawaiians by European explorers:

> *I don’t think we had alcohol...but the introduction of okolehao started Native Hawaiians’ problems with alcohol. Before, you know, we had okolehao, which was alcohol. I know we didn’t have it before Captain Cook, though...*

Others described that before European explorers arrived, “awa” was used (“awa” is a nonalcoholic, nonnarcotic, and mildly psychoactive substance):

> *What I know is that we had awa, but I don’t think we had alcohol…*

Many of the participants described that alcohol was deliberately introduced to Native Hawaiians.

> *Alcohol is a legacy that continues to affect the quality of life for us.*

Another participant expressed:

> *If he [Captain Cook] didn’t come, we wouldn’t have the issues we have today...there would be no alcohol.*

Theme 2: Alcohol Helped Expand Colonialism in Hawaii

Most of the participants described their beliefs that alcohol expanded colonialism in Hawaii. This caused frustration among the participants, and many noted the sadness related to the introduction of alcohol, how it was used to expand colonialism in Hawaii, which has contributed to the ongoing alcohol use problems they have today. One participant noted that they were:

> *...feeling frustrated that the US does not care about managing alcohol use in Native Hawaiians because they have gained control of the land.*

Another noted:

> *...the kupunas [elders] say that when our queen was overthrown, and the lands were taken away, it was taken away with the use and trade of rum and alcohol.*

Another noted:

> *The kupunas drink because of this [the loss of land], and now a lot of people drink because of what we lost and that we drink the most beer in the state of Hawai i because it is cheaper than anywhere else in Hawai i here.*

Multiple participants recognized that alcohol and the regulation of alcohol by settlers were used to help overthrow the Native Hawaiian monarchy. For example, one described that,

> *...alcohol and the regulation of alcohol by the colonizers before Hawai i became a state was used as a means to help overthrow our monarchy.*

Another stated:

> *The regulation of alcohol by them [colonizers] before Hawai i became a state was used to help overthrow the monarchy.*

Finally, one participant stated that,

> *After 1893, look at what happened….you could see there's a history…with alcohol at that point with the laws. Right? But what happened after that it was like they didn't care anymore because they already got the land. Right?*

Theme 3: Alcohol is Used Today as a Coping Strategy for Feelings of Grief and Anger Over Losses (Land, People, Cultural Traditions, and Language)

Participants shared their experiences about the use of alcohol in their community. They reported that many Native Hawaiian people in their community "are alcoholics." Several expressed that

> *Native Hawaiians drink alcohol to numb feelings of low self-esteem and being pushed down.*

Others shared that diminished self-esteem and grief related to the loss of land, people, cultural traditions, and language. Participants clearly articulated how alcohol was used as a coping mechanism and as self-medication. For example, one participant shared:

> *yeah, I think many Hawaiians drink….because of emotional pain because we Hawaiians lost so much, and I think that some just party with it. I really believe so a lot.*

Another participant said:

> *I believe that especially with the men too. Right? Hawaiians, they're pushed down, so they use alcohol. I just recently lost my fiancée, and he had a bad upbringing, and he dealt with a lot of demons. So, he did drugs… you do all of that because once somebody strips your identity, who you are, then it's hard because it brings down the self-esteem.*

Later, this participant went on to say:

> *When you get people always knocking you down, it's hard, and I see that a lot in our community… and that's what they [men especially] do to cope is use alcohol or drugs.*

Several also noted that this lingering pain and the use of substances then leads to anger, which can also be expressed as violence. For example, one stated:

> *I think some of them [Native Hawaiians] drink because they are angry about what's happened to us Hawaiians.*

Another stated:

> *Alcohol is a really big problem here, which causes a lot of violence because people bottle things up…and so, when people are in pain, they drink more.*

Theme 4: The Kupuna (Elders) Teach the Younger Generations to Drink Alcohol

When asked to share how Native Hawaiians currently use alcohol in their community and if the kupuna ever talked about how alcohol was used when they were growing up, several of the participants reported that it is the kupuna who are teaching the younger generations how to drink alcohol. One participant stated that

> *...the younger generation is like, the older generation in how they drink.*

Another participant reported:

> *...the kupunas have taught the younger generations to drink alcohol.*

She expressed concerns "...because…she continues to see them drinking."

Another participant reported that:

> *Alcohol is sold at the cheapest in all islands in this area…Native Hawaiians love alcohol.*

Several participants noted concerns about seeing many of the school-age kids drinking and using methamphetamine, and about the impact of these substances on them, and feel that the kids learn to drink when they see the kupuna drinking. One of the participants expressed feeling that,

> *Some of the kupunas do not think that drinking is a problem… but feels that methamphetamine is becoming a bigger problem among Native Hawaiians than alcohol.*

One expressed that,

> *Our kupunas teach us how to drink. It's what our kupunas are doing—teaching the younger generation how to drink alcohol and be like that. Yeah, look when I say habit my mom and dad drank. Drinking was considered no problem whatsoever. However, there was a problem because as we fast forward with what some those kupuna were doing destroyed our family.*

Another participant stated:

> *There are a lot of alcoholics, especially in my family. We grew up around it.*

Another participant stated:

> *I have to put that on my family, and I would say it's just a cycle like you know with my grandfather, and my uncle, who I would say is seventy. It's just normal to just drink, drink, drink.*

Later, she commented that,

> *...they [her grandfather and uncle] wake up wasted and drink again the next day. So, I think it's something when I look at that; it has been passed down.*

Discussion

Principal Findings

Participants in this study shared stories which supported the following four themes: (1) alcohol did not exist in Hawaii before European explorers arrived, (2) alcohol helped expand colonialism in Hawaii, (3) alcohol is used today as a coping strategy for feelings of grief and anger over losses (land, people, cultural traditions, and language), and (4) the kupuna (elders) teach the younger generations to drink alcohol. These themes were supported in the literature describing experiences both in Hawaii as well as among American Indian communities.

Alcohol, the Earliest Psychoactive Drug Introduced in Hawaii

Participant recollections of the history of the introduction of alcohol were in line with the literature. A review of the historical records revealed that the first documented accounts of alcohol (grog, ie, rum and water) appeared in Hawaii in 1778. By 1790, European explorers had introduced okolehao (iron bottom), a mild fermented brew made from the ti plant, native to Hawaii, and distilled in crude cast iron pots. The first Native Hawaiian chief to buy rum was in 1791. By the early 1800s, Native Hawaiian chiefs regularly drank gin, brandy, vodka, rum, and okolehao, and by 1810, excessive alcohol consumption had become a habit of many of the Native Hawaiian chiefs [1,5]. Alcohol was the earliest modern psychoactive drug to be introduced to Native Hawaiians and was imported in large quantities during the 19th century. Native Hawaiians quickly became addicted to alcohol, which had rapidly taken over from the traditional use of awa. The use of awa was prevalent in Hawaii long before European contact; awa was the only substance known in Hawaii. It was considered sacred, and its use was highly regulated by strict ceremonial rules, making abuse difficult [1,3,5]. Traditional Native Hawaiian culture had no perception of psychoactive addiction because awa lacked the neurobiological chemistry to create that effect. Awa is "non-narcotic, non-opiate, non-alcoholic, non-fermented, non-hallucinogenic, and is not physiologically addictive" [1]. Native Hawaiians quickly became addicted to alcohol, which had rapidly taken over from awa as the drug of choice [1].

A Shared History With American Indians

The history is the same with American Indian tribes, where distilled alcohol did not exist before colonization. Some tribes produced weak fermented beverages that were used mostly for ceremonial practices [3]. Today, contemporary stereotypes, such as the drunken Indian, continue to impact the mental health of Indigenous peoples. All too often, quick assumptions are made associating Indigenous people with alcoholism and poverty. Indigenous peoples continue to struggle to make meaning of their identity and place in the world. Issues, such as racism, discrimination, and marginalization, have worsened mental health, and adverse historical events are associated with substance use and mental health issues and unresolved grief [4,16].

The Impact of Colonization on Identity and the Regulation of Alcohol Among Native Hawaiians and American Indians

The introduction and regulation of alcohol played a considerable role in the colonization of Hawaii, as it had with American Indian tribes, by destabilizing sovereignty and facilitating the expansion and advancement of the colonial mission. European settlers intentionally disrupted Native Hawaiian ontology and epistemology. Native Hawaiians understood identity through genealogical, kinship ties, and place of birth. As with American Indians, the missionaries introduced Christianity, which taught new ways of thinking, including new patriarchal norms and the concepts of race and class [30-32]. These new concepts replaced traditional Native Hawaiian concepts. European settlers managed to influence Native Hawaiians to advance their own interests [23,32-35]. Liu and Alameda [8] stated, "the violence permeated every level, from disruption of traditional ontology and epistemology and violent displacement with Christianity and other Western systems to the appropriation of lands, loss of traditional economy and ultimately the loss of self-government." The factors giving rise to this include health impacts on the Native Hawaiians after contact with European settlers and their deliberate attempts to shape Native Hawaiian society to their own interests.

During the late 18th and early 19th centuries, infectious diseases were introduced to Native Hawaiians, and the population was reduced by 84% in 60 years. This allowed Native Hawaiians to be displaced from large tracts of land they had farmed and lived on for generations, converting them from self-sufficiency to dependence on outsiders [1]. Some Native Hawaiians tried maintaining cultural and religious traditions, while others adopted Christianity. The contradictions between the Native Hawaiian disrupted traditional spiritual practices and Christianity connect with how they conceptualized illness and the enticement to use alcohol because of its intoxicating effects as a more effective means of self-medicating in times of enormous losses. For example, when the missionaries arrived in 1820, they raised concerns over whether the Native Hawaiian monarchy could manage alcohol use and public disorder, which interfered with commerce and trade. These concerns influenced the Native Hawaiian monarch to transition to Christian laws, first, as oral declarations concerning everyone to regulate alcohol use [5]. The critique of Native Hawaiians' use of alcohol was part of the larger colonial discussion, suggesting that they were not capable of political self-governance. Drinking by Native Hawaiians was considered a problem, but not in the same way that drinking was a problem for Whites. The Native Hawaiians' use of alcohol was increasingly considered a threat to social order, although White foreign sailors and merchants' use of alcohol demonstrated unwanted behaviors as well. Because of these views, a unitary system of laws with dual legal codes for alcohol use was established, criminalizing alcohol use in Native Hawaiians but not in Whites. The regulation of alcohol with Native Hawaiians contrasted with the circumstances of alcohol regulation with American Indians only in that the Native

Hawaiian monarchy was influenced by the American missionaries to adopt the same prohibition policies that the US government established to control drinking among American Indians. The salient point from this is that the regulation of alcohol among both American Indians and Native Hawaiians was a means of acquiring and maintaining political autonomy over them, which further eroded cultural traditions and power, resulting in cultural shifts using alcohol [5,35-37].

Alcohol as a Way of Coping

In addition to participants acknowledging cultural loss and historical trauma, they shared with American Indians and the use of alcohol as a way to cope. Native Hawaiian mental health was traditionally related to pono, a state of balance attained through proper behaviors with the environment, the people, and the spiritual realm. The cause of illness was believed to be rooted in the spirit instead of the physical body. Alcohol's intoxicating effects were found to be better at self-medicating than awa, when so many losses were occurring. Alcohol had become widely used to self-medicate and quickly displaced awa. These observations are consistent with research findings from a scoping review on American Indian research, which found that 86% of studies (out of 63) found evidence of a positive link between alcohol and other drug use and historical trauma [36].

A pattern of consistent findings has been identified in qualitative studies with American Indians, identifying that historical trauma contributes to the use of alcohol in their communities [2,3,5,37-40]. Studies conducted by Whitbeck et al [38-40] established that historical loss thinking is prevalent among American Indians and also associated with the use of alcohol. A study by Weichelt et al [41] established that American Indian participants with higher historical loss thinking had a higher likelihood of using alcohol within the past 30 days. Walls and Whitbeck's [42] study of the multigenerational effects of relocation experiences on Indigenous family groups focused on historical trauma as a contributor to American Indian health disparities, including alcohol use, and to the advantages of treating cultural loss as a source of stress. They examined the multigenerational effects of relocation experiences on American Indian family groups. American Indians living on Indian reservations reported higher levels of drinking problems. The grandparent generations' relocation experiences were significantly associated with drinking, and the drinking problems were significantly associated with depressive symptoms and other substance use problems. Discrimination was found to be a trigger for historical loss thinking, and perceived discrimination was found to be positively associated with historical losses, which were positively associated with problematic alcohol use in women. Also, many of the traumatic events described by the participants involved both parents and children and were associated with the onset of alcohol misuse [43,44].

Intergenerational Transmission of Alcohol

The theme of intergenerational influences on alcohol use is consistent with the literature on American Indians. The participants described how historical trauma and problematic alcohol use disrupted their families and their communities and how maladaptive behaviors were maintained and spread through intergenerational historical trauma from the kupuna to the younger generations, undermining healthy family functioning and child development. This is consistent with the literature, which indicates that childhood trauma experiences may impede adults' abilities to provide responsive caregiving as they lack models of parenting in their own lives [2,45]. Indigenous cultures are interconnected, and generational connections are valued because elders are considered the sources of cultural knowledge. When these connections are broken, the consequences move through subsequent generations [42-44]. The literature shows how the intergenerational cycles of trauma manifest within families, which extends to communities impacted by historical trauma. Walls and Whitbeck's [42] study on American Indians discussed how the impact of government relocation policies on the grandparent generations' substance abuse was linked to the subsequent generation female adult caregivers' depressive symptoms and substance use. As a consequence, the female caregivers were less effective at parenting the next generation, the adolescent children. The substance use problems were negatively associated with supportiveness and warmth. In these circumstances, the grandparent generation functions as a possible risk factor for substance use across generations, and relocation may be a distal source of these problems when framed within the intergenerational model of risk [42]. They demonstrated that the grandparent generation's participation in government relocation programs negatively impacted not only the grandparent generation's well-being, leading to depression, alcohol, and other substance use problems, but also subsequent generations' well-being. Indigenous peoples began using alcohol as a way to self-medicate to cope with emotional pain.

Limitations

The results of the study should be viewed in light of its limitations. First, the study was conducted in a single rural Hawaii community, with participants being predominantly female, which limits generalizability. Second, while the results reveal similarities in the historical trauma responses to American Indian literature, the findings reflect the perspectives of 10 rural Native Hawaiian participants. While the sample size was adequate to achieve saturation, the findings may not represent the experiences of Native Hawaiians on other Hawaiian Islands or communities in Hawaii. Third, despite data saturation, the number of participants was small. It is uncertain if a larger sample size could have affected the resulting themes. Finally, bias may occur as the study only included those willing to be interviewed. Despite these limitations, findings provided robust insights into a shared history of colonization with American Indians and Native Hawaiians' perceptions related to historical trauma and alcohol use.

Implications and Recommendations for Future Research

This study is significant for several reasons and has implications for future research. When it was conducted in 2019, it was the only study that used the historical trauma conceptual model and Native Hawaiian storytelling methodology to explore the impact of colonization and historical trauma among Native Hawaiians.

Historical trauma can be transmitted intergenerationally through different mechanisms, such as oral or storytelling transmission, which were explored here.

In addition, it is essential to take into consideration Indigenous groups' geographical and regional differences in how trauma is experienced and also how individuals within groups experience trauma [23]. For example, the cumulative effects of historical trauma in Native Hawaiians are mitigated by the existence of resiliency and protective factors that are unique to them, requiring additional research. The findings of this qualitative study can be considered as contributing to the current knowledge base on the impact of colonization and historically traumatic experiences as an underlying predictor of alcohol and other substance use among Native Hawaiians. However, multilevel, systemic evaluations are needed to assess Indigenous communities for collective trauma while observing cultural differences between groups. While communities must be evaluated, individual family and community interventions must be developed [23,45-47].

Future research should further expand knowledge related to the health impact of colonization and historically traumatic experiences in diverse context-specific geographic regions. Indigenous groups must drive the research. In addition, healing intervention models such as the historical trauma and unresolved grief intervention adapted to Native Hawaiian experiences should be grounded in Native Hawaiian worldviews to eradicate emotional distress that emerges as a legacy of historical trauma [23]. Currently, the Historical Loss scale and the Historical Loss and Associated Symptoms scale do not include a full measure of depression or post-traumatic stress disorder symptoms and were developed with American Indians [38-40]. New directions in research would be strengthened by expanding and developing new measures tailored to individual Indigenous groups through participatory research, which is currently in progress with Native Hawaiians [22].

Conclusion

The results of this study provide important insight into Native Hawaiians' lived experiences of historical trauma and alcohol use. The results characterize the colonizing events that led to historical trauma, the introduction of alcohol, and links to the problem of alcohol use today, the impact, and the mechanisms of transmission. This study reveals commonalities in the historical trauma response, especially the loss of culture, the introduction of alcohol, self-medication with alcohol, and intergenerational transmission of historical trauma and problematic alcohol use from elders to younger generations. The findings can be integrated into the current literature on related occurrences of historical trauma to advance our understanding of the historical trauma response. Necessary next steps include including this knowledge to guide the development of culturally grounded trauma-informed interventions. The long-term goal of historical trauma research is to develop culturally relevant interventions that are informed by the communities to improve the quality of life and empower Indigenous peoples to reclaim traditional knowledge, their identity, and health, and to help heal communities so that they are unburdened by grief over historic losses.

In addition, more context-specific research is needed to validate the historical trauma model, which has implications for healing and prevention. Thoughts and awareness of historical trauma may not be harmful to health if the issues that are associated with them are addressed, and individuals within a group who have experienced the transmission of intergenerational trauma are provided with the resources and tools to manage the stress that is associated with it. Research must fully understand, validate, and operationalize the historical trauma conceptual model's theoretical constructs and link them to health outcomes. In addition, risk factors, resiliency, protective cultural factors, and survivance must be explored among Indigenous populations to include in the interventions. The knowledge gained from this study can be used to inform policies aimed at addressing historical trauma in Native Hawaiian communities.

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This is dedicated to author JC, PhD, and dissertation advisor.

Data Availability

The raw data are not available to be placed in a public repository as it deals with a vulnerable population. The participants requested that the data not be published for fear that they might be recognized by others in their community.

Authors' Contributions

The principal investigator, CTG, conceived and conducted the study, collected and analyzed the data, and wrote the manuscript with JC. PP and DMP were community experts on historical trauma among Native Hawaiians. MK-Y helped with editing and acquiring the funding. DMP, MK-Y, and EAV helped with editing. DMP helped with the diacriticals.

Conflicts of Interest

CTG is a member of the *Asian/Pacific Island Nursing Journal*’s editorial board. All other authors declare no conflicts of interest.

Multimedia Appendix 1
Interview semistructured script.
[DOCX File, 15 KB - apinj_v9i1e68106_app1.docx]

Multimedia Appendix 2
Additional illustrative quotes.
[DOCX File, 15 KB - apinj_v9i1e68106_app2.docx]

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Abbreviations

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Original Paper

Disparities in Clinical and Experimental Pain Between Non-Hispanic White and Asian American Individuals With Knee Osteoarthritis and the Role of Pain Catastrophizing: Pilot Study in Florida

Chiyoung Lee[1,2], PhD, RN; C. Kent Kwoh[2,3], MD; Juyoung Park[1], PhD, MSW; Lindsey Park[1], BS; Hyochol Ahn[1], PhD, APRN, ANP-BC

[1]College of Nursing, University of Arizona, Tucson, AZ, United States

[2]The University of Arizona Arthritis Center, Tucson, AZ, United States

[3]Division of Rheumatology, College of Medicine, University of Arizona, Tucson, AZ, United States

Corresponding Author:
Chiyoung Lee, PhD, RN
College of Nursing
University of Arizona
1305 N Martin Avenue
Tucson, AZ, 85721
United States
Phone: 1 5206266154
Email: clee33@arizona.edu

Abstract

Background: Although a few studies have delineated the disparities in knee osteoarthritis (KOA) pain between non-Hispanic White and Asian American individuals, a significant research gap persists in elucidating the mechanisms underlying these differences.

Objective: This pilot study aims to examine psychological factors, specifically pain catastrophizing and negative affect, as potential explanatory mechanisms for these dissimilarities.

Methods: A cross-sectional design was used. Forty community-dwelling participants aged 50-70 years with self-reported KOA pain, including 20 non-Hispanic White and 20 Asian American individuals, were recruited in North Central Florida. Clinical KOA pain intensity was assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the 4 subscales of the Short-Form McGill Pain Questionnaire-2. Quantitative sensory testing was conducted to measure experimental sensitivity to heat- and mechanically induced pain, including heat pain, pressure pain threshold, and punctate mechanical pain, as well as inhibitory pain processes through conditioned pain modulation. Pain catastrophizing was evaluated using the Coping Strategies Questionnaire-Revised Pain Catastrophizing subscale, while negative affect was assessed using the Positive and Negative Affect Schedule. Bayesian mediation analyses were used to examine both direct and indirect effects (mediation) between variables.

Results: Asian American individuals exhibited higher pain catastrophizing scores than non-Hispanic White individuals. Pain catastrophizing, at high levels, contributed to WOMAC and Short-Form McGill Pain Questionnaire-2, which measured clinical pain. Race had no direct effects on these pain scores but exerted significant indirect effects via pain catastrophizing (WOMAC pain: 0.96, 95% CI 0.03-2.16; continuous pain: 0.84, 95% CI 0.18-1.70; intermittent pain: 0.78, 95% CI 0.03-1.71; neuropathic pain: 0.43, 95% CI 0.03-0.95; and affective pain: 1.05, 95% CI 0.24-1.99); thus, pain catastrophizing likely fully mediated the relationship between race and these pain measures. While Asian American individuals reported greater experimental pain sensitivity (heat pain, pressure pain threshold, and punctate mechanical pain) than non-Hispanic White individuals, these racial effects were not mediated by pain catastrophizing. Asian American individuals reported higher negative affect scores compared with non-Hispanic White individuals; however, negative affect did not mediate the relationship between race and any pain measures.

Conclusions: The results demonstrate the contribution of pain catastrophizing to clinical pain in Asian American individuals with KOA and identify it as a potential mechanism underlying group differences in KOA pain between non-Hispanic White and Asian American individuals. However, caution is warranted due to the exploratory nature of this study and the treatment of Asian

American individuals as a monolithic sample. Hence, future replication with larger and more diverse samples is necessary. Additionally, the lack of mediation effects of pain catastrophizing in the relationship between race and experimental pain suggests the need to explore other factors, such as biological, genetic, social, and environmental influences. Moreover, further research is essential to clarify the role of negative affect.

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KEYWORDS

Asian American; non-Hispanic White; osteoarthritis; pain; pain catastrophizing

Introduction

Background

Symptomatic knee osteoarthritis (KOA), characterized by pain, disability, and diminished quality of life, is a prevalent joint disorder in middle-aged and older adults [1]. Traditional perspectives have primarily linked KOA pain to structural joint changes; however, the weak correlation between radiographic findings and clinical symptoms suggests that structural abnormalities alone do not comprehensively account for the pain experienced by sufferers [2-5]. This indicates that additional factors, including psychosocial influences, may significantly impact the severity and perception of OA-related pain [6].

The prevalence of symptomatic KOA is projected to increase in racially and ethnically marginalized groups [7]. Although significant disparities in clinical and experimental pain have been reported across racial and ethnic groups with KOA, relevant studies have predominantly compared non-Hispanic White with African American individuals [8]. Asian American individuals, a rapidly growing minority, have been underrepresented in pain research despite emerging evidence indicating that they experience greater KOA-related pain than non-Hispanic White individuals [9], challenging cultural stereotypes of stoicism. To date, no studies have delineated the mechanisms underlying the differences between non-Hispanic White and Asian American individuals.

The biopsychosocial model of pain recognizes the importance of various psychological factors in pain [10]. One such factor, pain catastrophizing—cognitive and affective pain appraisal characterized by the tendency to address and magnify the threat value of painful stimuli and feel helpless owing to pain—is reportedly significantly correlated with increased knee pain severity in both clinical and experimental settings [11-13]. Notably, Asian American individuals have been reported to exhibit higher levels of pain catastrophizing, possibly influenced by acculturative stress and cultural practices affecting pain perception and response [14]. The greater use of pain catastrophizing among racial and ethnic minorities can also be attributed to health disparities resulting from structural and systemic barriers to adequate pain treatment and biased health care interactions [15,16], possibly promoting negative perceptions regarding pain management and the belief that their pain cannot be controlled and is likely to worsen. Considering the association between higher levels of pain catastrophizing and increased KOA pain, pain catastrophizing plausibly mediates the racial disparities observed in KOA pain between non-Hispanic White and Asian American individuals.

In addition to specific pain-related factors, broader elements, such as depression and negative affect, influence knee pain experiences, and this prevails in situations involving clinical and experimentally induced pain [17-19]. Ahn et al [20] found higher levels of depression to occur in Asian American individuals with self-reported KOA pain compared with those in age- and sex-matched non-Hispanic White individuals, and such variations in depression evidently mediated racial group differences in clinical and experimental pain. Negative affect, a general predisposition to experiencing aversive mood states, has been associated with racial discrimination and psychological distress among Asian American individuals [21]. Daily microaggressions contribute to higher levels of mental health symptoms and negative affect among Asian American individuals [22-24] and specific Asian American groups [25]. To date, the role of negative affect in racial disparities in KOA pain between non-Hispanic White and Asian American individuals has not yet been investigated.

Objectives

This pilot study aims to investigate psychological factors, specifically pain catastrophizing and negative affect, as potential explanatory mechanisms underlying group differences in KOA pain between non-Hispanic White and Asian American individuals. Elucidating these mechanisms may inform the development of targeted interventions that improve KOA pain management in the understudied Asian American population and help address pain disparities across racial groups.

Methods

Study Participants

This cross-sectional analysis used baseline data from the randomized controlled trial registered at ClinicalTrials.gov (NCT02512393) to examine the efficacy of transcranial direct current stimulation on KOA pain. Detailed selection criteria and enrollment procedures have been documented previously [26]. In summary, at baseline, 40 participants with KOA pain (20 non-Hispanic White and 20 Asian American individuals) were recruited in North Central Florida between September 2015 and August 2016 through local advertisements. Participants were eligible if they were aged 50-70 years, had self-reported unilateral or bilateral KOA pain as per American College of Rheumatology criteria, could speak and read English, and were willing and able to provide written informed consent before enrollment. In our sample of Asian American individuals, detailed information on subgroup ethnicities, languages, cultural backgrounds, and demographic characteristics was not gathered during data collection and is therefore unavailable in this study.

Exclusion criteria ensured participants did not have concurrent medical conditions that could confound osteoarthritis-related outcomes or coexisting diseases that could impede protocol completion, including (1) prosthetic knee replacement or nonarthroscopic surgery on the affected knee; (2) serious medical illness, such as uncontrolled hypertension, heart failure, or recent history of acute myocardial infarction; (3) peripheral neuropathy; (4) systemic rheumatic disorders, such as rheumatoid arthritis, systemic lupus erythematosus, and fibromyalgia; (5) alcohol or substance abuse; (6) cognitive impairment (ie, Mini-Mental Status Examination score≤23); (7) history of brain surgery, tumor, seizure, stroke, or intracranial metal implantation; (8) pregnancy or lactation; and (9) hospitalization for psychiatric illness within the past year.

Measurement

The collected basic characteristics included age, sex, BMI (kg/m²), Kellgren-Lawrence radiographic grade, employment status, marital status, educational attainment, and household income.

Clinical KOA Pain

The Western Ontario and McMaster Universities Osteoarthritis Index Pain Subscale.

Average knee pain for the past 48 hours was measured by the pain subscale of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), which consisted of 5 items on a 0-4 Likert scale measuring the pain severity during walking, climbing stairs, sleeping, resting, and standing [27]. The participants' responses to each pain question were summed up to derive an aggregated score for pain intensity (range: 0-20). The subscales in WOMAC demonstrate reliability and validity in evaluating patients with KOA [28,29].

Short Form McGill Pain Questionnaire-2

The Short Form McGill Pain Questionnaire-2 (SF-MPQ-2) has been validated and widely used to assess the multidimensional qualities of pain [30]. It consists of 4 subscales, including continuous pain (6 items: throbbing pain, cramping pain, gnawing pain, aching pain, heavy pain, and tender), intermittent pain (6 items: shooting pain, stabbing pain, splitting pain, electric-shock pain, and piercing), neuropathic pain (6 items: hot-burning pain, cold-freezing pain, pain caused by light touch, itching, tingling or pins and needles, and numbness), and affective description of pain (4 items: tiring-exhausting, sickening, fearful, and punishing-cruel). Each subscale score was computed as the average of answered items, with higher scores indicating greater pain intensity.

Quantitative Sensory Testing

A multimodal Quantitative Sensory Testing (QST) battery was used to assess pain sensitivity using precisely controlled protocols that elicit pain with thermal and mechanical stimuli, as well as inhibitory pain processes. This includes heat pain (ie, threshold and tolerance), pressure pain threshold (PPT), punctate mechanical pain (PMP), and conditioned pain modulation (CPM). The sequence of heat and mechanical testing was randomized and counterbalanced, while CPM was always administered last to minimize any potential carryover effects. The same researcher performed QST on each participant throughout the study, and all participants were provided with standardized recorded instructions to prevent bias during data collection and to enhance the reliability of the results.

Thermal Testing Procedures

All thermal stimuli were delivered using a computer-controlled TSA-II NeuroSensory Analyzer (Medoc Ltd) to measure heat pain thresholds and heat pain tolerances on both the index knee and the ipsilateral ventral forearm using an ascending method of limits. At each body site, the thermode position was moved between trials to prevent sensitization or habituation of cutaneous receptors. Starting from a baseline of 32 °C, the thermode temperature increased at a rate of 0.5 °C per second until participants responded by pressing a button on a handheld device. Participants were instructed to press the button when heat first becomes painful to assess the heat pain threshold, and when they could no longer tolerate the heat pain to assess heat pain tolerance. Three trials of heat pain threshold were conducted at the first test site, followed by 3 trials of heat pain tolerance were conducted. Then, 3 trials each at the second test site were conducted, with a 5-minute rest period between sites. The average of the 3 trials was calculated for each individual, providing overall heat pain threshold and tolerance temperatures for analysis.

Mechanical Testing Procedures

Mechanical pain response was measured via 2 approaches. First, PPT was assessed by applying blunt mechanical pressure to deep tissues (ie, muscle and joint) via a handheld digital pressure algometer (Wagner). Increasing pressure was applied at a constant rate of 0.3 kgf/cm^2 per second to measure the PPT at 4 sites—the medial and lateral aspects of the index knee, ipsilateral quadriceps, and trapezius. The order of testing sites was counterbalanced and randomized. For assessing PPT, participants were instructed to inform the experimenter when the sensation "first becomes painful" occurred, and the pressure was recorded. The results of the 3 trials at each body site were averaged for each site, and then these PPTs at 4 sites were averaged to derive an overall measure of PPT. Second, PMP stimuli evaluated cutaneous mechanical sensitivity on both the index patella and the back of the ipsilateral hand. We used calibrated nylon monofilament that delivered a target force of 300 g to obtain verbal ratings of the pain intensity on a scale of 0 (no pain sensation) to 100 (the most intense pain sensation imaginable) following 10 contacts at the rate of 1 contact per second. An overall score for each site was computed by averaging across 2 trials.

Conditioned Pain Modulation

Ten minutes after assessing the thermal or mechanical pain, the CPM was evaluated. CPM reflects the endogenous pain inhibitory pathway (ie, descending pain inhibition) also known as the "pain inhibits pain" paradox [31]. CPM was assessed by determining the change in PPT on the trapezius, immediately following the immersion of the contralateral hand up to the wrist in the cold-water bath (12 °C) for 1 minute. The initial preimmersion PPT measurement was conducted just before placing the hand in the water. Thirty seconds after hand immersion, participants were asked to rate the cold pain intensity (0-100) from the immersed hand followed by the second PPT measurement, and were informed to keep their hand in the water bath for as long as tolerable up to 1 minute. After the removal of the hand, the final PPT measurement was taken. This temperature was chosen based on prior experience with middle-aged and older adults with KOA, where 12 °C was found to produce moderate yet tolerable pain for most participants. Water was continually circulated and maintained at a constant temperature by a refrigeration unit (Neslab). An increase in PPT following cold water immersion demonstrated pain inhibition.

Pain Catastrophizing

The Coping Strategies Questionnaire-Revised measures the use of strategies for coping with pain by assessing 6 domains—distraction, catastrophizing, ignoring pain sensations, distancing from pain, coping self-statements, and praying. Participants rate how often they use specific strategies on a 7-point Likert scale from 0=never to 6=always, with higher scores indicating greater usage for each domain. This study used the 6-item catastrophizing subscale, with scores calculated as the mean of the responses. The reliability and validity of the Coping Strategies Questionnaire-Revised subscales have previously been shown to be acceptable [32,33].

Negative Affect

The Positive and Negative Affect Schedule includes 20 items that evaluate the frequency of both pleasant and unpleasant emotions individuals experience [31]. The inventory is divided into 2 subscales, each with 10 items for positive and negative emotions. Negative affect is calculated from the sum of 10 items (afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared, and upset), rated on a 5-point scale from 1=very slightly or not at all to 5=extremely. A lower total negative score indicates less negative affect (range: 10-50). The Positive and Negative Affect Schedule has been validated and demonstrates reliability, with an α coefficient range of .84 to .87 for negative affect [34].

Statistical Analyses

Descriptive statistics were used to characterize the study participants. Chi-square or Fisher exact test for categorical variables and the 2-tailed t test for continuous variables were used to compare participant characteristics between the groups. Composite measures for QST were created by calculating z scores for the heat pain threshold and tolerance at the arm and knee; PPT at the medial and lateral aspects of the index knee, ipsilateral quadriceps, and trapezius; and PMP at the index patella and hand. The z scores for each pain measure were subsequently averaged across the body sites to yield overall heat pain threshold, heat pain tolerance, PPT, and PMP values for the analyses.

Separate path analytical models were estimated to assess the indirect effects (mediation) of ethnicity (coded 0 for non-Hispanic White and 1 for Asian American individuals) via pain catastrophizing or negative affect on each clinical and experimental pain measure. The path models facilitated the examination of both direct and indirect effects. Model fit, path coefficient estimates, and 95% highest posterior density CIs (“credibility” in Bayesian terms) for parameter estimates were generated using the Bayesian estimation method in Mplus (version 8.8; Muthén & Muthén). Bayesian estimation is advantageous in that it precludes the necessity of the normality assumption in the sampling distribution of estimates and potentially provides more accurate parameters in small-sample cases [35]. Model fit was evaluated using the criteria and methods recommended by Muthén and Asparouhov [36]. Where 95% CIs did not overlap with zero, the effect was considered significant.

Ethical Considerations

The institutional review board (IRB) of the University of Arizona (UA) considers investigators engaged in research if they (1) interact with participants for research purposes, (2) have access to identifying study information, (3) obtain informed consent from research participants, or (4) the UA directly receives part of federal funds for the study (ie, UA is the prime awardee). If none of the earlier are true, then the researchers would not need IRB approval. Thus, this secondary analysis of deidentified data from an existing randomized controlled trial does not need any IRB approval. The original study (NCT04016272) received appropriate ethical approval, and written informed consent was obtained.

Results

Table 1 presents the characteristics of the participants by race. The groups differed in terms of age (P=.001), BMI (P=.001), and Kellgren-Lawrence radiographic grade (P=.01). The mean age of non-Hispanic White individuals was 65.1 (SD 7.05) years, whereas the mean age of Asian American individuals was 54.8 (SD 7.36) years. The BMI for non-Hispanic White and Asian American individuals was 28.0 (SD 3.12) kg/m² and 25.0 kg/m² (SD 3.41) kg/m², respectively. Out of 20 Asian American individuals, most (n=11, 55%) were classified as grade 0. In contrast, grades 3 and 4 were predominant among non-Hispanic White individuals, with 7 out of 20 (35%) participants falling into these categories. Additionally, grade 2 was more common among non-Hispanic White individuals (8/20, 40%) compared with Asian American individuals (2/20, 10%). There were no significant differences between the groups in sex proportion, employment status, marital status, educational attainment, and household income.

Table 1. Basic characteristics of the participants (N=40)a.

Characteristic	Non-Hispanic White (n=20)	Asian American (n=20)	*P* value
Age (years), mean (SD)	65.1 (7.05)	54.8 (7.36)	*.001*
Sex, n (%)	8 (40)	13 (65)	.21
Male	12 (60)	7 (35)	
Female	8 (40)	13 (65)	
BMI (kg/m^2), mean (SD)	28.0 (3.12)	25.0 (3.41)	*.001*
Kellgren-Lawrence radiographic grade, n (%)			*.010* [b]
0	2 (10)	11 (55)	
1	3 (15)	5 (25)	
2	8 (40)	2 (10)	
3	6 (30)	2 (10)	
4	1 (5)	0 (0)	
Employment status, n (%)			.28
Yes	9 (47)	12 (71)	
No	10 (53)	5 (29)	
Marital status, n (%)			.13[b]
Married or partnered	13 (65)	18 (90)	
Nonmarried or unpartnered	7 (35)	2 (10)	
Educational attainment, n (%)			.50
2-year college degree or less	8 (40)	5 (25)	
4-year college degree of higher	12 (60)	15 (75)	
Household income (US $), n (%)			.52
More than 50,000	11 (58)	8 (42)	
50,000 or less	8 (42)	11 (58)	

[a] Significant results are indicated in italics.

[b] Fischer exact test.

Descriptive statistics for variables used in the path models are presented in Table 2. Figure 1 shows the mediation path (race → mediator → pain). Fit for each of the models was acceptable, with all 95% CIs for the difference between observed and replicated chi-square values encompassing 0, all posterior predictive values >.45, and convergence of posterior parameter trace plots. Tables 3 and 4 provide results of the path analysis, including direct and indirect effects and the 95% highest posterior density CIs for each of the pain measure models.

Table 2. Descriptive statistics for pain-related outcomes, pain catastrophizing, and negative affect among non-Hispanic White and Asian American individuals (N=40).

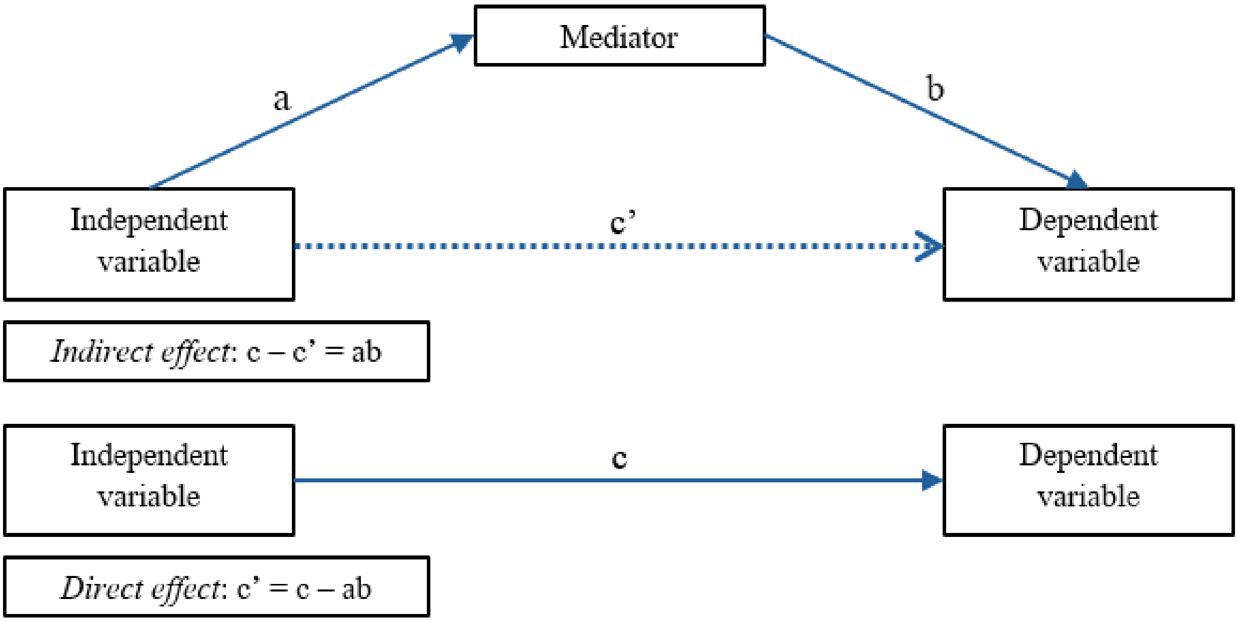
Pain measures	Non-Hispanic White (n=20)	Asian American (n=20)
WOMAC[a] pain (range: 0-20), mean (SD)	4.90 (2.55)	4.40 (2.67)
SF-MPQ-2[b] continuous pain (range: 0-10), mean (SD)	1.78 (1.94)	1.98 (1.37)
SF-MPQ-2 intermittent pain (range: 0-10), mean (SD)	1.28 (2.19)	1.47 (1.83)
SF-MPQ-2 neuropathic pain (range: 0-10), mean (SD)	0.67 (0.93)	1.07 (1.24)
SF-MPQ-2 affective pain (range: 0-10), mean (SD)	0.79 (1.83)	1.46 (1.66)
Heat pain threshold[c], mean (SD)	0.49 (0.82)	–0.49 (0.74)
Heat pain tolerance[c], mean (SD)	0.51 (0.76)	–0.51 (0.73)
Pressure pain threshold[c], mean (SD)	0.45 (0.86)	–0.45 (0.61)
Punctate mechanical pain[c], mean (SD)	–0.62 (0.56)	0.62 (0.76)
Conditioned pain modulation, mean (SD)	1.29 (1.14)	1.16 (0.71)
Pain catastrophizing (range: 0-6), mean (SD)	0.31 (0.74)	1.33 (1.25)
Negative affect (range: 10-50), mean (SD)	14.00 (4.29)	20.15 (9.02)

[a] WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

[b] SF-MPQ-2: Short-Form McGill Pain Questionnaire-2.

[c] Average *z* score.

Figure 1. Mediation path model. For clinical pain measures, we measured WOMAC pain and SF-MPQ-2 pain. To produce composite QST measures, average z scores were computed for heat pain threshold and heat pain tolerance measurements at the arm and knee; PPT measurements at the medial and lateral aspect of the index knee, ipsilateral quadriceps, and trapezius; and PMP measurements at the patella and hand. a = direct effect of race on the mediator; b = direct effect of the mediator on pain measures after controlling for race; ab = indirect effect of race on pain measures operating through the mediator; c' = direct effect of race on pain measures after controlling for the mediator; c = total effect of race on pain measures without accounting for the mediator. Due to the small sample size, we analyzed each mediating effect (ie, pain catastrophizing and negative affect) separately. PMP: punctate mechanical pain; PPT: pressure pain threshold; QST: quantitative sensory testing; SF-MPQ-2: Short-Form McGill Pain Questionnaire-2; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.



In each model (Table 3), the direct effect of race on pain catastrophizing (Figure 1; a = direct effect of race on the mediator) indicated that Asian American individuals had significantly higher pain catastrophizing scores than non-Hispanic White individuals (mean difference 1.03; 95% CI 0.29-1.70). Additionally, as shown in Table 4, in each model, the direct effect of race on negative affect indicated that Asian American individuals yielded significantly higher negative affect scores than non-Hispanic White individuals (mean difference 6.15; 95% CI 1.11-10.80).

Table 3. Estimated direct and indirect effects with 95% CI (N=40; pain catastrophizing as a mediator)[a,b].

Pain outcomes (R^2)	Direct effects		Indirect effect, ab (95% CI)
	c' (95% CI)	b (95% CI)	
WOMAC[c] pain (0.179)	–1.53 (–3.39 to 0.25)	1.00 (0.21-1.81)	0.96 (0.03-2.16)
SF-MPQ-2[d] continuous pain (0.283)	–0.67 (–1.78 to 0.40)	0.85 (0.38-1.34)	0.84 (0.18-1.70)
SF-MPQ-2 intermittent pain (0.187)	–0.64 (–2.07-0.73)	0.81 (0.20-1.43)	0.78 (0.03-1.71)
SF-MPQ-2 neuropathic pain (0.215)	–0.06 (–0.83 to 0.67)	0.45 (0.12-0.78)	0.43 (0.03-0.95)
SF-MPQ-2 affective pain (0.410)	–0.41 (–1.47 to 0.60)	1.06 (0.61-1.52)	1.05 (0.24-1.99)
Heat pain threshold[e] (0.284)	–1.07 (–1.67 to –0.50)	0.08 (–0.17 to 0.34)	0.07 (–0.20 to 0.39)
Heat pain tolerance[e] (0.304)	–0.94 (–1.52 to –0.39)	–0.07 (–0.32 to 0.18)	–0.06 (–0.38 to 0.19)
Pressure pain threshold[e] (0.259)	–0.96 (–1.54 to –0.41)	0.06 (–0.19 to 0.31)	0.05 (–0.23 to 0.34)
Punctate mechanical pain[e] (0.462)	1.09 (0.58-1.57)	0.15 (–0.07 to 0.37)	0.14 (–0.09 to 0.43)
Conditioned pain modulation (0.168)	–0.49 (–1.70 to 0.16)	0.36 (0.07-0.65)	0.34 (0.00-0.79)

[a] Significant results are indicated in italics.

[b] c' = direct effect of race on pain measures after controlling for pain catastrophizing; b = direct effect of pain catastrophizing on pain measures after controlling for race; ab = indirect effect of race on pain measures operating through pain catastrophizing.

[c] WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

[d] SF-MPQ-2: Short-Form McGill Pain Questionnaire-2.

[e] Average *z* score.

Table 4. Estimated direct and indirect effects with 95% CI (N=40; negative affect as a mediator)[a,b].

Pain outcomes (R^2)	Direct effects		Indirect effect, ab (95% CI)
	c' (95% CI)	b (95% CI)	
WOMAC[c] pain (0.091)	–1.05 (–2.92 to 0.83)	0.09 (–0.03 to 0.22)	0.50 (–0.23 to 1.59)
SF-MPQ-2[d] continuous pain (0.094)	–0.17 (–1.36 to 1.04)	0.06 (–0.02 to 0.14)	0.34 (–0.13 to 1.04)
SF-MPQ-2 intermittent pain (0.155)	–0.45 (–1.83 to 0.95)	0.11 (0.02-0.20)	0.59 (–0.04 to 1.48)
SF-MPQ-2 neuropathic pain (0.186)	0.04 (–0.70 to 0.80)	0.06 (0.01-0.11)	0.34 (–0.03 to 0.80)
SF-MPQ-2 affective pain (0.108)	0.32 (–0.93 to 1.59)	0.06 (–0.02 to 0.14)	0.32 (–0.17 to 1.04)
Heat pain threshold[e] (0.274)	–1.01 (–1.58 to –0.43)	0.00 (–0.03 to 0.04)	0.02 (–0.25 to 0.27)
Heat pain tolerance[e] (0.297)	–1.01 (–1.56 to –0.45)	–0.00 (–0.04 to 0.04)	–0.00 (–0.25 to 0.26)
Pressure pain threshold[e] (0.255)	–0.94 (–1.49 to –0.38)	0.01 (–0.03 to 0.04)	0.03 (–0.22 to 0.29)
Punctate mechanical pain[e] (0.453)	1.13 (0.65-1.62)	0.02 (–0.01 to 0.05)	0.09 (–0.10 to 0.36)
Conditioned pain modulation (0.039)	–0.15 (–0.85 to 0.56)	0.01 (–0.04 to 0.05)	0.02 (–0.31 to 0.33)

[a] Significant results are indicated in italics.

[b] c' = direct effect of race on pain measures after controlling for pain catastrophizing; b = direct effect of pain catastrophizing on pain measures after controlling for race; ab = indirect effect of race on pain measures operating through pain catastrophizing.

[c] WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

[d] SF-MPQ-2: Short-Form McGill Pain Questionnaire-2.

[e] Average *z* score.

Direct Effect of Race on Pain Measures After Controlling Pain Catastrophizing

The direct effect of race on the heat pain threshold (c'=–1.07), heat pain tolerance (c'=–0.94), and PPT (c'=–0.96) indicated that Asian American individuals had lower mean scores on these experimental pain measures than non-Hispanic White individuals after controlling for pain catastrophizing. The direct effect of race on PMP (c'=1.09) indicated that Asian American individuals generated higher mean scores on this pain measure than non-Hispanic White individuals after controlling for pain catastrophizing. After controlling for pain catastrophizing, Asian

American and non-Hispanic White participants yielded similar mean scores for clinical pain measures.

Direct and Indirect Effect of Pain Catastrophizing on Pain Measures

Pain catastrophizing exhibited positive direct effects, while race exerted positive indirect effects through pain catastrophizing on WOMAC (b=1.00, ab=0.96), SF-MPQ-2 continuous (b=0.85, ab=0.84), SF-MPQ-2 intermittent (b=0.81, ab=0.78), SF-MPQ-2 neuropathic (b=0.45, ab=0.43), and SF-MPQ-2 affective (b=1.06, ab=1.05) pain. These results indicate that participants with higher pain catastrophizing scores tend to have higher values on these pain measures after controlling for race. Considering that race had no direct effects on these pain scores but exerted indirect effects via pain catastrophizing, the effects of race were likely fully mediated through pain catastrophizing for these measures. After controlling race, we did not identify any direct effects of pain catastrophizing on the heat pain threshold, heat pain tolerance, PPT, and PMP. Surprisingly, pain catastrophizing exhibited positive direct effects on CPM (b=0.36).

Direct Effect of Race on Pain Measures After Controlling for Negative Affect

Based on the direct effect of race on the heat pain threshold (c'=–1.01), heat pain tolerance (c'=–1.01), and PPT (c'=–0.91), Asian American individuals yielded lower mean scores on these experimental pain sensitivity measures than non-Hispanic White individuals after controlling for negative affect. The direct effect of race on PMP (c'= 1.13) indicated that Asian American individuals had higher mean scores on this pain measure than non-Hispanic White individuals after controlling for negative affect. Race had no direct effect on CPM. After controlling for negative affect, Asian American and non-Hispanic White participants were found to have similar mean scores for all clinical pain measures.

Direct and Indirect Effects of Negative Affect on Pain Measures

We exclusively detected direct effects of negative affect on SF-MPQ-2 intermittent (b=0.11) and SF-MPQ-2 neuropathic (b=0.06) pain after controlling for race. Race exerted no indirect effects on pain measures via negative affect in any of the path models.

Discussion

Principal Findings

This study investigated whether variations in pain catastrophizing and negative affect explain group differences in clinical and experimental pain between non-Hispanic White and Asian American individuals with KOA. Our main finding suggests that Asian American individuals show higher levels of pain catastrophizing than non-Hispanic White individuals and that it plays a relevant role in greater clinical pain in Asian American individuals. The results additionally indicate that participants with higher pain catastrophizing scores tended to have higher WOMAC- and SF-MPQ-2-measured clinical pain. Furthermore, Asian American individuals exhibited greater sensitivity to experimental pain compared with non-Hispanic White individuals; however, this difference was not due to pain catastrophizing. Asian American individuals also reported experiencing more negative affect than non-Hispanic White individuals, yet this did not seemingly influence the relationship between race and any pain measures.

Comparison With Prior Work

Disparities in pain catastrophizing based on race and ethnicity have been documented in individuals with KOA [13,37-39] and various other pain-related medical conditions [40-43]; notably, individuals who self-identify as minorities, including Black and Hispanic or Latinx groups, are reported to engage in pain catastrophizing as a pain coping strategy more frequently than their non-Hispanic White peers. Increasing evidence also suggests that catastrophizing is a significant mediator of race differences in clinical pain. A recent study by Fullwood et al [39] found that pain catastrophizing mediated the relationship between race (Black vs non-Hispanic White individuals) and WOMAC pain in adults with KOA. Similar findings were reported in the study by Lane et al [43] on individuals with chronic spinal pain receiving physical therapy and the study by Fabian et al [44] in healthy pain-free samples. Our study expands on previous investigations by identifying pain catastrophizing as a significant contributor to group differences in clinical pain between non-Hispanic White and Asian American individuals.

Extensive prior research has demonstrated that pain catastrophizing is associated with undesirable pain outcomes, including more frequent pain experiences or greater pain intensity [11-13]. However, our finding that Asian American individuals have higher clinical pain scores with increasing levels of pain catastrophizing represents a novel contribution to the field. The exact reasons underlying the significantly higher pain catastrophizing scores among Asian American individuals compared with non-Hispanic White individuals remain unclear. A possible explanation is the relationship between acculturative stress and pain catastrophizing in Asian American individuals. Ahn et al [14] suggest that chronic stress contributes to increased pain perception, potentially owing to its physical impact from chronically high levels of sympathetic activation and subsequent physiologic exhaustion; this, in turn, may reduce one's ability to cope with the added stress of pain [45]. They further note that a major source of chronic stress for immigrants could be the process of acculturation [46,47]. In addition, higher pain catastrophizing scores among Asian American individuals could be attributed to a cultural emphasis on pain-related stoicism in Asian communities, which may discourage openly expressing chronic pain to avoid burdening others [48,49]. This cultural disposition causes Asian American individuals to suffer silently, thus amplifying their mental agony. Furthermore, Asian cultural communication styles often prioritize indirectness and subtlety, which can result in less effective communication with health care providers from different cultural backgrounds regarding pain experiences [50]. This communication gap may hinder effective pain management and perpetuate a cycle of unexpressed and poorly managed KOA pain, thereby contributing to higher levels of pain catastrophizing compared to non-Hispanic White individuals. Furthermore, immigrants' experiences with the health care system and the challenges they encounter in accessing adequate pain treatment may lead to poorer pain outcomes. This may foster negative thinking about their pain and may leave Asian American patients feeling that their pain is unmanageable and will inevitably worsen.

Asian American individuals reported greater experimental pain sensitivity (heat pain, PPT, and PMP) than non-Hispanic White individuals, replicating previous findings on middle-aged and older adults with KOA [9] and similar reports on younger Asian American individuals [51]. Furthermore, heightened sensitivity occurred at both the affected knee and unaffected body sites, suggesting increased central sensitization. However, pain catastrophizing could not explain the racial group differences in any measures of experimental pain in this study. This contradicts previous studies wherein pain catastrophizing was found to influence racial group differences in QST measures among nonclinical samples [52-55] and patients with chronic low back pain [41]. Several explanations can be proposed for such findings. First, Meints et al [55] found that racial group differences in cold pain tolerance (non-Hispanic White vs African American individuals) were mediated by the rumination component of pain catastrophizing but not by the magnification or helplessness components, examining the mediatory effects of different pain catastrophizing components may yield varied results. Second, other critical factors, such as biological, genetic, social, and environmental mechanisms, may also influence the observed differences. For instance, Rowell et al [51] found that differences in endogenous pain regulatory mechanisms, such as mean arterial pressure and heart rate, potentially play a role in the differences in experimental pain sensitivity between young non-Hispanic White and Asian American individuals. Based on earlier evidence, genetic links to pain phenotypes differ according to racial or ethnic group, potentially generating dissimilarities in pain sensation. For example, pain sensitivity has been associated with variations in the catechol-O-methyltransferase [56] and µ-opioid receptor genes [57]. Moreover, frequency differences in the alleles of pain-related gene polymorphisms may contribute to racial and ethnic disparities in pain responses [58]. Furthermore, studies have suggested a role for nutritional supplement status [59], lower sociodemographic resources [60], and racial discrimination [61] in accounting for individual or racial and ethnic differences in experimental pain sensitivity—all of which potentially contributed to the observed differences but require further evaluation in the future.

Asian American individuals had significantly higher negative affect scores than non-Hispanic White individuals. Although higher negative affect scores were strongly correlated with both intermittent and neuropathic pain (measured using the SF-MPQ-2), negative affect did not seem to influence the relationship between race and any pain measures. Various negative affect-related constructs are important to pain; nevertheless, they differ in specificity and are conceptually distinct; some constructs are general, such as anxiety, depression, and negative affect, whereas others are more specifically pain-related, such as fear of pain, pain anxiety, and pain catastrophizing [62]. Overall, our preliminary findings suggest that pain-specific variables (ie, pain catastrophizing) should be prioritized over general negative affect to minimize pain disparities between non-Hispanic White and Asian American individuals. However, further studies involving larger sample sizes are necessary to confirm our findings. In fact, a study by Ahn et al [9], which established that higher depression levels in Asian American than in non-Hispanic White individuals explained racial group differences in clinical and experimental pain, included 50 participants per group. Additionally, we could not account for covariates, such as sex, age, and pain-related medication, owing to the small sample sizes in the path models, which might have affected the results.

Strengths and Limitations

Our study is the first to highlight the crucial role of pain catastrophizing in explaining disparities in clinical KOA pain between non-Hispanic White and Asian American individuals, contributing to the growing body of literature on racial group differences in pain among individuals with KOA and its associated psychological conditions. Further, the study's strength was upheld by its comprehensive examination of pain in Asian American individuals using a wide range of pain measures, focusing on a population that has received limited attention in studies assessing and managing KOA pain.

This study has certain limitations. First, the findings may not be generalizable as they are based on a convenience sample from a specific region. Moreover, the Asian American participants in the study were limited to English speakers. These limitations introduce challenges in interpreting the findings, underscoring the need for samples from other regions and a more diverse group of Asian American individuals for cross-validation. Second, as previously mentioned, a key limitation of this study is the lack of information about potential commonalities or differences within our broadly categorized, monolithic Asian American sample. Therefore, caution is warranted when interpreting our conclusions. Furthermore, although we use the term "Asian American" when referring to the prior works, we acknowledge the significant heterogeneity within this population, including the diverse countries of origin of participants in individual studies and the considerable variation across "Asian American" cohorts in different studies. Thus, our discussion on racial and ethnic differences should be carefully interpreted. Third, this pilot study had a small sample size. Consequently, statistical analyses were constrained, and data outliers were more likely to skew the results, highlighting the need for a larger sample size. Furthermore, the combination of the small sample size and the lack of subgroup information on the Asian American sample limited the study's capacity to be specifically designed or sufficiently powered to explore variations within smaller subgroups of Asian American individuals. Fourth, the cross-sectional design hindered our ability to discern the directionality of the relationships between variables. Indeed, evidence suggests that pain catastrophizing may not be a characterological trait but a complex phenomenon that can both affect and be affected by pain [39]. Kim et al [48] argue that as clinical pain scores increase, a sense of helplessness or an inability to control chronic knee pain may develop, contributing to higher levels of pain catastrophizing in Asian American individuals. These important relationships warrant further investigation in future studies. Furthermore, previous studies have evaluated pain catastrophizing over a longitudinal period to better understand its influence on pain over time in adults with KOA [39]. Similar studies should also be conducted in Asian American samples. Finally, we acknowledge that the term "pain catastrophizing" can considered pejorative and stigmatizing, conflicting with patient-centered care approaches [63]. Labeling patients in this manner potentially leads to blame and stereotyping, adversely affecting decision-making and care quality. Recent analyses have proposed that "pain-related worrying" and "pain-related distress" may better capture the essence of what is measured by pain-catastrophizing items [64].

Future Directions

This pilot study's findings provide a crucial foundation for future research and clinical practice. Considering the limited sample size, we analyzed each mediatory effect separately. Future studies including larger samples may use more sophisticated models to concurrently examine a broader range of factors, thereby more comprehensively elucidating the mechanisms underlying racial disparities in pain between non-Hispanic White and Asian American individuals; in addition to pain catastrophizing and negative affect, as previously discussed, future research should investigate biological, genetic, and other psychological variables essential to understanding chronic KOA pain and evaluate them as explanatory mechanisms to develop more tailored interventions.

Additionally, it is important to acknowledge that the lumping of Asian American groups together in the current study is problematic, as it obscures the tremendous diversity and complexity within and across these groups. This approach may have excluded individuals with varying levels of pain catastrophizing and negative affect or overlooked how acculturative stress and cultural practices—factors that can vary greatly between Asian American subgroups—may influence pain perception and response. Therefore, future studies should account for the demographic and social construction of the Asian American category and its implications in KOA pain research to ensure nuanced and culturally informed analyses.

Finally, our findings underscore the need to systematically assess and treat pain catastrophizing in Asian American individuals in health care settings to ensure effective pain management. Interventions targeting this maladaptive cognitive style among Asian American individuals may help mitigate racial disparities in clinical pain. In particular, the interventions should be culturally sensitive and tailored by further scrutinizing the factors influencing pain catastrophizing in Asian American individuals. If acculturative stress influences pain catastrophizing, then therapy for pain catastrophizing (eg, cognitive behavioral therapy) could be enhanced by focusing on culturally sensitive stress management techniques. In addition, a better understanding of differences in pain experiences based on race, sociocultural background, and experiences with the health care system—such as Asian communities facing structural and systemic barriers that influence pain—may help reduce disparities in pain management.

Conclusions

This pilot study examined psychological factors, specifically pain catastrophizing and negative affect, as potential explanatory mechanisms behind racial group differences in clinical and experimental pain between non-Hispanic White and Asian American individuals with KOA pain. Apparently, pain catastrophizing is essential to addressing racial disparities in clinical KOA pain; however, further research is warranted to verify our findings and elucidate unresolved mechanisms.

Acknowledgments

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Data Availability

The datasets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.

Authors' Contributions

CL and CKK were responsible for the conception or design of the work. LP and HA contributed to the acquisition of the data. CL and CKK were involved in the analysis and interpretation of the data, as well as drafting the work. JP and HA revised the manuscript critically for important intellectual content. All authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

Conflicts of Interest

HA is the Editor-in-Chief of Asian/Pacific Island Nursing.

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Abbreviations

CPM: conditioned pain modulation
IRB: institutional review board
KOA: knee osteoarthritis
PMP: punctate mechanical pain
PPT: pressure pain threshold
QST: quantitative sensory testing
SF-MPQ-2: Short-form-McGill Pain Questionnaire-2
UA: University of Arizona
WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index

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Corrigenda and Addenda

Correction: Factors That Affect the Quality of Life of Mothers Caring for Children With Medical Needs at Home: Cross-Sectional Questionnaire Study

Kanako Nakamura[1], MSN; Yuko Hamada[2], PhD; Ayaka Fujita[2,3], PhD; Seiichi Morokuma[4], PhD

[1]Fukuoka Jo Gakuin Nursing University, Koga City, Japan

[2]Department of Nursing, Faculty of Nursing, Shimonoseki City University, Shimonoseki, Japan

[3]Cicely Saunders Institute of Palliative Care, Policy & Rehabilitation, Florence Nightingale Faculty of Nursing, Midwifery & Palliative Care, King's College London, London, United Kingdom

[4]Department of Health Sciences, Graduate School of Medical Sciences, Kyushu University, Fukuoka City, Japan

Corresponding Author:
Kanako Nakamura, MSN
Fukuoka Jo Gakuin Nursing University
1-1-7 Chidori
Koga City 811-3113
Japan
Phone: 81 92 943 4174
Fax: 81 92 940 2341
Email: k_nakamura@fukujo.ac.jp

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In “Factors That Affect the Quality of Life of Mothers Caring for Children With Medical Needs at Home: Cross-Sectional Questionnaire Study” (Asian Pac Isl Nurs J 2024;8:e63946), the authors made the following corrections.

1. In Table 1, the data in the “Value, n (%)” column for the “Home medical care period (years)” category had been originally reported as follows:

> *<5: 19 (41)*
>
> *5 or more: 25 (54)*

This has now been corrected to:

> *<5: 20 (43)*
>
> *5 or more: 26 (57)*

Similarly, the data in the “Value, n (%)” column for the “Hospitalization” category had been originally reported as follows:

> *Yes: 27 (59)*
>
> *No: 19 (41)*

This has been corrected to:

> *Yes: 19 (41)*
>
> *No: 27 (59)*

2. In Table 2, in the “Home medical care period (years)” category, the values for the “Participants (N=46), n (%)” column had been originally reported as:

> *<5: 19 (41)*
>
> *5 or more: 25 (54)*

This has now been corrected to:

> *<5: 20 (43)*
>
> *5 or more: 26 (57)*

Furthermore, in the “Home medical care period (years)” category, the values for the “WHO QOL26 score” column had been originally reported as follows:

> *<5: 2.94*
>
> *5 or more: 3.34*

This has now been corrected to:

> *<5: 3.32*
>
> *5 or more: 2.97*

Similarly, in the “Hospitalization” category, the values for the “Participants (N=46), n (%)” column had been originally reported as:

> *Yes: 27 (59)*
>
> *No: 19 (41)*

This has been corrected to:

> *Yes: 19 (41)*
>
> *No: 27 (59)*

Furthermore, in the "Hospitalization" category, the values for the "WHO QOL26 score" column had been originally reported as follows:

> *Yes: 3.03*
>
> *No: 3.24*

This has been corrected to:

> *Yes: 3.24*
>
> *No: 3.03*

3. Due to corrections to data related to the "Home medical care period (years)" subcategories in Tables 1 and 2, the following corrections have been made to the section "Attributes of Mothers and Children and Their QOL."

The following sentence:

> *The WHOQOL-26 scores were significantly higher for the group with daycare or school attendance (P=.03) and for those with a home care duration of 5 years or more (P=.005).*

Has been revised to:

> *The WHOQOL-26 scores were significantly higher for the group with daycare or school attendance (P=.03) and for those with a home care duration of less than 5 years (P=.01).*

The sentence below (last sentence of the "Attributes of Mothers and Children and Their QOL" section) has been deleted:

> *Regarding the duration of home care, while the WHOQOL-26 scores were higher for those with a duration of 5 years or more (P=.005), the physical and environmental QOL scores were higher for those with a duration of less than 5 years (both P=.007).*

4. The first paragraph in the "Duration of home care" section was originally published as:

> *With regards to the duration of home care, significantly higher WHOQOL-26 scores were obtained in the group with a duration of 5 years or more. It is possible that through continued long-term home care, there is stabilization of the child's health condition as a result of improvement in the child's growth and the family's management abilities. In their study on factors influencing the empowerment of mothers of children with disabilities during home care, Noguchi and Ohmachi [14] reported that a longer duration from diagnosis was significantly associated with higher levels of maternal empowerment. In this study, it is considered that the duration of home care, which correlates with the length of time from diagnosis, is related to a high level of maternal empowerment, resulting in significantly higher WHOQOL-26 scores in the group with a duration of 5 years or more of home care. Baker and Claridge [15] stated that numerous mothers found the transition period post their child's diagnosis to be very difficult and stressful. However, most families were able to establish new daily routines and felt that they could manage their children's illness. Therefore, it is believed that creating a life together as a family with a child receiving medical care may lead to stabilization in life. These findings suggest that patients with longer periods of home care may ultimately experience improvements in their QOL.*

This has been replaced with the following text.

> *During home care, the WHOQOL-26 scores were significantly higher in the group with less than 5 years of care. Parents of children requiring medical care face additional burdens beyond typical childcare, including the technical aspects of medical care and various challenges, leading to a more demanding situation. Nygård and Clancy [14] reported, "When the burden of care becomes overwhelming, parents may lose motivation to continue caregiving, potentially leading to a decline in their caregiving abilities. This may affect the health of parents, family functioning, and the potential health status of children with illnesses." As reported, this suggests that longer care periods may be associated with various impacts and a potential decrease in WHOQOL-26 scores in the group with care periods of five years or more. This finding is consistent with the results of this study. Moyes et al [15] reported that the need for support among parents of children requiring complex medical care changes over time. As the duration of a child's home care increases, it is not that mothers' needs for support disappear, but rather that their needs change over time and they continue to seek support. In this study as well, it is considered that insufficient support tailored to the needs of mothers with longer home care periods may have contributed to the decline in WHOQOL-26 scores.*

5. The following paragraph (last paragraph of "Duration of home care" section) has been deleted:

> *However, it should be noted that this study targeted young mothers ranging from 20 to 40 years of age, while the children's ages were aged 12 years and younger. Considering the possibility of a lighter body weight during growth and development, mothers might not perceive home care as a significant burden. Research on the duration of home care is limited, and further studies on these factors are needed.*

6. Finally, references [14] and [15] have been revised to the following:

> *14. Nygård C, Clancy A. Unsung heroes, flying blind-A metasynthesis of parents' experiences of caring for children with special health-care needs at home. J Clin Nurs. Aug 2018;27(15-16):3179-3196.*
>
> *15. Moyes A, Abbott T, Baker S, Reid C, Thorne R, Mörelius E. A parent first: Exploring the support needs of parents caring for a child with medical*

complexity in Australia. J Pediatr Nurs. 2022;67:e48-e57.

The correction will appear in the online version of the paper on the JMIR Publications website, together with the publication of this correction notice. Because this was made after submission to PubMed, PubMed Central, and other full-text repositories, the corrected article has also been resubmitted to those repositories.

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The Lived Experiences of Racial and Ethnic Minority Nurses Exposed to Racial Microaggressions in the Hospital Setting: Qualitative Study

Da S Kim[1,2], RN, BSN; Ha Do Byon[1], RN, MPH, MS, PhD

[1]School of Nursing, The University of Virginia, 202 Jeanette Lancaster Way, PO Box 800782, Charlottesville, VA, United States

[2]MedStar Georgetown University Hospital, Washington, DC, United States

Corresponding Author:
Da S Kim, RN, BSN
School of Nursing, The University of Virginia, 202 Jeanette Lancaster Way, PO Box 800782, Charlottesville, VA, United States

Abstract

Background: Type II (client-on-worker) workplace violence (WPV) between patients and nurses is an ongoing safety and health challenge in health care. However, little is known about the experiences of racial and ethnic minority nurses specifically in a profession in which most individuals identify as White. During and after the COVID-19 pandemic, type II WPV against certain minority groups increased, which suggests that underrepresented racial and ethnic minority nurses may have unique experiences with type II WPV inflicted by patients, their family members, or visitors.

Objective: The aim of this study was to (1) explore the lived experiences of racial and ethnic minority nurses who have faced type II WPV from patients in the hospital setting, and (2) assess the emotional and physical effects of type II violence among racial and ethnic minority nurses.

Methods: Semistructured individual interviews were conducted with racial and ethnic minority nurses. The research team recruited participants through snowball sampling. Nurses were eligible to participate if they (1) were ages 18 years and older, (2) were currently working as a registered nurse in a hospital in the United States or had previous experience in this role, with the experience dating no earlier than March 2020, when the COVID-19 pandemic began, (3) had experienced WPV from patients, their family members, or visitors at some point during their career, and (4) identified as a racial and ethnic minority. Interviews were conducted between February 2023 and March 2023. A qualitative descriptive approach was used to analyze the findings.

Results: A total of 10 nurses from racial and ethnic minority groups were interviewed: 5 Asian, 2 Latina, 2 African American, and 1 Middle Eastern nurse. Violence experienced by the nurses fell under 2 categories: macroaggressions and microaggressions. Macroaggressions included physical violence, verbal abuse, and sexual violence. Microaggressions were subtle and often unconscious and unintentional comments, interactions, or behaviors relating to the participants' race. All nurses (10/10) reported experiencing racial microaggressions and considered them very harmful. Microaggressions left a negative impact on these nurses in terms of their self-esteem, the nurse-patient relationship, and their job performance. However, many participants did not speak up about microaggressions to either the perpetrator or management because they feared that their experiences would be dismissed. Minimization and normalization of microaggressions were common themes among participants. In total, 90% of participants (9/10) expressed that they do not feel supported in the hospital as nurses of underrepresented minority groups.

Conclusions: Microaggressions are a form of WPV. "Micro" implies small, but the consequences of microaggressions are additive and detrimental. Racial microaggressions negatively impact nurses in terms of their personal well-being, job performance, and ability to deliver quality patient care. Given this, more policies, procedures, and resources must be in place to support racial and ethnic minority nurses in the hospital setting.

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KEYWORDS

nurse; ethnic; minority; marginalized; violence; workplace; microaggression; racism; discrimination; diversity; inclusion; belonging; nurse-patient relationship; Asian; Latinx; African American; Middle Eastern; qualitative; perspective; attitude; lived experience; interview; COVID-19; SARS-CoV-2; coronavirus; respiratory; infectious; pulmonary; pandemic

Introduction

Background

According to the University of Iowa Injury Prevention Research Center, workplace violence (WPV) is divided into 4 main categories: Type I, Type II, Type III, and Type IV [1]. Type II (client-on-worker) WPV is the most common in health care settings [2], involving violence committed by patients, their family members, or visitors.

Compared to other health care professionals, nurses in particular are at a higher risk of being abused in the workplace since they spend more time with patients [3]. Thus, type II WPV is a prevalent issue between nurses and patients in hospitals. In fact, according to a survey conducted in 2024 by National Nurses United, 8 in 10 nurses (81.6%) have experienced at least one type of WPV in the past year [4]. WPV has been found to result in psychological consequences among nurses, including increased levels of anxiety, powerlessness, and helplessness, as well as manifestations of burnout such as emotional exhaustion, diminished job satisfaction, and decreased patient safety [3]. Research has been conducted to describe the overall prevalence and negative effects of WPV among nurses, but unfortunately, little is known about the experiences of nurses from racial and ethnic minority groups specifically in what is a profession in which most individuals identify as White. In 2020, about 81% of nurses were White; in 2022, 80% of nurses were White [5].

The COVID-19 pandemic has shed more light on the experiences of WPV among racial and ethnic minority nurses. Between March 2020—the beginning of the COVID-19 pandemic—and April 2022, there was a 119% increase in WPV among hospital nurses as a whole across all 50 states in the United States, with most assaulters being patients [6]. But Asian American workers specifically were left in a painful position during the pandemic, as there was an increase in anti-Asian racism, violence, and xenophobia [7]. Asian nurses in Canada and the United States actually admitted to experiencing more racism from colleagues, patients, and patients' family members during the pandemic compared to pre-pandemic [8]. They experienced microaggressions such as questions about their ethnic origin and health status with COVID-19, derogatory comments on Asian stereotypes, and blatant discrimination (ie, rejection of care and racial profanities) [8]. A scoping review further confirmed that the COVID-19 pandemic exacerbated racial discrimination against nurses from racial and ethnic minority groups [9].

These findings suggest that nurses from racial and ethnic minority groups may have unique experiences with WPV. We aimed to further explore their experiences.

Literature Review

Our literature review revealed a lack of studies understanding WPV among nurses from racial and ethnic minority groups. We performed an extensive search on 3 databases focused on health care: CINAHL, PubMed, and Web of Science. We were strictly interested in qualitative studies that explored experiences with WPV among bedside registered nurses from racial and ethnic minority groups. The initial search included the terms "nurses," "violence," "harassment," "hospitals," and "qualitative." From here, we identified potentially relevant articles based on title and abstract screening and eliminated articles that were duplicates or not relevant based on full-text review. Articles that were excluded were: published before the year 2020 (the start of the COVID-19 pandemic), conducted outside of North America, systemic reviews, and focused on the experiences of non-bedside registered nurses, such as nursing students, physicians, advanced practice nurses (ie, nurse practitioners), physician assistants, and nurse managers. Our literature review resulted in 1 relevant qualitative study conducted in Canada.

The study found that it was uncommon for White nurses to be discriminated against by patients, and discrimination was mostly reported by nurses from racial and ethnic minority groups [10]. In addition, compared to their White counterparts, racial and ethnic minority nurses experienced sexual harassment, racial slurs, disrespect, rejection or questioning of care by patients for perceived incompetence, degradation, and abuse because of skin color, language barriers, or accents [10]. Nurses from racial and ethnic minority groups reported feeling stereotyped because they were seen to be of a lower class [10].

There have been high rates of violence and aggression experienced by racial and ethnic minority nurses. However, few studies have been conducted to understand the thoughts, feelings, and perceptions of racial and ethnic minority nurses in relation to these experiences. Such studies are needed because there may be unique emotional and physical imprints that WPV and aggression leave on nurses of underrepresented backgrounds.

Goal of This Study

By gaining a better understanding of the experiences of nurses from ethnic and minority groups, hospitals can tailor resources to best meet their unique needs and cultivate a safer environment where they feel seen, heard, and understood. Given this, the purposes of this study were to (1) explore the lived experiences of racial and ethnic minority nurses who have faced type II WPV in the hospital setting and (2) assess the emotional and physical effects of type II violence among nurses from racial and ethnic minority groups.

Methods

Study Design and Recruitment

To explore the experiences of nurses from racial and ethnic minority groups with type II WPV in the hospital setting, we conducted a qualitative descriptive study, following the methodology outlined by Colorafi and Evans [11]. Qualitative description is grounded in the principles of naturalistic inquiry and the concept of truth. It does not require deep theoretical inference or interpretation. Rather, it focuses on studying the topic in a way that is straightforward and avoids deep theoretical abstraction. Data are described and organized in their natural state, through lower levels of inference and manipulation. This approach leads to "true understanding" of the material [11]. This study used the qualitative descriptive approach to ensure that participants' experiences could be studied and described as closely as possible to how they were shared. We aimed to honor the authenticity of the participants' voices and ultimately provide a straightforward and comprehensive summary of findings.

Nurses were eligible to participate in this study if they (1) were ages 18 years and older, (2) were currently working as a registered nurse in a hospital in the United States or had previous experience in this role, with the experience dating no earlier than March 2020, when the COVID-19 pandemic began, (3) had experienced type II WPV from patients, their family members, or visitors at some point during their career, and (4) identified as a racial and ethnic minority. WPV was defined broadly, including, but not limited to: verbal abuse, physical assaults, sexual assaults, threats of harm, harassment, microaggressions, etc.

Ethical Considerations

The study was approved by the Institutional Review Board of the University of Virginia (#5532). Prior to initiating the interviews, all participants were informed about the study's objectives, methods, potential risks, benefits, and data protection measures. Consent was obtained through Qualtrics, a secure online survey platform. No direct identifiers were collected, and all data were collected anonymously. The only information collected from participants were race and ethnicity. No additional data (eg, name, gender, age) were collected to protect participant confidentiality. Participants did not receive compensation for this study.

Data Collection

Semistructured individual interviews were conducted with registered racial and ethnic minority nurses using snowball sampling (N=10) between February 2023 and March of 2023. The sample size was determined by data saturation [12]. After the tenth interview, the ethnic and racial breakdown of participants was diverse, and the first and second author determined that additional data collection would no longer contribute to new insights, patterns, or themes. Because the participants in this study were interviewed based on specific eligibility requirements, their perspectives were rich enough to reach saturation after 10 interviews. Semistructured individual interviews were the preferred method of data collection to gather more open-ended data and delve deeper into experiences that may have been sensitive for the participants. Interviews were conducted by the first author (DSK) through one-on-one Zoom video sessions. Multimedia Appendix 1 shows the semistructured interview guide that was used. Opener questions were posed to participants at the beginning of the interview to create a more comfortable environment, such as: "What race/ethnicity best describes you?" "Tell me about your job;" "Tell me what your typical work day looks like;" "Tell me about your interactions with your patients, their family members, or visitors." Subsequent questions were aimed at exploring the participant's experiences with type II WPV. These questions included: "Tell me about any situation where you experienced workplace violence from patients, their family members, or visitors during your time as a nurse;" "How did you feel when you experienced this workplace violence?" "What thoughts occur to you when you experience violence?" "In what ways, if any, does workplace violence affect your job performance?" Interviews typically lasted between 60 and 90 minutes. At the end of the interview, the participant was provided with a list of resources relating to mental health and WPV due to the vulnerable and sensitive nature of the topic.

Data Analysis

Data analysis began after all interviews were completed. The data was organized following Colorafi and Evan's [11] descriptive qualitative framework and conventional content analysis, a type of analysis that describes a phenomenon where existing research and theory are limited. Recorded interviews were transcribed verbatim by the first author (DSK). The transcripts were read closely multiple times to develop a deep understanding of the data. Sentences or paragraphs from the transcripts were divided into meaning units: segments of text that contain a single idea [11]. Descriptive codes were applied to each meaning unit, and these codes were then grouped into broader categories or themes based on conceptual similarities. The analysis was an interactive process, where codes and themes were continuously reviewed, refined, and revisited as analysis progressed. Codes and themes were developed by the first author (DSK) and finalized with the second author (HDB). There were no concerns or disagreements regarding the codes and themes.

Throughout the entire process of data analysis, we used Colorafi and Evan's [11] 5 standards to ensure trustworthiness of the study: objectivity, dependability, credibility, transferability, and application.

To ensure objectivity, we avoided inflicting personal assumptions and bias and described the study's methods and procedures in detail. To ensure dependability, we maintained consistency in procedures by adhering to Colorafi and Evan's [11] qualitative descriptive analysis method and referencing an interview guide across all participants during interviews. To ensure credibility, the data analysis was reviewed by the second author to confirm that the first author's discovered themes accurately aligned with participants' experiences. To ensure transferability, we provided detailed characteristics of participants (ie, race and ethnicity, role as hospital nurses). We also provided thick descriptions through direct quotes from participants' interviews and rich details of their experiences. Finally, to ensure application, we have suggested ways to stimulate further research under the "Future Research" section of this paper.

Results

Interviewee Characteristics and Their Experiences of Violence

Overview

A total of 10 registered nurses working in hospitals in the United States participated in an individual interview. The ethnic and racial breakdown of the participants was: 5 Asian, 2 Latina, 2 African American, and 1 Middle Eastern nurse. All participants identified as female. During their career, these nurses experienced violence from patients and their family members.

The violence was categorized into 2 main types: macroaggressions and microaggressions.

Macroaggressions

Macroaggressions are more “overt” forms of violence. Macroaggressions are more blatant, often intentional acts of aggression. This form of violence is more deliberate with a clear intent to cause harm against an individual or group [13]. The types of macroaggressions that were experienced by racial and ethnic minority nurses of this study included physical violence, verbal abuse, and sexual violence.

At least once, 70% (7/10) of the nurses experienced physical violence from patients or patients’ family members, such as being hit or swung at. In addition, 90% (9/10) of the nurses experienced verbal abuse. This included yelling, cursing, threats of violence, negative criticism, bullying, name-calling, and derogatory language. Finally, 40% (4/10) of the nurses experienced sexual violence. They experienced being called inappropriate terms of endearment and receiving sexual comments about their body.

Microaggressions

Microaggressions—particularly racial microaggressions—are “subtle insults” or “brief, everyday exchanges that send denigrating messages” to people of color because they belong to a racial minority group [14]. Unlike macroaggressions, microaggressions are more subtle and often unconscious and unintentional comments, interactions, or behaviors that communicate bias to an individual. Within this category, 100% (10/10) of racial and ethnic minority nurses experienced racial microaggressions, which were the most common forms of violence reported. Thus, findings related to microaggressions were highlighted in this study.

Types of Racial Microaggressions Experienced by Racial and Ethnic Minority Nurses

Participants reported experiencing racial microaggressions from patients such as: questioning or inquiries of ethnic and racial origin, generalizations of identity, demeaning comments, questioning of competence, rejection of care, and sexual harassment (see Table 1).

Table . Examples of microaggressions experienced by racial and ethnic minority nurses in the hospital setting.

Type of racial microaggressions	Examples and quotes
Questioning of ethnic or racial origin	A patient asking a racial and ethnic minority nurse “Where are you from?” or “No, where are you *really* from?” with an assumption that the nurse was not born in America. [5 Asian, 1 Latina nurse]
Questioning of ethnic or racial origin	Openly guessing what their nurse’s race or ethnicity is shortly after they walk into the room. (ie, “Are you Chinese? Japanese? Korean?”) [2 Asian nurses]
Questioning of ethnic or racial origin	A patient relating their racial and ethnic minority nurse to another person they are reminded of due to similar skin color or uniqueness of name. (ie, “Oh, I know another Filipino person!”) [1 African American, 1 Asian nurse]
Generalizations and assumptions of identity	Angry black woman stereotype – Pediatric patients referring to African American nurses as “mean” and White nurses as “nice.” [2 African American nurses]
Generalizations and assumptions of identity	A patient stating, “I want a nurse who was educated in the United States” when they see a minority nurse, or when the nurse has an accent. [2 Asian nurses]
Generalizations and assumptions of identity	“Oh my gosh, you must be so lucky you’re here. You’re very blessed to be in America.” [1 Middle Eastern nurse]
Demeaning or invalidating comments	A patient telling a nurse of Iraqi background about their experiences in the military and associating the country with war and violence. (ie, “Things are so bad [in Iraq] ... It’s very uncivilized.”) [1 Middle Eastern nurse]
Demeaning or invalidating comments	A patient mixing up two nurses of the same race/ethnicity and saying, “You two look alike.” [1 Asian, 1 African American nurse]
Questioning of competence	A patient questioning a racial and ethnic minority nurse more than their White counterparts due to perceived incompetence. (ie, Directing simple questions such as “Do you know what heparin does?” to a minority nurse, but not to their White counterparts) [1 African American, 2 Asian, 2 Latina, 1 Middle Eastern nurse]
Rejection of care	A patient stating, “You’re not going to be my nurse” and requesting a White nurse instead. [2 Asian, 2 Latina nurses]
Sexual harassment	Being called “exotic.” [1 Latina nurse]

Feelings Behind Microaggressions Among Racial and Ethnic Minority Nurses

All participants (10/10) expressed that they consider microaggressions very harmful. In fact, they considered it to be a form of direct violence. Participants expressed feelings of annoyance, frustration, sadness, discomfort, and anger when experiencing microaggressions.

Racial and ethnic minority nurses disapproved of microaggressions involving questioning or inquiries of ethnic and racial origin as they felt that they were “weird and uncomfortable conversations.” They believed that their identity was not relevant to patient care:

> *I come in, and I’m like, “Hi, I’m your nurse tonight. Let’s talk about the plan for tonight,” right? And they [the patient] ask me where I’m from… I’m like, “…That’s not the topic at hand.” I’m always like, “Why are we talking about this?”* [Participant A, Asian]

> *It makes me a little uncomfortable when people are like, “Where are you from?” It annoys me ‘cause… that’s not what you should be thinking about. I’m your nurse. We should be thinking about medical care… not my ethnic background. I know most people are just trying to make small talk and be friendly… It’s just not how I like the small talk to go.* [Participant B, Asian]

Racial and ethnic minority nurses also expressed that when experiencing microaggressions, they often felt that they were only seen “at face value” because of the color of their skin, rather than being seen and accepted as a nurse or as a person:

> *It makes me view it as like, “Oh, they don’t see me as, like, a true person. They just see me as, like… an identity,” you know? Like, just… the ethnicity. They don’t really take into account, like… I’m my own individual person. They just see color. Black. And they roll with it.* [Participant I, African American]

Impacts of Microaggressions

Microaggressions were found to have an impact on both a personal and interpersonal level.

Impact on Self

On a personal level, participants expressed that microaggressions negatively impact their confidence and self-esteem. The assumptions that patients had made about racial and ethnic minority nurses (ie, being perceived as “mean” or “incompetent”) caused them to “feel inferior from the get-go.” A participant stated,

> *Why does the way I look have to… attract all of these negative interactions with people? It makes me feel not as worthy, and… not as competent. It just feels like I’m always on edge about my comfort and safety.* [Participant J, Middle Eastern]

As a result of these feelings, nurses of underrepresented minority groups frequently mentioned feeling pressure to “overcompensate.” A participant explained that “as a person of color... you have to work… ten times as hard just to be perceived as more competent in the workplace. You have to make your stance known.” Another participant shared about the challenges she had experienced when trying to build positive relationships with patients:

> *I had to convince her that I was a nice person instead of that already being assumed. I had to convince her that I was knowledgeable. It’s like you always have to convince people that you are these qualities that they assume of others – or at least, that’s how it feels. I don’t know if that’s just… an insecurity that some people of color have… but I definitely feel like I’ve overcompensated a lot by trying to… prove myself when I shouldn’t have to.* [Participant J, Middle Eastern]

Participants also reported feeling vulnerable as racial and ethnic minority nurses. Although WPV is an issue that affects nearly all health care professionals, nurses of underrepresented backgrounds felt especially prone to violence as they believed that their racial and ethnic background added an “extra layer of vulnerability” that gave patients “something else to target.”

Impact on Nurse-Patient Relationship

On an interpersonal level, participants felt that microaggressions impacted their job performance and ruined the nurse-patient relationship. They felt more detached, less willing to engage in conversation, and less willing to go above and beyond when providing care. As a result, they would “minimize staying in the room” by doing the “bare minimum” and “just go in and out.” Participants believed that minimizing their interactions with patients would provide patients with fewer opportunities for microaggressions. A participant explained:

> *I feel like it [microaggression] is so demeaning. It… ruins the patient-nurse relationships. I don’t do anything bad – It’s just the way I approach them is just different… More detached. I do what I need to do, and I get out. It’s unfortunate because they don’t get the best care that I can give them because they’re being inappropriate.* [Participant G, Latina]

In addition, the nurses often experienced a sense of “vigilance” or anxiety when approaching conversations due to fear of what the patient would say in regard to their racial or ethnic identity. Some explained it as being in a constant state of “fight or flight”:

> *I think that it [microaggression] has affected the way that I… relate to my patients… There’s that… sort of a barrier inside of me that’s worried that they're gonna be… racist towards me or say something rude and… strike up a conversation that I’m not gonna want to navigate… I think that that affects how I talk to them, which sucks because I don’t want it to… affect the bond that I have with my patients. But sometimes those… anxious feelings kind of do.* [Participant J, Middle Eastern]

Speaking Up About Microaggressions

Only one (n=1) racial and ethnic minority nurse expressed speaking up about microaggressions to the charge nurse when they occurred, while others remained silent. There were two main reasons behind not speaking up: (1) minimization and (2) normalization.

Minimization

Many participants did not speak up about microaggressions to either the perpetrator or management because they felt that their experiences with microaggressions would be undermined or dismissed. Participants felt that they would be seen as "dramatic" if they were to bring these issues to light:

> *I think because it's not, like, a "direct" attack, then it's harder for other people to understand because they'd be like, "Oh, what's the problem? They just asked you this" or "They were just commenting on their experience with this."* [Participant H, African American]

Normalization

Majority of participants (n=8) of participants expressed that they experienced racial microaggressions not only in the hospital but also in their personal lives outside of work and while growing up. They had become "used to it," and, as a result, learned to "just deal with it" over time. Thus, they internalized their experiences:

> *We're just so used to getting asked that question… 'cause we don't wanna focus on it, we just brush it aside… We just… shove it under the rug, ignore it, and that's what we're used to doing. And that's probably why it's been normalized because people are like, "Oh, they don't mind being asked that question." … But the reason that we do it is because we want to move past that… Other people don't see it the same way.* [Participant A, Asian]

Perceived Causes of Microaggressions Among Racial and Ethnic Minority Nurses

Participants believed that racial microaggressions stemmed from the media, news, and politics, a lack of diversity in the health care team, patients' lack of exposure to diverse cultural groups, patients' upbringing, and patients' inability or unwillingness to unlearn certain stereotypes and assumptions.

Lack of Support for Racial and Ethnic Minority Nurses

In total, 9 out of the 10 interviewed participants (n=9) expressed that they do not feel supported in the hospital as nurses of underrepresented minority groups due to three main reasons: (1) lack of conversations and acknowledgment surrounding the unique struggles that racial and ethnic minority nurses face, (2) lack of resources on diversity, equity, and inclusion, and (3) lack of diversity within the health care team:

> *I feel like it hasn't even been brought up… not really any topics regarding… diversity, or the fact that we're [racial and ethnic minority nurses] kind of more vulnerable to WPV… I think that they don't acknowledge that it's there, which is the bigger issue.* [Participant H, African American]

> *I… don't have anybody on the unit that is… Latina as well to… talk about these things… So, I do feel alone sometimes in that sense.* [Participant F, Latina]

Discussion

Principal Findings

Microaggressions were highlighted in our study. All participants in our sample (10/10) experienced racial microaggressions by patients in the hospital, and they considered microaggressions as a form of WPV. Many racial and ethnic minority nurses referred to their accounts of microaggressions as "little comments" or "small comments" that may not be seen as a form of violence in others' eyes, especially when comparing the magnitude of this violence to more blatant forms of violence such as physical attacks or sexual assault. Microaggressions are falsely believed to have minimal negative impact, and people of color are often told not to "overreact" and simply "let it go." [14] This was a common sentiment among nurses from racial and ethnic minority groups in this study.

However, even though the prefix "micro" means "small," all interviewed participants expressed that they consider microaggressions very harmful. Microaggressions had a negative impact on participants' confidence and self-esteem, causing feelings of inadequacy and inferiority. Participants felt that they had to work harder to prove their competence in the workplace. Microaggressions unfortunately impacted the nurse-patient relationship as well. Participants experienced decreased job performance and felt more detached from their work after experiencing microaggressions. They limited interactions with patients and spent less time in patients' rooms due to anxiety, ultimately compromising the quality of care that was delivered. Previous studies have shown that microaggressions can be "detrimental to persons of color because they impair performance in a multitude of settings by sapping the psychic and spiritual energy of recipients and by creating inequities." [14] This shows that microaggressions are subtle, but the consequences are additive and prevent the delivery of adequate, patient-centered care [15].

Most nurses (n=9) did not feel supported in the hospital. They expressed that there was a lack of conversations and acknowledgment regarding the fact that racial and ethnic minority nurses can be more vulnerable to WPV. They wished for more resources and topics that teach about diversity, equity, and inclusion, as well as more diverse health care teams.

Comparison With Previous Work

The findings of this study were consistent with those of another study that explored racial microaggressions experienced by minority registered nurses working in a hospital in the mid-Atlantic region. Microaggressions from patients and their families were commonly experienced by racial and ethnic racial and ethnic minority nurses, and examples included biased first impressions (ie, making comments or assumptions about race), "firing" the nurse (ie, refusal of care due to race), and questioning experience or credentials [16]. Nurses of this study also "felt that they had to prove themselves to be perceived as equal to their White coworkers," [16] which was a similar finding among nurses of our study.

Racial microaggressions are a common experience among individuals from racial and ethnic minority groups, and they are so "pervasive and autonoetic in daily conversations and interaction that they are often dismissed and glossed over as being innocent and innocuous." [14] However, there are several research studies that have shown the detrimental effects of racial microaggressions in the health care setting [17].

In a cross-sectional, correlational study, racial and ethnic minority nurses reported experiencing racial microaggressions at a rate that was nearly 3 times higher than their White counterparts, and racial microaggressions had a large effect on the likelihood of severe emotional distress [18]. Another study explored the specific impact of racial microaggressions among underrepresented medical and nursing students at various universities in the United States. Overall, students felt devalued by racial microaggressions and experienced stress, frustration, and anger; they also believed that microaggressions negatively impacted their academic performance and personal well-being [19]. In a study that examined medical students' experiences with microaggressions, the cumulative effects were devastating—the results were feelings of self-doubt, isolation, poor academic and learning performance, impaired productivity, well-being, and mental function, and weakened relationships [20]. These findings are congruent with those of our study, further supporting the idea that microaggressions are both harmful and cumulative.

In our study, racial microaggressions and WPV were shown to impact not only the nurses but also the delivery of patient care. In one study, health care providers who experienced WPV in the emergency department were interviewed and asked to identify the consequences of type II WPV [21]. Participants believed that while health care providers experienced the most consequences, patients and patient care suffered greatly as well. In fact, participants reported that fear of violence often affected their medical decision-making, causing them to treat patients in the manner least likely to result in a violent outcome, rather than doing what is medically indicated. These findings align with those of our study, where participants felt that limiting their interactions with patients or spending less time in patients' rooms would reduce their exposure to microaggressions. Other studies have reported that type II WPV and discrimination are correlated with burnout among health care professionals, and burnout results in higher odds of major medical errors [22].

Racial and ethnic minority nurses in this study expressed that they do not feel supported in the hospital. More specifically, they reported inadequate support from management in terms of navigating microaggressions, which fuels the normalization of microaggressions in the hospital setting. Other studies have shown that many faculty educators lack formal training in supporting students after incidents of microaggressions in the clinical environment, especially since microaggressions are more difficult to recognize or easily dismissed compared to more overt forms of WPV and macroaggressions [23]. This highlights the need for strategies, resources, and structural accountability to address and mitigate microaggressions in the clinical setting. Examples of structural accountability include implicit bias and antiracism training (ie, set policies, training tools when microaggressions are witness or experienced) and identification of mentors to provide a support system where recipients of microaggressions feel protected and valued [24].

Most of the nurses in our study did not speak up about microaggressions after they occurred to either the perpetrator or to management. Sue et al [25] outlines four key strategies for victims, allies, and bystanders when addressing microaggressions: (1) make the "invisible" visible by raising awareness to the fact that microaggressions do exist, (2) disarm the microaggression by immediately stopping it, interrupting or redirecting, communicating disagreement, stating values, and setting limits, (3) educate the offender on how or why their microaggression is harmful, and (4) seek external support by alerting leadership, reporting the act, and creating community with friends, allies, and support groups. At the systemic level, hospitals can offer workshops centered around educating employees on microaggressions. There is one study that implemented an active bystander training workshop with physicians; the workshop used cased-based simulations with standardized patients to teach physicians how to respond to microaggressions. Participants of this workshop reported statistically significant improvement in recognizing microaggressions, responding to patient's microaggressions, and debriefing with team members [26]. Other workshops incorporating educational PowerPoints and small-group discussions have been reported to have high satisfaction from participants as well [27,28].

Many of our participants expressed the importance of diversifying the health care team. Studies have shown that there is a lack of underrepresented minorities in health care leadership positions. In nursing specifically, only 20% of nurses are of racial and ethnic groups [29]. Since it can be easier for marginalized groups to recognize microaggressions than nonmarginalized groups, promoting diversity in the health care setting would improve the recognition of microaggressions, eventually leading to the implementation of institutional policies and culture change [23]. In this study, racial and ethnic minority nurses reported feeling supported and greater job satisfaction when working with other minorities. In addition, they expressed a sense of hesitancy in speaking up about their experiences to their White coworkers due to fear that their concerns would be undermined. A participant expressed that they felt alone and isolated in their experiences as they lacked other racial and ethnic minority nurses to turn to. Similarly, one study found that when encountering WPV, racial and ethnic minority nurses often sought support from the larger network of nurses from racial and ethnic minority groups at the hospital as a way to cope with conflicts [10].

Hospitals can diversify health care teams through various strategies. First and foremost, diversity and inclusion should be ingrained within the culture of the organization as a whole by making these values an integral part of its mission [29]. In addition, stakeholders from all levels of the organization should be included in discussions regarding diversity, equity, and inclusion so that these values are upheld at every structural level [29]. Given this, increased racial and ethnic minority nurse representation in leadership and decision-making roles is critical. A key method in achieving this would be to provide mentorship programs that support racial and ethnic minority nurses in obtaining leadership positions [30]. Finally, it is important for recruiters to recognize and eliminate their own biases during the recruitment process through implicit bias training [31].

Strengths and Limitations

There are several strengths to this study. For one, this study contributes to the gap in the literature that exists regarding the experiences of racial and ethnic minority nurses with WPV, specifically in the context of microaggressions. In addition, the qualitative approach of this study allowed participants to elaborate on their experiences and provide specific details. The sample was also diverse in their racial and ethnic identities. Finally, the research team was composed of individuals who are well-versed in this topic of study. They are racial and ethnic minorities with health care experience, and the second author's (HDB) research expertise lies in WPV in health care settings. Thus, their background and knowledge allowed for the study to be strategically designed in a way that is not only culturally sensitive but also meets the research aims.

A limitation of this study is the lack of previous research on this topic which prevented us from replicating procedures or building on significant findings. In addition, because our interviews were not intentionally designed to achieve diversity across other demographics such as gender, our sample consisted of exclusively female participants, which limits the generalizability of findings. The snowball sampling method and small sample size make it challenging to make accurate inferences about the larger population as well. It is also important to acknowledge that while the semistructured interviews allowed for more fluidity in conversation, they may have resulted in inconsistencies in data collection. For example, valuable questions that were posed to some participants were not posed to other participants at times.

Future Research

More research can be done to explore variability in WPV experiences across different racial and ethnic groups. For example, a study found that Asian American nurses experienced an increase in discrimination after COVID-19, and 75% of nurses experienced job harassment, unfair treatment, and feeling invisible at work [32]. Only 1 study exploring WPV among Hispanic nurses was found. The study found that some of the top reported WPV events were emotional-verbal types of violence such as "criticized," "made to feel bad," "shouted or yelled at," and "insulted or sweared at." Sexual types of WPV were also some of the most common among Hispanic nurses, including "suggestive looks" and "sexist remarks" [33]. Another study that explored mistreatment in the workplace among physicians of various racial and ethnic groups found that verbal mistreatment was the highest among physicians from Black communities and lowest among physicians from White communities [34]. Physicians from multiracial and Black communities were more likely than physicians from White and Asian communities to report experiencing at least one form of mistreatment [34]. These findings highlight the need for further research to better understand if and how WPV manifests differently across various minority groups.

In addition, studies are needed to explore the role that intersectionality plays in WPV. Although this study highlights how race and ethnicity impacts WPV, it is important to acknowledge that other aspects of an individual's identity—gender, age, sexuality, disability, class, immigration status, religions, cultural background, and other social and demographic identities—may shape a unique experience. For example, while sexual harassment impacts all individuals, research has shown that lesbian women and women who do not conform to traditional feminine expectations are more often targets of sexual harassment, and older women have been found to face more discrimination than older men based on physical appearance [35]. The study also found that 69% of women wearing a hijab have experienced at least one incident of discrimination [35]. In our study, all participants identified as female, which may have impacted our findings in some way. Taking an intersectional approach to future WPV studies is a complex yet necessary step to better understand individuals' lived experiences.

There is a lack of literature on effective interventions for confronting and preventing microaggressions in health care settings. More research is needed to examine successful models that tackle microaggressions, as well as institutional efforts aimed at supporting racial and ethnic minority nurses. This would allow hospitals to implement similar interventions at their own facilities.

Quantitative studies examining the long-term effects of microaggressions on racial and ethnic minority nurses' well-being would provide valuable data as well. Racism-related stress theory [36] suggests that individuals who encounter racism, prejudice, and discrimination also experience high levels of stress, leading to long-term outcomes in 5 domains: physical (ie, hypertension and cardiovascular reactivity), psychological, (ie, general psychological distress and trauma-related symptoms), social (ie, decreased ability to trust or have close relationships), functional (ie, decreased job performance), and spiritual (ie, threatened vitality of spirit and faith). More research is needed to study how racial microaggressions may affect racial and ethnic minority nurses in each of these domains.

At the same time, studies can be conducted to explore how racial microaggressions may empower racial and ethnic minority nurses. One scoping review found several studies reporting that "the experience of racism, though challenging, also motivated participants to succeed or overcome obstacles, suggesting a complex interplay between adversity and resilience among minority nurses" [37]. Racial and ethnic minority nurses in this study expressed experiencing microaggressions not only in the hospital but also in their day-to-day personal lives and while growing up. To have continued to maintain their dignity in the face of hostility is a testament to their resiliency [14]. Exploring their coping mechanisms and strategies may empower those who have faced similar experiences.

Finally, studies are needed to explore type III (worker-on-worker) WPV and racial microaggressions. Although not included in the results of this study, participants did mention experiencing racial microaggressions from coworkers. Studying this may highlight the need for increased cultural awareness and education among health care professionals.

Conclusions

The findings of this study offer insight into the genuine thoughts, feelings, and experiences of nurses from racial and ethnic minority groups who have experienced WPV in the hospital setting. This study shows that microaggressions are a form of WPV. By recognizing microaggressions and understanding their harmful effects, hospitals and management can provide resources that aid racial and ethnic minority nurses in navigating such incidents. In addition, the findings raise awareness of what may constitute microaggressions, which sheds light on the need for patients, family members, and health care professionals to be more educated and culturally aware on issues that impact marginalized communities. Supportive organizational infrastructures need to be in place to enhance diversity awareness and encourage better multicultural interactions in the workplace [38]. Finally, racial and ethnic minority nurses thrive in diverse health care teams—prioritizing diversity and inclusion in the workplace can improve feelings of support, safety, and self-esteem among the nurses as well as cultivate a culturally sensitive environment. Addressing these issues will improve the nurse-patient relationship and the delivery of care.

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Data Availability

The datasets generated during and analyzed during this study are not publicly available due to confidentiality reasons.

Authors' Contributions

DSK conceptualized and designed the study, recruited participants, conducted interviews, transcribed interviews, analyzed the data, interpreted the findings, and took the main role in writing the manuscript. HDB contributed to the study's conception and design, participated in data analysis and interpretation, and critically revised the manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1
Semistructured interview guide used during the data collection process.
[DOCX File, 3496 KB - apinj_v9i1e67029_app1.docx]

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Abbreviations

WPV: workplace violence

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Perspectives of Persons With Disabilities Toward Home Adaptations and Assistive Products in Rural Northern Thailand: Comparative Study

Anuchart Kaunnil*, PhD; Peeraya Munkhetvit*, PhD; Hataichanok Apikomonkon*, MSc; Jiranan Griffiths*, PhD

Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, 110 Intawaroros Rd., Sripoom subdistrict, Mueang District, Chiang Mai, Thailand

*all authors contributed equally

Corresponding Author:
Jiranan Griffiths, PhD
Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, 110 Intawaroros Rd., Sripoom subdistrict, Mueang District, Chiang Mai, Thailand

Abstract

Background: Persons with disabilities in rural northern Thailand face significant challenges in accessing appropriate support, particularly in Chiang Mai's rural community, where limited infrastructure and socioeconomic barriers hinder their independence. Home adaptations (HAs) and assistive products (APs) play a crucial role in enhancing the safety and quality of life; however, perspectives on their use remain underexplored.

Objective: This study aimed to compare the views of persons with disabilities with and without experience of using HAs and APs, focusing on their perceptions of the environmental conditions, safety, benefits, and barriers.

Methods: A comparative cross-sectional survey was conducted among persons with disabilities living in rural communities of the Doilor Subdistrict, Chiang Mai. Data were analyzed using descriptive statistics and the Mann-Whitney *U* test.

Results: In 96 participants, 84 completed the questionnaire (48 without and 36 with experience using HAs and APs). Most individuals without HAs and APs were dissatisfied with their living conditions (36/48, 75%) and felt unsafe at home (33/48, 69%), whereas experienced users reported higher satisfaction (21/36, 58%) and safety confidence (25/36, 69%). While those without HAs and APs believed these adaptations could enhance their engagement at home, 75% (27/36) of experienced users reported that they had improved their participation skills. Significant differences were found between groups in perspectives on home conditions, living environment, and APs ($P<.001$), confidence in safety ($P<.001$), and skills for home engagement ($P<.03$). Both groups recognized the benefits of HAs and APs, with 94% (45/48) and 91% (33/36; without and with experience, respectively) agreeing that they improve daily functioning, and 95% (46/48) and 92% (33/36) acknowledging their role in reducing accident risks. HAs and APs significantly enhanced social participation ($P<.04$), with 41% (15/36) of experienced users strongly agreeing, compared with 19% (9/48) of those without experience. Financial constraints were the main barrier to HAs and APs adoption for over 90% of both groups. Service access challenges were more common among experienced users (32/36, 89%) than those without experience (36/48, 75%), with no significant differences in difficulties accessing services for home modifications and assistive devices.

Conclusions: The study indicates that persons with disabilities face various problems. Both with and without experience of HAs and APs need to enhance their home modification and support to bridge the gaps in accessibility and practical solutions to improve the quality of life for persons with disabilities in rural communities. This study recommends that policymakers should focus on increasing funding, improving service delivery, and enhancing awareness programs to support individuals in need. Future research should explore the long-term impacts of HAs on quality of life and independence.

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KEYWORDS

persons with disabilities; home adaptations; assistive products; rural Thailand; occupational therapy

Introduction

Over 1.3 billion people globally have some form of disability; these people represent about 16% of the global population [1]. The rise in noncommunicable diseases and longer life expectancy are contributing to a growing number of people with disabilities. This group is diverse, with their life experience and health needs shaped by various factors like sex, age, gender identity, sexual orientation, religion, race, ethnicity, and economic status. Furthermore, there were 190 million persons with disabilities aged 15 years and older who experienced obstacles in daily life and needed medical and social services [2]. Significantly, the majority of persons with disabilities, approximately 80%, reside in low- and middle-income countries, where they encounter substantial barriers to social participation and inclusion [3]. According to the countries in South America, housing modifications were established as sustainable development for persons with disabilities [4].

In Thailand, the National Statistical Office [5] conducts disability surveys every 5 years, with the most recent survey carried out between October and December 2022 to collect comprehensive data on persons with disabilities. It is estimated that 2.2 million persons with disabilities, representing 3.33% of the Thai population, comprise 51.4% (1,141,167/2,220,009) males and 48.6% (1,078,842/2,220,009) females. The most common types of disabilities are mobility disability (1,149,437/2,220,009, 51.78%), followed by hearing impairment (428,397/2,220,009, 19.3%) and visual impairment (171,083/2,220,009, 7.71%). Regarding labor force participation, 48.72% (395,252/811,350) of persons with disabilities are unemployed, 26.84% (217,737/811,350) are unable to work due to severe disabilities, 24.09% (195,434/811,350) are employed, and some prefer not to disclose their occupation. Most persons with disabilities are employed in the agriculture sector (96,153/195,434, 49.2%), followed by the service and trade sectors (75,828/195,434, 38.8%) and the production sector (23,452/195,434, 12%) [5]. As a result, these persons with disabilities face barriers to employment, leading to a diminished quality of life. According to the World Health Organization (WHO) [6], quality of life is influenced by the interaction between an individual, social participation, and their environment. Five key environmental factors contributing to this interaction include (1) products and technology, (2) the built environment, (3) social relationships and support, (4) societal attitudes, and (5) services, systems, and policies. Within the various factors influencing daily living, environment and products are integral components within the broader domain of assistive products (APs) and technology. This is a field that plays a crucial role in enhancing quality of life by promoting independence, enabling active participation, and supporting overall well-being among persons with disabilities, older adults, and other populations in need.

Home adaptations (HAs) refer to permanent structural modifications made to enhance accessibility and suitability for individuals with disabilities [7]. This intervention aims to prevent further deterioration of bodily functions, enhance functional capacity, and promote engagement in social and community services. The primary goal of HA is to eliminate environmental barriers, enabling individuals to perform daily activities with greater safety and efficiency. This approach aligns with environmental theories emphasizing the relationship between the individual, their environment, and functional performance. Research conducted in Sweden demonstrated that HAs significantly improved individuals' abilities to perform daily living activities and enhanced their sense of safety [8]. In addition, a separate study found that environmental assessments and modifications could effectively reduce care needs among older people and persons with disabilities [9].

APs encompass a wide range of external devices such as prosthetic limbs, wheelchairs, hearing aids, pill organizers, and accessible information and communication technology that are designed to support persons with disabilities by enhancing their functional independence and ability to participate in daily life activities [10]. However, just 10% of people worldwide have access to APs, making the proportion of persons with disabilities who do so extremely low. To address this, the WHO launched the Global Cooperation on Assistive Technology initiative and the Priority Assistive Products List to improve access through better infrastructure, policies, service delivery, and trained personnel [11]. Furthermore, Tebbutt et al [12] found that without universal access to APs, the Sustainable Development Goals cannot be achieved equitably, reinforcing their role as a cornerstone of inclusive and sustainable development.

In previous studies, Ding et al [13] examined practitioners' perspectives on the growing affordability (budget-friendly) and practical importance of HAs, smart technology, and assistive devices. Their findings indicate that these interventions are vital in assisting persons with disabilities by improving environmental management and promoting greater independence [13]. Giesbrecht et al [14] examined the mobility device needs of Canadians with disabilities (n=45,442) using follow-up data from the National Household Survey. They found that 10% of wheeled mobility device users had unmet needs, with users experiencing higher unmet needs than nonusers. In addition, users required more home modifications and assistance compared with nonusers. According to Labbé et al [15], the research team explored how families with disabilities perceive their homes, using the psychoenvironmental potential model to assess home characteristics influencing well-being. Through interviews with 31 individuals with spinal cord injuries, they found that home plays a crucial role in meeting psychological and social needs. Their findings highlight the significant impact of home on well-being and suggest that disability shapes experiences differently for individuals and families.

Struckmeyer et al [16] examined home modifications concerning accessibility challenges and aesthetic preferences. Through focus groups involving 16 participants (8 consumers and 8 professionals), the study identified barriers to accessibility, including inadequate contrast, inappropriate fixture heights, door designs, and flooring. In addition, findings indicated that consumers prioritize attractiveness more than professionals. The study suggests that repurposing existing spaces can effectively address affordability while accommodating consumer preferences, consistent with Ainsworth et al [17], who conducted a study to examine the experiences of older adults and persons with disabilities regarding home modifications and their perceived value of outcomes. Using an interpretive description approach, interviews were conducted with 20 participants aged 24-93 years. The findings revealed two primary themes: (1) experience before and during home modifications and (2) experience after modifications. The study highlighted that valued outcomes included enhanced health, safety, and considerations for future planning.

In South Korea, Jo and Kim [18] conducted a pilot randomized controlled trial comparing the effects of HAs and APs with home exercise among 20 persons with disabilities. The findings indicated that the use of HAs and APs significantly increased activities of daily living participation time in the experimental group ($P<.05$). Furthermore, the experimental group demonstrated enhanced competence in occupational performance, while the control group exhibited improved occupational performance values ($P<.05$). In addition, activity limitations significantly decreased in the control group ($P<.05$), whereas no significant reduction was observed in the experimental group.

In Thailand, Sukkay [19] conducted a study on multidisciplinary approaches to HA design for persons with disabilities, using the International Classification of Functioning, Disability and Health framework in conjunction with postoccupancy evaluations focused on mobility. The study revealed that the majority of residencies of persons with disabilities lacked standardized criteria for HAs. Notably, inappropriate room dimensions and unsuitable furniture significantly impeded accessibility. The study emphasized that essential spaces, such as toilets and bedrooms, were particularly difficult for persons with disabilities to access. Building upon this work, Sukkay and Upala [20] developed a set of housing and spatial design guidelines tailored for persons with disabilities. Their methodology involved a comparative assessment of guideline approaches—one based on comparative studies, and the other on participatory processes. Data were collected via questionnaires distributed to 30 government officials and 30 individuals with mobility impairments. The findings indicated significant differences in the evaluation of design categories between the 2 groups. Furthermore, the participatory-based guideline approach demonstrated greater efficacy in addressing user needs than the comparative study-based method.

While Tongsiri et al [21] examined the effectiveness of a home environment modification program aimed at improving the quality of life for Thai persons with disabilities, their intervention incorporated training sessions focused on universal design principles, followed by direct modifications in 43 homes. The results underscored the importance of collaboration with district hospitals and local health care teams to optimize the functional capacities of individuals with disabilities. More recently, Selanon and Chuangchai [22] explored interior residential design preferences and needs among individuals with physical disabilities. Employing a large-scale questionnaire survey comprising 384 participants with 8 types of disabilities, their study found that physical abilities varied significantly by age, gender, and place of residence. Importantly, the data revealed a positive correlation between in-home mobility and various outcome measures such as out-of-home mobility, physical capabilities, independence, and perceived health status ($P<.05$). These findings highlight the critical need for residential interior design that accommodates physical variability through strategic planning of layout, furniture, flooring, and lighting to enhance overall mobility.

Hence, Thai persons with disabilities continue to face significant barriers in accessing HAs and APs, despite national efforts to promote inclusive living environments. Previous studies had identified substantial gaps in the availability and accessibility of HAs and APs support services, underscoring the pressing need for strengthened policies to ensure equitable access to health care and social support for persons with disabilities [23,24]. Furthermore, studies have pointed to low rates of disability registration and limited uptake of disability-related welfare benefits, suggesting systemic challenges in reaching persons with disabilities and their families through current service delivery models [25].

In terms of HAs and APs approach, occupational therapists play a critical role in assessing an individual’s capacity to perform daily living activities through comprehensive activity analysis. This process involves evaluating and recommending appropriate HAs and assistive devices tailored to the client’s needs, skills, and abilities. Occupational therapy interventions frequently include structural modifications such as installing grab bars, ramps, walking aids, bath transfer cushions, and pressure-relieving cushions. These modifications aim to create a more accessible and safer environment, promote independent self-care, enhance access to household items and furniture, and ultimately improve overall quality of life [26]. By integrating knowledge of daily living activities, environmental modifications, and assistive technology, occupational therapists strive to align interventions with the individual’s lifestyle, personal factors, environment, and broader contextual influences.

This study focused on the target area at Doilor Subdistrict, situated in Chiang Mai Province in northern Thailand. This rural area comprises 26 villages with a total population of 12,227 individuals, including 5982 males and 6245 females [27]. Most residents (8546/12,227, approximately 70%) are engaged in agricultural work, producing crops such as longan, rice, cantaloupe, tomato, and pumpkin, with longan being the primary export commodity. As of 2024, a total of 235 persons with disabilities were officially registered in Doilor community [27]. Access to appropriate HAs and APs plays a vital role in enhancing the health, autonomy, and overall quality of life of persons with disabilities, particularly in rural and remote areas. By exploring the perspectives of persons with disabilities in this rural northern Thai community, this study aims to compare the views of persons with disabilities with and without experience using HAs and APs, focusing on their perceptions of environmental conditions, safety, benefits, and barriers. This study could contribute to the development of more responsive, community-centered strategies that bridge the gap between policy and practice.

Methods

Overview

A cross-sectional study was designed using a questionnaire to examine the perspectives of people with disabilities on HAs and APs. A structured questionnaire was developed comprising four main sections: (1) participant background—collected demographic and general information about the respondents; (2) perceived benefits of HAs and APs—assessed participants’ views on the advantages and usefulness of HAs and APs in daily living; (3) accessibility and usability—examined the availability, ease of access, and usability of HAs and APs in participants’ homes and communities; and (4) challenges and barriers—identified obstacles and limitations faced by persons with disabilities in adopting or using HAs and APs. Before its deployment, the questionnaire underwent validation using the item-objective congruence method to evaluate content relevance and clarity. Each item was rated on a scale from –1 to +1, where +1 indicated clear relevance (congruent), 0 indicated uncertainty (questionable), and –1 indicated irrelevance (incongruent). Items scoring 0.5 or higher were retained. Those with lower scores were either revised based on expert feedback or removed if no feedback was available. Content validation was conducted by 3 licensed occupational therapists, each with over a decade of experience working with persons with disabilities in rural Thai communities. Following expert review and revision, the final version of the questionnaire achieved an item-objective congruence index score of 0.83, indicating strong content validity. Participants responded to survey items using a five-point Likert scale: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree.

The required sample size was calculated with Cochran’s sample size formula for proportion [28]. The total persons with disabilities population in Doilor subdistrict, Chiang Mai Province, was obtained from the database (n=235). The Cochran sample size formula was modified for a smaller (finite) population, resulting in a sample size of 91. After adding 5% for the nonresponse rate, the final sample size was calculated to be 96 persons with disabilities.

The study used a structured approach to data collection. Between October and November 2022, the research team visited the Doilor Community Rehabilitation Center to administer questionnaires to persons with disabilities who met the inclusion criteria. Questionnaires and informed consent forms were provided for participants at home. All participants reviewed and signed the consent forms before completing the questionnaires. Additional information was collected regarding the participants’ home settings and surrounding environments. To ensure the quality and reliability of the data, each step of the research process was carefully documented.

The study analyzed survey data using descriptive statistics and employed the Mann-Whitney *U* test to compare median responses on Likert scale items between 2 independent groups. Data analysis was conducted using SPSS version 25.0 for Windows (SPSS Inc). Given the nature of the data, nonparametric tests were used to compare participants with and without experience using home HAs and APs. The Mann-Whitney *U* test assessed group differences, with statistical significance set at $P<.05$ (1-tailed).

Ethical Considerations

The study was approved by the Ethics Committee of the Faculty of Associated Medical Sciences at Chiang Mai University (reference AMSEC-65EX-030). Before participation, written informed consent was obtained from the legally authorized representatives of all participants. The data safeguarded participants’ privacy, maintained the confidentiality of all information collected, and ensured fair compensation for their involvement.

Results

A questionnaire survey was conducted with 96 participants from the Doilor community. A total of 84 individuals participated and completed the questionnaire, including 37 (44%) men and 47 (56%) women. Among them, 35 (42%) participants were older than 60 years old, 21 (25%) were aged 51 - 60 years, and 18 (21%) were aged 41 - 50 years. Regarding marital status, 53% (43/84) were married, 42% (34/84) were widowed, and 2.5% (2/84) were separated. Most participants (65/84, 77%) lived alone, while 23% (19/84) lived with family members; 88% (74/84) resided on their own land. In terms of education, 59% (49/84) had completed primary school, while 35% (29/84) had no formal education. More than half (44/84, 52%) were still employed. Most participants (31/84, 70%) were employed by others and received wages or salaries: 21% (9/84) engaged in farming on their own land or family-owned farms, and 9% (4/84) ran small businesses, such as local shops or self-employed services. Notably, 92% (77/84) reported a monthly income below 5000 Baht (approximately US $149), as detailed in Table 1.

Table . Demographic data of the survey participants (n=84).

Categories	Participants, n (%)
Gender	
Women	47 (56)
Men	37 (44)
Total	84 (100)
Age (y)	
18 - 30	4 (5)
31 - 40	6 (7)
41-50	18 (21)
51-60	21 (25)
>60	35 (42)
Marital status	
Married	43 (53)
Widow or widower	34 (42)
Divorced	2 (2.5)
Separated	2 (2.5)
Living arrangement	
Family	19 (23)
Alone	65 (77)
Residency status	
Owner	74 (88)
Resident with family	10 (12)
Rent	—[a]
State properties	—
Educational level	
Uneducated	29 (35)
Primary school	49 (59)
Junior high school	2 (2)
Senior high school	3 (4)
University degree	—
Work status	
Work	44 (52)
Retired or unemployed	40 (48)
Profession status (n=44)	
Agriculture (work on their own land or family-owned farms)	9 (21)
Business (local shops or self-employed services)	4 (9)
Employee (are employed by others and receive wages or salaries)	31 (70)
Income (month)	
<5000 Baht (US $149)	77 (92)
5000 - 10,000 Baht (US $149 - 298)	7 (8)
10,001 - 15,000 Baht (US $298 - 447)	—
>15,000 Baht (US $447)	—

[a] Not applicable.

The survey results revealed that 57% (48/84) of participants without previous experience using HAs and APs (nonusers), while 39% (36/84) had experience using HAs and APs (users). Among those who had access to these HAs and APs, the majority (21/84, 58%) received them from family members, while 39% (14/84) were supported by government assistance.

Multimedia Appendix 1 presents the distribution of daily living activities supported by HAs and APs. Toileting emerged as the most frequently supported activity, reported by 39.2% (33/84) of participants. This was followed by bathing and showering (22/84, 25.7%), and indoor and outdoor mobility devices, including wheelchair use (9/84, 10.8%). A smaller proportion of participants reported support for activities such as health management, personal hygiene and grooming, and dressing, with each category accounting for only 1.4% (1/84) of responses, as presented in detail in Multimedia Appendix 2.

Table 2, participants without previous experience using HAs and APs, largely expressed dissatisfaction with their home environments. Specifically, 35% (17/48) strongly disagreed and 40% (19/48) disagreed with statements indicating satisfaction with their home conditions and AP availability. Furthermore, 27% (13/48) strongly disagreed and 42% (20/48) disagreed that their homes were safe for performing daily activities. Conversely, participants who had previous experience with HAs and APs demonstrated significantly more positive attitudes. Specifically, 36% (13/36) reported agreement and 22% (8/36) reported strong agreement regarding satisfaction with their home environment. In addition, 69% (33/48) reported feeling safe while using HAs and APs. Among participants without experience in HAs and APs, 69% (33/48) agreed and 21% (10/48) strongly agreed that they felt confident in their abilities, while participants with experience in HAs and APs presented 58% (21/36) agreeing and 32% (12/36) strongly agreeing.

Table . Participants' perspectives on their current home, living environment, and use of various assistive products (n=84), including participants without experience home adaptations and assistive products (n=48) and participants with experience home adaptations and assistive products (n=36).

Perspective and subgroup	Strongly disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly agree, n (%)
Do you think that now your home, living environment, and various APs[a] are already in good condition?					
Without experience HA[b] and AP	17 (35)	19 (40)	1 (2)	6 (13)	5 (10)
With experience HA and AP	4 (11)	4 (11)	7 (20)	13 (36)	8 (22)
Are you confident that your home, living environment, and APs are safe for activities and use?					
Without experience HA and AP	13 (27)	20 (42)	2 (4)	9 (19)	4 (8)
With experience HA and AP	2 (6)	3 (8)	6 (17)	13 (36)	12 (33)
Do you currently feel like you have the skills you need to use your home, living environment, and APs?					
Never used HA and AP	11 (23)	4 (8)	5 (11)	24 (50)	4 (8)
Having experience with HA and AP	2 (6)	3 (8)	4 (11)	20 (56)	7 (19)
Do you think you could improve your activity skills if your living environment were adapted, and APs were provided for you?					
Never used HA and AP	3 (6)	2 (4)	0 (0)	33 (69)	10 (21)
Having experience with HA and AP	0 (0)	2 (5)	2 (5)	21 (58)	12 (32)

[a] AP: assistive product.

[b] HA: home adaptation.

The Mann-Whitney U test results in Table 3 reveal significant differences in participants' perspectives between those without and with experience using HAs and APs. Participants with experience using HAs and APs reported more positive views regarding the condition of their home and assistive environment ($P \leq .001$), greater confidence in the safety of their surroundings ($P < .001$), and higher self-rated skills in using these supports ($P = .03$). However, no significant difference was found between the groups in their perceived potential for activity improvement through APs and environmental changes ($P = .41$).

Table . Mann-Whitney *U* test results comparing participants without and with experience on perspectives of their current home, living environment, and use of various assistive products.

Topics	*U* value	*P* value
Condition of home, living environment, and assistive products	4590	<.001[a]
Confidence in the safety of home and assistive products	376.5	<.001[a]
Skills to use home, living environment, and assistive products	646.0	.03[a]
Potential activity improvement with environmental adaptations and assistive products	785.5	.41

[a] Significant *P* value <.05, the Mann-Whitney *U* test was applied.

As illustrated in Table 4, both participant groups without and with experience using HAs and APs recognized their benefits. A majority agreed that HAs and APs could help restore daily functioning (27/48, 56% agreed and 18/48, 38% strongly agreed among nonusers; 17/36, 47% agreed and 16/36, 44% strongly agreed among users) and improve efficiency and quality of life (31/48, 65% agreed and 15/48, 31% strongly agreed; 21/36, 58% agreed and 10/36, 28% strongly agreed, respectively). Comparable trends were observed regarding time savings (30/48, 63% agreed and 15/48, 31% strongly agreed among nonusers; 19/36, 53% agreed and 12/36, 33% strongly agreed among users) and reduction of accident risks (31/48, 64% agreed and 15/48, 31% strongly agreed among nonusers; 20/36, 56% agreed and 13/36, 36% strongly agreed among users). With respect to social participation, respondents believed that HAs and APs supported engagement in family and social activities (36/48, 75% agreed and 9/48, 19% strongly agreed among nonusers; 19/36, 53% agreed and 15/36, 41% strongly agreed among users). Notably, persons with disabilities without experience using HAs and APs consistently reported higher levels of agreement across all categories.

Table . Participants' perspectives on the benefits of modifying the home environment and using assistive products (n=84), including participants without experience home adaptations and assistive products (n=48) and participants with experience home adaptations and assistive products (n=36).

Perspective and subgroup	Strongly disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly agree, n (%)
Do you think that modifying your home environment and using APs[a] can help you regain the ability to perform daily activities?					
Without experience HA[b] and AP	0 (0)	2 (4)	1 (2)	27 (56)	18 (38)
With experience HA and AP	0 (0)	1 (3)	2 (6)	17 (47)	16 (44)
Do you believe that modifying your home or living environment, and using APs can help you improve your efficiency and quality of life?					
Without experience HA and AP	0 (0)	2 (4)	0 (0)	31 (65)	15 (31)
With experience HA and AP	0 (0)	1 (3)	4 (11)	21 (58)	10 (28)
Would you be able to save time on your daily activities if your home environment was modified and you had access to various APs?					
Without experience HA and AP	0 (0)	1 (2)	2 (4)	30 (63)	15 (31)
With experience HA and AP	0 (0)	0 (0)	5 (14)	19 (53)	12 (33)
Do you believe that modifying your home, living environment, and APs can help you reduce the risk of accidents or injuries?					
Without experience HA and AP	0 (0)	1 (2)	1 (2)	31 (64)	15 (31)
With experience HA and AP	0 (0)	2 (5)	1 (3)	20 (56)	13 (36)
Do you think that modifying your home, living environment, and using APs can help you participate more in family activities and activities with others?					
Without experience HA and AP	0 (0)	1 (2)	2 (4)	36 (75)	9 (19)
With experience HA and AP	0 (0)	1 (3)	0 (0)	19 (53)	15 (41)

[a] AP: assistive product.

[b] HA: home adaptation.

According to the Mann-Whitney *U* test results in Table 5, participants with experience in using HAs and APs significantly differed from those without experience only in their views on increasing participation in family and social activities (*P*=.04). For other perceived benefits such as regaining the ability to perform daily activities, improving efficiency and quality of life, saving time, and reducing the risk of accidents, no significant differences were found between the 2 groups (*P*>.05).

Table . Mann-Whitney *U* test results comparing participants without and with experience on the benefits of modifying the home environment and using assistive products.

Topics	*U* value	*P* value
Regaining ability to perform daily activities	817.5	.64
Improving efficiency and quality of life	946.5	.39
Saving time on daily activities	890.0	.79
Reducing the risk of accidents and injuries	849.0	.88
Increasing participation in family and social activities	674.0	.04[a]

[a] *Significant *P* value <.05, Mann-Whitney *U* test was applied.

Multimedia Appendix 2 outlines the perceived barriers to participants without and with experience using HAs and APs. Financial constraints emerged as the most significant obstacle, with over 90% (47/48) of respondents identifying cost as a major concern (11/48, 23% agreed and 36/48, 75% strongly agreed among nonusers; 8/36, 22% agreed and 26/36, 72% strongly agreed among users). A substantial proportion also cited a lack of information regarding HAs and APs (39/48, 82% agreed and

5/48, 10% strongly agreed for nonusers; 26/36, 72% agreed and 5/36, 14% strongly agreed for users). Difficulties in accessing HAs and APs services were reported by 80% of both groups (34/48, 71% agreed and 6/48, 13% strongly agreed among nonusers; 28/36, 78% agreed and 4/36, 11% strongly agreed among users). Concerns about maintenance were also prevalent, although more pronounced among users (33/48, 68% agreed and 10/48, 20% strongly agreed for nonusers; 16/36, 45% agreed and 13/36, 36% strongly agreed for users). While the Mann-Whitney *U* test found no significant differences between participants without and with experience regarding perceived barriers to HAs and APs. Both groups reported similar concerns across all topics, including cost, information, service access, and maintenance, with only service access nearing significance (*P*=.05).

Discussion

Principal Findings

This study explored the experiences of persons with disabilities in a rural Thai community (Doilor subdistrict) regarding HAs and APs, which are individualized for each participant. The findings contribute valuable insights to the understanding of HAs and APs for persons with disabilities. In this study, most participants without HAs and APs were dissatisfied with their living conditions (36/48, 75%) and felt unsafe at home (33/48, 69%), while those with HAs and APs experience reported greater satisfaction (21/36, 58%) and safety (25/36, 69%). According to several studies, home modifications and APs can enhance the satisfaction of persons with disabilities in daily life, improve postmodification safety, and positively impact their mental well-being by reducing feelings of insecurity at home [29,30]. Importantly, this study found that participants with experience using HAs and APs had shown more positive perceptions of their home environment (*P*<.001), greater confidence in its safety (*P*<.001), and stronger self-rated usage skills (*P*=.03). However, no significant differences emerged between the groups in terms of their perceived potential for improving activity skills, such as functional mobility (eg, moving safely within the home), self-care tasks (eg, bathing, dressing, and feeding), and household activities (eg, cooking and cleaning); through APs and HAs (*P*=.41). This finding is noteworthy as it indicates that both groups equally acknowledged the value of these interventions in promoting engagement in daily life. The convergence of views suggests a shared understanding among persons with disabilities of the essential role that HAs and APs play in fostering independence, safety, and participation in meaningful activities. Furthermore, the agreement across groups regarding the potential for increased participation in family and social activities underscores the broader social implications of such interventions. Consistent with previous studies [31,32], these findings reinforce the importance of integrating home modifications and assistive technologies into rehabilitation and community-based support strategies. Regardless of differences in demographic or functional characteristics, the need for accessible and supportive home environments remains a priority for improving the quality of life of persons with disabilities in rural contexts.

In this study, persons with disabilities also believed that using HAs and APs contributed to the restoration of daily functioning (45/48, 94% among nonusers and 33/36, 91% among users) and enhanced efficiency and quality of life (46/48, 96% among nonusers and 31/36, 86% among users). According to Moon et al [30], the implementation of the Korean smart home modification program and devices assisted individuals with physical disabilities in maintaining occupational performance and improving their engagement in daily activities, ultimately promoting a higher quality of life. Furthermore, this study found that persons with disabilities perceived that using HAs and APs could support time (45/48, 94% among nonusers and 31/36, 86% among users) and reduce the risk of accidents or injuries (46/48, 95% among nonusers and 33/36, 92% among users). Consistent with Petersson et al [8], this study explored how home modifications influence the ability of persons with disabilities to carry out daily tasks. The findings demonstrated that home modifications not only alleviate difficulties in performing everyday activities but also result in measurable time savings within 6 months. Similarly, Jo and Kim [18] implemented occupation-based home modifications for persons with disabilities, demonstrating improvements in time efficiency, participation in activities of daily living, and occupational performance. Furthermore, the innovative safe at home provided various in-home accessibility enhancements such as grab bars, safety railings, stair lifts, and bathtub cutouts for older adults and individuals with disabilities. This study revealed high program satisfaction (190/241, 79%), an absence of falls, and a notable reduction in fear of falling following the use of APs and environmental modifications [33]. In contrast, our study observed no significant differences between groups (without and with experience using HA and AP) regarding perceived improvement in daily function, efficiency, quality of life, timesaving, or accident and injury prevention.

In our study, participants with previous experience using HA and AP reported that such modifications, along with improvements in the living environment, significantly enhanced their engagement in family and general activities (15/36, 41% strongly agreed while 19/36, 53% agreed. In contrast, among participants without experience with HA and AP, only 19% (9/48) strongly agreed and 75% (36/48) agreed with this sentiment. Goddard et al [29] observed that individuals with mobility impairments perceived home modifications as beneficial in reducing physical exertion while enhancing social interaction and independence. Similarly, Greiman et al [34] emphasized that improved home usability enables access to appropriate housing, thereby promoting community participation among individuals with disabilities. Their findings further suggested that enhanced home usability facilitates participation by improving health, autonomy, social interaction, organization, and safety. This is confirmed that our study of both groups of participants presented significant differences in relation to increasing participation in family and social activities (*P*=.04).

The key barrier reported by participants identified financial constraints as the primary obstacle to modifying homes and acquiring affordable APs reported by 98% (47/48) of nonusers and 94% (34/36) of users. Gusheh et al [35] noted that most persons with disabilities were compelled to self-finance modifications, which were frequently unaffordable, especially for individuals with constrained financial resources. Layton et al [36] similarly assert financial limitations significantly impede the availability and implementation of HAs and APs for persons with disabilities. Existing funding structures often fall short in accommodating the necessary adaptations, thereby fostering inequities in access to essential resources. Consistent with Puli et al [37], financial exclusion continued to impact persons with disabilities in low- to middle-income countries. Although the demand for affordable and accessible housing is rising, current financial mechanisms remain insufficient to meet these needs. Many families face financial constraints that limit their ability to afford necessary HAs and APs. In addition, there is often a lack of availability and accessibility of these products in rural areas, which poses a significant barrier to improving the living conditions of persons with disabilities [26,32]. In the long term, the effectiveness of sustainable approaches to addressing this issue has been demonstrated in a study conducted in India [38]. Prajapati et al [38] highlight that integrating persons with disabilities into the economic structure could increase national gross domestic product by 3%‐7%, demonstrating their potential as active contributors rather than passive beneficiaries. Furthermore, industry collaboration, start-ups, and public-private partnerships could enhance access to affordable assistive technologies while also generating employment opportunities for persons with disabilities. Importantly, initiatives such as academia-industry collaboration, corporate social responsibility funding, and innovation parks have been shown to support sustainable models of device development and distribution. Thailand should learn from and adapt these strategies to effectively address the financial limitations of persons with disabilities.

The lack of mandatory accessibility standards in residential construction continues to reinforce the prevalence of inaccessible housing, highlighting the need for greater awareness about HAs and APs. Our study revealed that a substantial proportion of individuals face difficulties accessing HAs and APs services (40/48, 84% among nonusers and 32/36, 89% among users). In addition, a widespread lack of information was observed, especially among participants with no previous experience: 92% (44/48) reported insufficient knowledge, compared with 86% (31/36) among those with previous experience. According to the studies, evidence from both low- and middle-income countries indicates that persons with disabilities often lack awareness of available HAs and APs, as well as knowledge on how to access or use them. In Nigeria, for instance, Okonji and Ogwezzy [39] found that only 36% (152/423) of visually impaired adults were aware of assistive technologies, and just 17.4% (74/423) reported knowing how to use them. Similarly, a study by Senjam et al [40] in India revealed that among visually impaired patients, high levels of awareness were observed for only 2 out of 42 assistive devices, with more than 30 devices showing awareness levels below 33%. These findings underscore a critical gap in information that must be addressed by health care providers, rehabilitation professionals, and policymakers. Enhancing awareness and facilitating the use of APs and technologies should be a priority in service delivery.

Beyond statutory schemes, Thailand has an active system of nongovernmental organizations (NGOs) and foundations that raise awareness and enable practical access to HAs and APs in rural communities. The Mahasarakham University Universal Design Center's Home for Life program trains multidisciplinary local teams (public health staff, civil servants, and built-environment actors) to identify hazards and plan universal-design home changes; the program has been scaled with Thai Health Promotion Foundation support and a train-the-trainer model (improving local capacity for sustainable adaptations) [41]. The Rajanagarindra Institute of Child Development Wheelchair Project sources and customizes wheelchairs and mobility aids that often require complementary home changes (eg, ramps and bathroom adaptations) supplies adapted mobility and daily living devices through community programs [42]. Community-based organizations such as Buddy HomeCare coordinate home-based support and link clients to product or adaptation options, frequently acting as catalysts for simple, affordable environmental modifications [43]. The initiatives led by these NGOs and foundations enhance awareness, facilitate referrals, and mobilize community resources, providing practical pathways to overcome the access barriers identified in the Thai sample.

Furthermore, persons with disabilities and their families frequently report a lack of clarity on how and where to obtain reliable information on home and APs. As highlighted by Jutai et al [44], individuals with low income and disabilities often face compounded barriers due to both limited access to information and insufficient resources for device acquisition. In many cases, the absence of centralized or accessible information emerges as a primary obstacle to the broader adoption of APs. This trend is evident across diverse settings; for example, in Bangladesh, Myanmar, and similar contexts, Pryor et al [45] report that many individuals remain unaware of available devices, services, or even the existence of disability support programs. This systemic lack of information presents a major challenge to equitable access and usage of home modification and device support. Although our study found no statistically significant differences between participants with and without previous experience regarding barriers to HAs and APs, the difficulty in accessing services approached significance (P=.05). This implied that some users with experience of HAs and APs may have slightly better knowledge or access to services, which could explain the small difference between the groups.

Maintaining home and environmental adaptations, as well as APs, poses a significant challenge for persons with disabilities and their families. In this study, 88% (43/48) of participants without experience using HAs and APs, and 81% (29/36) of those with experience reported difficulties in maintaining them. This highlights the difficulty of repairing or maintaining these devices at home, with users struggling to access appropriate repair services, ensure sustainability, and manage upkeep. Toro Hernandez [46] found that among 142 Indonesian wheelchair users, 34% (n=142) required more than one repair after receiving a new wheelchair, and 70% (n=142) did not receive complete repairs—underscoring a gap in maintenance training. Similarly, Eide et al [47] found that in low-income countries, only 7% of repairs were handled by government services, while 40% were managed by users or their families; another 40% of devices remained unrepaired due to financial constraints and other barriers. While Oldfrey et al [48] conducted a synthesis of findings across 4 distinct studies and contextual settings, their analysis revealed that, in low-resource environments, the scarcity of specialized repair services poses a significant barrier to the effective provision of assistive devices and technology. In such contexts, community-based repair practices often serve as the primary means of device maintenance. To improve the efficacy of assistive devices and technology delivery, formal systems should recognize, incorporate, and support these grassroots repair mechanisms. Nonetheless, a critical gap persists in the availability of data tracking AP outcomes over their lifecycle, particularly in areas such as follow-up, repair, and maintenance, which hampers further advancements. Strengthening community-based repair networks may also facilitate more accurate referrals to specialist services when complex repairs are needed.

The quality and appropriateness of HAs and APs can also be strengthened through 3 mutually reinforcing strategies. First, copartnerships among local small and medium-sized enterprises, universities, and clinical services should collaborate with the industrial sector to identify relevant APs related to the needs of persons with disabilities and users in the communities [49]. Integrating suppliers for prequalification, product standards, and service standards (eg, WHO guidance for priority APs and wheelchair provision) should be implemented to ensure the safety and maintenance of after-sale support in rural communities [50,51]. Second, product development which embraces ramps, low-cost transfer aids, context-appropriate wheelchairs, bathroom modifications, and toilet adaptations should be designed in alignment with the local context and combined with local materials including easy repair [52]. This development should be coordinated with social enterprises and public agencies [53]. Third, training programs should be implemented to develop local staff competencies that include (1) community workers for screening and follow-up; (2) technicians for fitting, customizing, and fixing and repairing; and (3) therapists for assessment, evaluation, prescription, fitting, and monitoring. These strategies could support persons with disabilities in the needs of HAs and APs based on the local contexts [54].

Even though subsidies could reduce immediate financial limitations of the families of persons with disabilities, they are not a long-term solution for ensuring equitable access to HAs and APs in the low- and middle-income countries [55,56]. Subsidy approaches by public agencies could fail due to the weak service capacity, supply chains, and follow-up and maintenance systems. Sustainability should be coordinated based on community-based rehabilitation, NGOs, and private partnerships. This would build local capacity through train-the-trainer models and strengthen the sustainable community mobilization [57]. In APs such as wheelchairs, the use of the WHO Wheelchair Service Training Package needs to be used in service step assessment, fitting, training, and follow-up. This subsidy and training program could enhance the ability of persons with disabilities to meet their outcomes and reduce the condition of dependence and abandonment [58]. The use of local materials in manufacturing and designs could reduce costs and increase supply chains [59]. Effective procurement, outcome-based contracts, and microcredit with transparency could allow the families of persons with disabilities to access the money with accountability [60]. Finally, integrating a competency-based workforce for persons with disabilities into employment will be a successful process that is supported by mentoring under therapists and stakeholders to ensure long-term usability. These approaches should be reinforced to provide service delivery and supply, quality, and local ownership to remove obstacles and promote independence for persons with disabilities.

In Northern Thailand, HAs and APs are vital for promoting mobility, independence, and the overall well-being of persons with disabilities in rural areas. Nevertheless, access to these essential supports is significantly hindered by geographic isolation, limited health care infrastructure, and socioeconomic constraints. Homes often have hazardous features, such as inappropriate door widths and high thresholds, which can impede mobility and independence for individuals with disabilities. These environmental barriers highlight the need for targeted home modifications [61]. Although global progress has been made in advancing disability-inclusive policies, rural regions in low- and middle-income countries often remain underserved due to persistent economic, infrastructure, and sociocultural barriers. While HAs and APs are instrumental in facilitating daily activities, a pronounced disparity between urban and rural access persists, with rural persons with disabilities facing greater obstacles in obtaining these resources. To effectively address this challenge in rural Northern Thailand, local municipalities, governmental and private agencies, and NGOs, including industrial sectors, should not only provide targeted subsidies but also strengthen the ability and capability of persons with disabilities to use HA and APs.

Limitations

The primary limitation of this study lies in its recruitment from a single subdistrict (Doilor community), which restricts the generalizability of the findings to the broader population of persons with disabilities in rural Thailand. In addition, the reliance on self-reported data may have introduced social desirability bias, potentially leading to an overestimation of the perceived benefits of HAs and APs. The study also provides limited exploration of important contextual and cultural factors, such as stigma, family support, and beliefs surrounding disability, which may significantly influence the use and acceptance of HAs and APs. Furthermore, it lacks detail regarding the specific types and contextual appropriateness of HA and AP in the rural northern Thai setting. These limitations affect the external validity of the study and constrain the applicability of its findings across different disability types and geographic areas. Future research should conduct a longitudinal approach to examine the long-term impact of HA and AP use on quality of life, allowing for a deeper understanding of users' evolving experiences over time.

Conclusions

Enhancing access to HAs and APs for persons with disabilities in rural communities requires a comprehensive and collaborative approach. These supports are essential for improving quality of life by promoting safety, efficiency, independence, and participation in daily activities. Active engagement of families and communities is equally important, as they play a crucial role in mobilizing local resources to support budgeting, information sharing, accessibility, and ongoing maintenance. To ensure sustainable and equitable access, both local and central governments must work to address barriers, strengthen community support systems, and implement inclusive policies that facilitate the provision of HAs and APs. In addition, further studies are needed to explore the long-term impacts of these interventions, helping to develop contextually appropriate and effective solutions for persons with disabilities in underserved rural areas.

Acknowledgments

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Data Availability

The datasets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.

Conflicts of Interest

None declared.

Multimedia Appendix 1
Daily living activities supported by home adaptations and assistive products (n=84).
[PNG File, 306 KB - apinj_v9i1e79040_app1.png]

Multimedia Appendix 2
Participants’ perspectives on barriers to modifying home, living environment, and using assistive products (n=84), including participants without experience home adaptations and assistive products (n=48) and participants with experience home adaptations and assistive products (n=36).
[DOCX File, 16 KB - apinj_v9i1e79040_app2.docx]

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Abbreviations

AP: assistive product
HA: home adaptation
NGO: nongovernmental organizations
WHO: World Health Organization

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Development of a Qigong Used for Insomnia Therapy (QUIT) Program for Improving Sleep Quality and Blood Pressure in Chinese Women With Menopause: Pre-Post Pilot Test of Feasibility

Sean Huang[*]; Jung Eun Kim[*], PhD; Wen-Wen Li[*], MS, PhD

School of Nursing, College of Health and Social Sciences, San Francisco State University, 1600 Holloway Ave, BH383, San Francisco, CA, United States

[*]all authors contributed equally

Corresponding Author:
Wen-Wen Li, MS, PhD
School of Nursing, College of Health and Social Sciences, San Francisco State University, 1600 Holloway Ave, BH383, San Francisco, CA, United States

Abstract

Background: Around 20%-50% of Chinese menopausal women experience insomnia, which is associated with elevated blood pressure (BP). Despite this, the population remains understudied. Qigong, a simple form of Chinese exercise, has been shown to improve insomnia and BP but has not been explicitly used to address menopausal symptoms in Chinese women. This study aims to test the feasibility of a Qigong-based intervention in enhancing sleep quality and BP control in this population.

Objective: This study aimed to develop and pilot test the feasibility of a culturally sensitive Qigong Used for Insomnia Therapy (QUIT) intervention in improving sleep quality and BP among Chinese menopausal women.

Methods: From August 2023 to May 2024, this study used a 1-group pretest-posttest design (N=22) to evaluate the QUIT intervention. The intervention consisted of a 10-minute Qigong demonstration video, a 10-minute practice and return demonstration and a 5-minute insomnia counseling session at baseline. Participants were instructed to engage in daily 10-minute Qigong practice for 1 month. Outcome measures, including sleep quality and BP, were assessed at baseline and at the 1-month follow-up. Data on demographics were collected via self-reported questionnaires. At the end of the study, participants were interviewed using semistructured questions to assess their perception of the intervention's feasibility. Qualitative data were analyzed using content analysis, with interviews transcribed and coded independently by the principal investigator and research assistant. Categories related to feasibility, adherence, and barriers were identified. Quantitative data were analyzed using SPSS 27.0 (IBM Corp), using descriptive statistics and paired sample *t* tests to assess changes in sleep quality and BP, with statistical significance set at .05.

Results: The mean age of participants was 53.78 (SD 8.79, range 42 - 74) years. Most participants lived with relatives or friends (20/22, 91%), were employed (16/22, 73%), were married (19/22, 86%), and had at least high school education (19/22, 86%). The mean 23-item Sleep Quality Scale score significantly improved from 18.59 (SD 11.41) at baseline to 15.64 (SD 9.65; mean difference 2.96, SD 7.04; t_{21}=1.97, *P*=.03) after 1 month, indicating better sleep quality (the 23-item Sleep Quality Scale was reversely scored). There was a trend toward reduced systolic BP from 115.47 (SD 14.95) at baseline to 113.59 (SD 13.93; mean difference −0.89, SD 1.64; t_{21}=−1.15, *P*=.26) after 1 month. Diastolic BP also improved from 74.69 (SD 10.81) at baseline to 71.41 (SD 16.82) at 1 month (mean difference −3.28, SD 4.04; t_{21}=−0.81, *P*=.43).

Conclusions: The QUIT intervention was culturally sensitive, low-cost, and easy to implement. It showed significant improvements in sleep quality and trends toward reduced BP in Chinese menopausal women. Further investigation is recommended to further test the QUIT intervention to establish a robust program across different states. Once validated, the QUIT intervention may be implemented in various clinical settings to help Chinese menopausal women achieve optimal sleep quality and BP management.

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KEYWORDS

Qigong; sleep quality; blood pressure; menopause; Chinese women

Introduction

In the United States, approximately 30% of individuals experience from at least 1 symptom of insomnia [1]. Insomnia is characterized by difficulties falling or remaining asleep, which causes significant distress to the individual [2]. This condition leads to decreased cognitive ability, difficulty functioning, and fatigue and increases the risk of developing cardiovascular disease [3]. Around 20%-50% of women undergoing menopausal transition are affected by insomnia, and the prevalence of the condition is higher in Chinese menopausal women (51%-55%) than in Caucasian (40%), Japanese (28%), and Korean (16%) women [4]. Developing accessible intervention options for chronic insomnia is necessary to combat the disorder in Chinese menopausal women.

Traditional Chinese medicine (TCM) has been successfully used to treat insomnia and alleviate some symptoms, such as fatigue and low energy, in Chinese women [5-7]. TCM has been used for thousands of years as a medical practice to treat disorders such as insomnia. This medical practice is rooted in maintaining a balance between yin and yang, 2 forces that make up the force of life, Qi. Qigong, a very affordable treatment modality, is a common form of Chinese medicine that is used to promote circulation of the brain, which can, in turn, help with sleep and body relaxation at night [8]. However, its effectiveness in Chinese immigrant women has rarely been studied. Literature notes that Chinese immigrants are less compliant with Western medical regimens if their health self-management is influenced by their cultural beliefs and practices, such as TMC [9]. Thus, a sole traditional western health practice may not be feasible in this Chinese women population. Given this, Qigong was used as our primary intervention to improve sleep quality for Chinese menopausal women. Specifically, Ba Duan Jing, a popular and straightforward form of Qigong, was used in our study, which is characterized by 8 slow movements coupled with breathing exercises.

In addition to Qigong, a conventional Western sleep regimen was also used to enhance our therapy for insomnia [10-13]. It asks the participants for several behavioral modifications, which are listed here. (1) Maintaining a consistent sleep schedule is crucial to reducing insomnia as it prepares the brain to transition to sleep. By performing a nighttime routine at the same time every day, the brain is given around 30 minutes to slow down before bedtime [10]. (2) Avoiding caffeine, which is helpful to avoid fitful sleeping. Caffeine taken up to 6 hours before bedtime causes sleep disturbances and a reduced total sleep time [11]. (3) Avoid consuming excessive alcohol close to bedtime, which promotes sleep continuity and decreases wake periods [12]. (4) Following a balanced diet promotes falling asleep faster and maintaining the depth of sleep [13]. (5) Removing distractions or stimulants, such as electronics and bright lights or noises before bedtime, creates a good sleeping environment and primes the brain for sleep [10].

In addition to the traditional Western regimen, we added a Chinese medicine–based regimen, which includes practicing Qigong daily and soaking one's feet before bedtime. Qigong helps Qi (energy) movement, which supports overall circulation, and practicing it daily helps with consistent sleep quality [14]. Besides Qigong, soaking one's feet in hot water before bedtime also increases circulation, thus allowing the body to repair and relax. A study found that soaking the feet increased blood flow to the rest of the body, including up to the earlobes, and reduced blood pressure (BP), which benefits cardiovascular health [15].

Since both Qigong and soaking one's feet may improve sleep quality and reduce BP, it is essential to measure both sleep quality and BP as the outcomes to test the feasibility of the intervention. Insomnia results in activating a sympathetic nervous system, which in turn increases heart rate and metabolic rate [16]. This is interesting because the association between shortened sleep duration and higher BP suggests that treating insomnia can improve BP levels, thereby reducing the risk of hypertension and other health problems. Likewise, high BP is a significant contributing factor for insomnia [17,18]. A meta-analysis suggested that a combination of both insomnia and high BP would put patients at a greater risk of developing cardiovascular disease [17,18]. Thus, managing insomnia and BP can help improve patients' health conditions [19]. Nevertheless, there is limited evidence to support the feasibility of adopting insomnia treatments to also help improve BP [20,21]. Given the above, developing methods to improve both insomnia and BP can be beneficial in reducing the risk of strokes, heart failure, and other cardiovascular issues in Chinese menopausal women.

The purpose of this study was to develop and pilot test the feasibility of a Qigong Used for Insomnia Therapy (QUIT) program in improving sleep quality and BP in Chinese menopausal women. The QUIT program consists of 2 components: daily Qigong practice and a Western- and Eastern-fused sleep regimen (ie, the aforementioned behavioral modifications).

Methods

Design

A 1-group pretest-posttest design was used to test the feasibility of the QUIT intervention. This design allows for assessing whether the intervention works for Chinese women and if there is a trend for improvements in sleep quality and BP.

Setting

Participants were recruited from a Chinese community health care center in Chinatown, San Francisco. This center serves a large population of Chinese residents (more than 20,000), the majority of whom are first-generation immigrants.

Sample

In total, 22 Chinese immigrants in the San Francisco Bay Area were recruited to participate in this study. The inclusion criteria were (1) self-identified Chinese immigrant, (2) 45 years of age or older, (3) menopausal, (4) reported to be experiencing from insomnia, (5) can read or speak Chinese (Cantonese or Mandarin). The exclusion criteria were: (1) terminal illness, and (2) cognitive impairment.

Sample Size

The sample size (N=22) was determined based on the resources available in the study period and the study objectives (with a purpose to pilot test feasibility of the QUIT intervention).

Recruitment

The research team developed and discussed a recruitment strategy plan. First, a flyer in Chinese was posted in the community health clinic to explain the study's purpose and provide a toll-free number to discuss the study. For those who made contact and agreed to participate in the study, the research assistants obtained verbal consent and conducted a phone-based eligibility-screening interview, followed by an appointment for an interview visit. A referral system was also used to recruit participants, including word-of-mouth through health care providers and study participants who had already taken part in the study.

Study Procedure

A total of 2 bicultural and bilingual (Chinese and English) research assistants were recruited and trained by the principal investigator (PI) for one day (8 h) on the study protocol, understanding and implementing the QUIT intervention, interview techniques, and data management and analysis. These 2 research assistants were also trained by a Qigong master (roughly eight 1-h sessions) until they mastered the Qigong practice.

At the initial (baseline) visit, the research assistant explained the study's purpose, procedures, and requirements and the right to decline to participate and discontinue participation at any time. Written informed consent and a Health Insurance Portability and Accountability Act (HIPAA) authorization were obtained. Participants completed the self-report questionnaire on demographic, cultural, and clinical factors to be used as baseline descriptive data. The participants' insomnia levels were measured using the 1-item Sleep Quality Scale (SQS-1)- and 23-item Sleep Quality Scale (SQS-23) as baseline data.

The research assistant measured the participants' BP 2 - 3 times using a digital sphygmomanometer, with a 5-minute interval between 2 measurements. A third measurement was performed if the first 2 systolic BP readings differed by 10 mm Hg or more or if the first 2 diastolic BP differed by 5 mm Hg or more. The average BP was calculated from the 2 or 3 readings to get a more reliable BP measurement.

Subsequently, the research assistant showed the Qigong video to study participants, practiced with participants for all 8 movements, and asked participants to return to demonstrate the movements to ensure their correct understanding of how to practice Qigong properly (10 mins). The participant was asked to do Qigong once daily, 7 days per week, for 4 weeks. The participant was also instructed to perform Qigong consistently at around the same time each day and at least 2 hours before bedtime. In addition, the entire QUIT regimen, including the frequency of Qigong and other lifestyle modifications (eg, drinking herbal tea to replace coffee or caffeinated tea), was discussed with each participant(5 mins). Participants were asked to adhere to this regimen for 1 month. The entire initial visit lasted for about 40 minutes.

After the initial visit, 1 follow-up phone call was made at midpoint (2 wk from the baseline visit). During this phone call, the same research assistant (from the initial visit) checked in with the participants to discuss any challenges they experienced while carrying out the regimen. The research assistant then focused on problem-solving these challenges with the participants.

At the second (final) visit (4 wk from the baseline visit), participants were asked to return to measure their BP and insomnia levels using the same Sleep Quality Scale (SQS) questionnaires from the baseline. The BP measurement was conducted in the same manner as the initial visit. After BP measurements were taken and SQS questionnaires were filled out, the research assistant conducted an individual interview with each participant to assess the feasibility of the intervention protocol. The semistructured questions used to assess participants' feedback included their comprehension of the QUIT content, the usefulness of the QUIT, the ease of following the QUIT intervention protocol, and the strengths and limitations of the QUIT intervention. Sample questions included, "Were you able to comprehend the QUIT instruction? If yes, please explain your answers."

The interview session was audiotaped with the consent of the participants. The second visit lasted around 45 minutes.

Measurements

Measurement of Sleep Quality

SQS-1

The SQS-1 (single item) was used to measure overall sleep quality over a 7-day recall period with a rating from 0 to 10. A higher score indicated better sleep quality [19]. This single-item SQS is more suitable than lengthier sleep questionnaires such as the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality [19]. Since this instrument has only 1 item, it does not cause any burden for participants and has been used in published studies [22-26], including studies conducted in China [23]. Concurrent criterion validity demonstrated a strong correlation (inverse) between the SQS-1 and PSQI (Goodman-Kruskal correlation=0.92) in populations with insomnia. Test-retest reliability was 0.62 for sleep stability in patients with insomnia over a 4-week period.

SQS-23

Besides SQS-1, another insomnia measure, SQS-23, was chosen to help measure different aspects of insomnia. SQS-23 showed good reliability (Cronbach α=0.89) in Chinese patients, and the scoring system is straightforward and easy. The SQS-23 contains 4 factors of sleep quality, including difficulty in getting up (factor 1: 2 items – negatively scored), difficulty in falling asleep (factor 2: 5 items- negatively scored), sleep recovery (factor 3: 6 items - positively scored) –and daytime dysfunction (factor 4: 10 items – negatively scored). Participants used a 4-point Likert scale to report the frequency of their sleep behaviors, with 0 indicating "few," 1 indicating "sometimes," 2 indicating "often," and 3 indicating almost always. A total score was calculated by summing all 23 items, with factor 3 being reverse-scored to match the scoring of the other factors. A higher score indicated poorer sleep quality (possible score range: 0 ‐ 69). Sample questions for 4 factors include the following: “Having refreshed feeling of body after sleep” for factor 1; “Difficulty in getting back to sleep after nocturnal awakening” for factor 2; “Regaining vigor after sleep” for factor 3; and “Sleepiness that interferes with daily life” for factor 4.

Measurement of BP

An Omron brand digital BP machine (code: HEM-7201) was used to measure the patients’ BP. BP was obtained twice, and the values for systolic and diastolic BP were averaged.

Ethical Considerations

This study protocol was approved by the Institutional Review Board of the San Francisco State University (approval number 2023 ‐ 038). All participants provided informed consent before data collection. Participant data were anonymized during analysis to ensure privacy and confidentiality. All data were handled in accordance with institutional data protection guidelines, and permission to tape the interviews was obtained from the institutional review board. At the end of the second visit, a gift card (US $50) was presented to each participant to show appreciation for their participation in the study. This incentive was also approved by the institutional review board.

Data Management and Analysis

Data on demographic information and the participants’ evaluation of the QUIT content were gathered through self-reported questionnaires filled out by each participant. Open-ended questions were posed to probe the participants’ reactions to the QUIT intervention and the overall visit (tolerance levels, ability to track, clarity, and comprehensibility). Close-ended questions asked participants to fill out relevant health and demographic information and to use a 5-point Likert Scale (extremely unhelpful to extremely helpful) to rate the usefulness of QUIT.

For qualitative data, content analysis was used to systematically examine participants’ answers to the feasibility-related questions described in the “Study Procedure” section. First, 1 of the 2 research assistants transcribed the audiotaped interview data verbatim. The PI and research assistant then independently analyzed the interview data using a structured coding scheme. The analysis was based on extensive line-by-line coding of the raw data. Coding and categorization continued until no new information was forthcoming, and the categories appeared “saturated.” The percentage of agreement on coding categories between the PI and research assistant was calculated. Any disagreements were then discussed, and further data analysis was performed. It was ensured that the coding between the PI and research assistant reached at least 80% agreement. The final categories (themes showing the perceived strengths of the QUIT intervention) are listed in Textbox 1. These categories are related to the feasibility and adherence of the QUIT intervention. The areas for improvement of the QUIT intervention are also presented. This information is anticipated to help guide the refinement and optimization of the QUIT intervention.

For quantitative data, SPSS 27.0 was used to analyze and describe baseline sociodemographic and clinical data. Data entry and management were done by one research assistant and verified by the PI. Descriptive statistics were used to screen data for missing values and outliers and to describe the demographic and clinical variables. A paired sample *t* test was used to examine the difference between pre- and postintervention in terms of changes in sleep quality and BP. Statistical significance was set at .05.

Textbox 1. Strengths of Qigong Used for Insomnia Therapy (QUIT) in promoting well-being.

Easy and convenient treatment plan

- It is easy to practice Qigong and follow a sleep regimen
- Qigong can be done anywhere and at any time
- Having a routine makes life more organized

Improvement of sleep quality

- One falls asleep more quickly
- It is easier to fall asleep by reducing thoughts of daytime thinking and activities

Promotion of breathing and relaxation

- It helps to breathe
- It encourages practicing breathing exercises
- It creates a peaceful mood
- It lets the body become more relaxed

Improvement of physical health

- Helps with losing fat
- Increases flexibility of body

Improvement of mental health (positive mood or mind)

- Clears mind
- Elevates mood

Improvement of energy

- Improves energy
- Increases motivation to do one's daily activities

Increased exercise amount

- Practicing Qigong helps one exercise regularly
- It serves as another form of exercise on top of a regular workout routine

Results

Sample Characteristics

All participants were women (n=22). The mean age of participants was 53.78 (SD 8.79; range 42 - 74) years. The majority of the participants lived with relatives or friends (20/22, 91%), were employed (full-time or part-time job: 16/22, 73%), were married (19/22, 86%), and had at least high school education (19/22, 86%; Table 1).

Table . Baseline characteristics of Chinese menopausal women (N=22).

Variables		Values
Age, mean (SD)		53.78 (8.79; range 42 - 74)
Gender (female), n (%)		22 (100)
Education, n (%)		
	Primary school	2 (9.1)
	Middle school	1 (4.5)
	High school	2 (9.1)
	Associate	4 (18.2)
	Bachelor	5 (22.7)
	Master and above	8 (36.4)
Marital Status, n (%)		
	Married	19 (86.5)
	Divorced or separated	1 (4.5)
	Single	1 (4.5)
	Widow	1 (4.5)
Religion, n (%)		
	None	10 (45.5)
	Buddhism	4 (18.2)
	Taoism	2 (9.1)
	Christian	3 (13.6)
	Others	2 (9.1)
	Missing	1 (4.5)
Are you living with your family or friends(s)?, n (%)		
	No	2 (9.1)
	Yes	20 (90.9)
Employment, n (%)		
	Full time	14 (63.6)
	Part time	2 (9.1)
	Not working	2 (9.1)
	Retired	3 (13.6)
	Others	1 (4.5)
Annual income (US $), n (%)		
	Less than or equal to $9,999	3 (13.6)
	$10,000 - 99,999	2 (9.1)
	$20,000 - 29,999	4 (18.2)
	$30,000-$39,000	2 (9.1)
	$40,000-$49,999	1 (4.5)
	$50,000-$59,000	2 (9.1)
	>$100,000	3 (13.6)

Feasibility Evaluation of the QUIT Intervention

Overview

This study evaluated the feasibility of the QUIT intervention by gathering both quantitative and qualitative feedback from participants. Using a 5-point Likert scale (1=extremely unhelpful or inappropriate; 5=extremely helpful or appropriate), participants rated the overall helpfulness and appropriate content of the intervention. More than half (12/22, 55%) found the intervention to be helpful or extremely helpful, with 50% (n=11) rating it as helpful and 5% (n=1) as extremely helpful. Notably, no participants rated the intervention as unhelpful or extremely unhelpful, though 45% (10/22) remained neutral. Regarding the appropriateness of the content, the response was even more favorable, with 82% (18/22) of participants considering the content to be appropriate or extremely appropriate—specifically, 41% (9/22) rated it as appropriate and another 41% (9/22) as extremely appropriate. Only 18% (4/22) remained neutral, and no participants found the content to be inappropriate. In addition to these quantitative findings, qualitative feedback was collected to explore the perceived strengths of the QUIT intervention and identify areas for improvement, which provided valuable insight into participant experiences and guided future enhancements of the intervention.

Strengths of the QUIT Intervention

Ease and Convenience Treatment Plan

Many participants thought implementing the routine was easy and convenient. The routine consisted of a set of movement practice and behavioral changes that did not require any additional equipment. One participant claimed it was “easy” since they could do it “anywhere, anytime.” Another participant said the routine was “stable and easily established,” while others said it made their “life more organized.”

Improvement of Sleep Quality

Quite a few participants commented that the Qigong video helped assist them in falling asleep easier and faster. One participant said that “practicing Qigong decreases the time needed to fall asleep” and “helps me fall asleep faster.” Another participant explained that it became easier to fall asleep by reducing thoughts of daytime thinking or activities.” Other participants added that the routine helped them “sleep deeper.”

Promotion of Breathing and Relaxation

Many participants found that the Qigong exercise helped regulate their breathing. One participant said that it “helps me breathe,” while another observed that it “fixes my breathing.” Another participant noted that the routine was “good exercise to have every day” since it “allows [them] to practice breathing.” Some participants claimed that the routine “let my body become more relaxed.”

Improvement of Physical Health

Several participants reported that the QUIT intervention (sleep hygiene routine) positively improved their physical health. Some participants said that establishing a good sleep routine “can help with losing fat.” Some reported that it gave them greater flexibility, enabling them to “move my arms around higher,” after practicing Qigong.

Improvement of Mental Health (Positive Mood or Mind)

Several participants noted an uplift in their mood after practicing the Qigong routine. One participant mentioned that it “clears my head,” while another shared that they felt “in a more peaceful mood.”

Elevated Energy Levels

The participants commented that the Qigong practice helped them to become more energetic during and after the practice. The participants commented that Qigong “improves in terms of energy levels” and “I feel more energetic and motivated to do my daily activities.”

Development of Exercise Habits

The participants appreciated the additional Qigong exercise alongside their regular workouts. One participant noted that practicing Qigong “helps me to exercise regularly,” even though they had not done so before. Another mentioned it as “another form of exercise on top of my regular workout, such as jogging.”

Areas of Improvement of the QUIT Intervention

A couple of patients complained it is hard for them to practice Qigong daily. Some quotes included “I cannot do this every day,” “it is hard for me to do it consistently,” and “having to do this every day is challenging for me.”

Pilot Test of the Outcomes of the QUIT Intervention

Changes in Sleep Quality Before and After Intervention

Sleep quality, measured using SQS-1, significantly improved from 6.68 (SD 2.42; baseline visit) to 7.36 (SD 2 postintervention; t_{21}= 2.19, *P*=.04;Table 2). The SQS-23 (negatively [reversely] scored) sleep quality score was also significantly improved from 18.59 (SD 11.41) to 15.64 (SD 9.65); t_{21}= 1.97; *P*=.03;Table 2).

Table . Changes in outcomes from baseline to 1 month.

Outcomes	Baseline (N=22)	1 Month (N=22)		Mean change	
	Mean (SD)	Mean (SD)	Mean difference (SD)	*t* test (*df*)	*P* value[a]
SQS-1[b]	6.68 (2.42)	7.36 (2.00)	0.68 (1.46)	2.19 (21)	.04
SQS-23[c] (reversely scored)	18.59 (11.41)	15.64 (9.65)	2.96 (7.04)	1.97 (21)	.03
Systolic BP[d]	115.48 (14.95)	113.59 (13.93)	−0.89 (1.64)	−1.15 (21)	.26
Diastolic BP	74.69 (10.81)	71.41 (16.82)	−3.28 (4.04)	−0.81 (21)	.43

[a] Statistical significance was set at $P<.05$.

[b] SQS-1: 1-item Sleep Quality Scale.

[c] SQS-23: 23-item Sleep Quality Scale.

[d] BP: blood pressure.

Changes in BP Before and After Intervention

The baseline systolic BP was 115.48 (SD 14.95) mm Hg, and diastolic BP was 74.69 (SD 10.81) mm Hg (Table 2). Approximately 4 weeks after the baseline visit (postintervention), the average systolic and diastolic BP dropped to 113.59 (SD 13.93) mm Hg and 71.41 (SD 16.82) mm Hg, respectively (Table 2). Although the data were not statistically significant, both systolic BP (−0.89, SD 1.64 mm Hg; t_{21}=−1.15; *P*=.26) and diastolic BP (−3.28, SD 4.04 mm Hg; t_{21}=−0.81; *P*=.43) showed a trend toward improvement from baseline to week 4 (postintervention; Table 2).

Discussion

This study outlines the development of a QUIT intervention approach in Chinese menopausal women with insomnia to increase sleep quality. Of the 22 participants, most had higher education, did not practice religion, lived with family or friends, were employed full-time, and were married.

Principal Findings

Feasibility Evaluation of the QUIT Intervention

Overall, the participants found the QUIT intervention very clear and easy to understand. Most participants could follow the instructions without difficulty and had no problem executing the exercises demonstrated in the video. The strengths of the Qigong routine include its easy implementation and the inclusion of familiar, culturally appropriate movements that helped participants ease into the routine. Participants also appreciated that the Qigong routine could be performed at any time and place, and they recognized the positive impacts it had on their lives. In addition, participants reported improvements in sleep quality and other aspects of physical and mental health. Thus, the QUIT intervention was feasible and culturally appropriate for Chinese menopausal women.

Areas for improvement were also identified through participant feedback. The most challenging aspect mentioned was the difficulty of practicing Qigong every day. To address this, future refinements of the QUIT intervention could consider reducing the frequency of Qigong practice from daily to 4 or 5 days per week.

Pilot Test of the Outcomes of the QUIT Intervention (Insomnia and BP)

The results demonstrated that the QUIT intervention resulted in statistically significant improvement in sleep quality 18.59 (SD 11.41) to 15.64 (SD 9.65); reversely scored, indicating higher scores reflect poorer sleep quality (mean difference 2.96, SD 7.04; t_{21}=1.97, *P*=.03) and a trend in improving systolic (mean 115.47, SD 14.95 to mean 113.59, SD 13.93; t_{21}=−1.15, *P*=.26) and diastolic BP (mean 74.69, SD 10.81 to mean 71.41, SD 16.82; t_{21}=−0.81, *P*=.43). Both sleep quality outcomes (SQS-1 and SQS-23) showed significant improvement, indicating the feasibility of the QUIT intervention in improving insomnia among Chinese women experiencing menopause. For further comparisons with other studies, the data on SQS-23 will be used, as it presents various aspects of sleep patterns and quality.

Comparison to Previous Work

Our finding in improving sleep quality is similar to a randomized controlled trial (RCT) conducted in China that tested the effects of Tai Chi on sleep quality [27]. This study found that practicing Tai Chi for 60 minutes, 3 times a week for 8 weeks, significantly improved overall sleep quality compared to the control group (*t*=2.05, *P*=.04) (from mean 6.08, SD 4.01 to mean 4.89, SD 4.43; reversely scored) [27]. Our QUIT intervention had less intensity (10 min of Qigong practice daily for a month) than this RCT, but our study found a significant improvement in sleep quality similar to Wang et al [27]. However, since our sample size is small and there was no control group, further testing of our QUIT intervention is required to investigate its efficacy. The reason that our less intense intervention (10 min instead of 60 min per session) had a similar result to this RCT is that we implemented the Qigong practice on a daily basis, which helped participants treat it as a routine so they would not forget to do Qigong, generating a significant effect in improving their sleep quality.

It is noteworthy that there is a similarity between Qigong and Tai Chi [28]. Both are ancient Chinese practices that focus on the cultivation and balance of Qi (life energy) through coordinated movements, breathing techniques, and meditation. They aim to improve physical health, mental clarity, and emotional balance. In addition, both practices emphasize relaxation, slow movements, and mindfulness. The difference is that Qigong focuses on cultivating and balancing Qi through simple, repetitive movements, breathing techniques, and meditation, while Tai Chi, a martial art, involves more complex, flowing sequences of movements [27]. In our QUIT study, we chose a simpler form to promote daily practice.

Another study conducted in Spain examined the effects of Qigong on 125 postmenopausal women and showed a significant improvement in overall sleep quality [6]. The results, measured with the PSQI questionnaire, indicated significant improvements in sleep quality in the intervention group. Participants completed 24 sessions over 12 weeks (two 60-min sessions weekly). The overall sleep quality score (reversely scored) improved from mean 7.56 SD (4.56) to mean 5.89 (SD 3.74; $F_{1.115}$=12.27, P=.001), with a mean difference of 1.67. The score ranged from 0 to 21.

In comparison, the study from Spain had a longer, less frequent intervention (24 sessions over 12 wk, with two 60-min sessions weekly) compared to our QUIT intervention, which involves a shorter, daily practice (eg, 10 min daily for 1 month). Both studies showed statistically significant improvements in sleep quality (mean difference of 1.67 in Spain's study vs 2.69 in our QUIT study). This finding may suggest that frequent shorter practice has the same effect as less frequent longer sessions. Based on interviews with some of our study participants, they commented that practicing 10 minutes per session may be difficult to adhere to, and a 60-minute session would be even harder. This would create more barriers for Chinese women in maintaining the Qigong practice long-term. Thus, it is recommended that future studies test the feasibility and efficacy of a shorter duration of Qigong practice, such as less than 10 minutes, for 4 to 5 days a week in Chinese menopausal women to establish more robust results.

It is noted that compared to Wang et al [27] (the study in China) and Carcelén-Fraile et al [6] (the study in Spain), our results on the overall improvement of sleep quality are more promising. This difference may be attributed to behavioral modifications included in our QUIT regimen. Participants of the QUIT intervention made additional changes to their lifestyle, such as avoiding coffee and alcohol and soaking their feet in hot water in addition to performing the daily qigong exercise, which may explain the increase in sleep quality scores.

Regarding reduction of BP, compared to a study conducted in Hong Kong which tested the effect of Tai Chi in reducing BP [29], our study showed improvement in both systolic BP (mean difference from baseline to week 4: −1.89) and diastolic BP (mean difference −3.28 from baseline to week 4); but the study by Ko et al [29] only showed improvement in systolic BP but no change in diastolic BP (−6.0 mm Hg for systolic and 0.00 mm Hg for diastolic BP). In general, both studies showed promising results of their intervention. There was a similarity between our Qigong session and the study by Ko et al [29]. Both interventions use movement techniques to promote Qi movement [28], which in turn improves BP. The difference is that our approach used video instruction for Qigong practice, which is very economical and requires less labor so that it could be practiced more frequently, such as 5-7 days per week. In contrast, Ko et al [29] asked their participants to practice Tai Chi with a Tai Chi master in person twice (1 hour each time) every week, which is more expensive and labor intensive [29]. If both interventions can improve BP, a low-cost and sustainable intervention should be preferred in the clinical setting as it will be easier for self-management of BP at home without economic and physical limitations (eg, patients do not need to travel to practice Qigong and can practice Qigong at any time and any place). In the future, it is recommended to use video instruction instead of hiring a master to teach twice per week to be further investigated for its long-term feasibility and efficacy.

Strengths

The QUIT intervention is a potentially affordable approach, using a 10-minute Qigong video as the primary source of health education. This is followed by a short 10-minute practice and return demonstration of Qigong and a 5-minute discussion of the sleep regimen by trained personnel. It is easy to implement, so it is anticipated that the QUIT intervention can potentially be applied in the clinical setting once it is tested to be effective in a larger population of menopausal Chinese women in the future.

Limitations

The study limitations include possible participant bias and threats to the design's validity. First, Chinese women tend to overemphasize improvements to their health and adherence to medical advice to please their health care providers. This may result in discrepancies between self-reported and genuine health improvements. To mitigate this, the participants were told to report the true results as much as possible to help us generate reliable results. In the future, sleep quality could be assessed by using other methods, such as a device to measure sleep quality in an objective way, to compare the results between self-report and objective measurements.

Second, a threat to our design's validity is the uncertain effect of the QUIT intervention. It is not certain that adherence to the QUIT intervention was solely responsible for improvements in sleep quality and BP. For example, discussions with health experts and encouragement to make behavioral changes may have motivated participants to adopt other lifestyle changes beyond what was outlined in the QUIT regimen (eg, use of sleep assist devices). In this study, the participants were informed to follow the QUIT protocol and no other treatment regimen during the study period, but they were not monitored 24/7, so it is impossible to completely stop them from doing something beyond what was advised. It is recommended that in the future the QUIT study be replicated and conducted with a 2-armed (intervention and control groups) RCT to eliminate confounding effects.

Implications for Clinical Practice

The results of our QUIT intervention approach may prove to be a culturally suitable method for treating insomnia and improving BP in Chinese menopausal women. Given the current lack of affordable and accessible treatment options (eg, shortage of medical practitioners) for both insomnia and BP, QUIT illustrates the potential for simple habitual changes to improve Chinese women's health outcomes. One advantage of QUIT is its simplicity. After a single training session with an expert, patients can practice the QUIT regimen at home at their convenience. Thus, implementing the QUIT intervention may be clinically meaningful and promising for Chinese menopausal women.

Conclusions

Our pilot QUIT intervention built upon the existing recommended sleep regimen (eg, adhering to a healthy diet) to promote blood circulation, providing both a feasibility test and assessment of the QUIT intervention, to shed light on the potential direction for the future research, and to help develop a robust culturally sensitive intervention to improve sleep quality and BP in Chinese menopausal women. Our results demonstrated that our QUIT intervention was feasible and culturally acceptable for Chinese menopausal women. It is noteworthy that our Eastern- and Western-fused sleep regimen (eg, soaking one’s feet in hot water) along with daily Qigong practice significantly improved sleep quality and may further improve BP over time. Once the QUIT intervention is shown to be effective in enhancing sleep quality and improving BP through more robust studies, the program can be used in Chinese communities.

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Data Availability

The datasets generated or analyzed during this study are available from the corresponding author on reasonable request.

Authors' Contributions

SH contributed to data curation, formal analysis, writing – original draft and review, and editing. JK managed formal analysis, writing – original draft, and review and editing. WWL handled conceptualization, funding acquisition, formal analysis, investigation, methodology, project administration, supervision, writing – original draft, and review and editing.

Conflicts of Interest

WWL serves on the editorial board of the *Asian Pacific Island Nursing Journal*.

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Abbreviations

BP: blood pressure
HIPAA: Health Insurance Portability and Accountability Act
PI: principal investigator
PSQI: Pittsburgh Sleep Quality Index
QUIT: Qigong Used for Insomnia Therapy
RCT: randomized controlled trial
SQS: Sleep Quality Scale
SQS-1: 1-item Sleep Quality Scale
SQS-23: 23-item Sleep Quality Scale
TCM: Traditional Chinese medicine

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Original Paper

A Culturally Tailored Artificial Intelligence Chatbot (K-Bot) to Promote Human Papillomavirus Vaccination Among Korean Americans: Development and Usability Study

Minjin Kim[1,2], RN, PhD; Ellie Kim[3], BS, BA; Hyeongsuk Lee[4], RN, PhD; Meihua Piao[5], RN, PhD; Brittany Rosen[3,6], CHES, MEd, PhD; Jeroan J Allison[2], MD, MS; Adrian H Zai[7], MD, MPH, PhD; Hoa L Nguyen[8], MD, MS, PhD; Dong-Soo Shin[9], PhD; Jessica A Kahn[10], MD, MPH

[1]College of Nursing, University of Cincinnati, Cincinnati, OH, United States
[2]Department of Population and Quantitative Health Sciences, University of Massachusetts Chan Medical School, Worcester, MA, United States
[3]College of Medicine, University of Cincinnati, Cincinnati, OH, United States
[4]Research Institute of AI and Nursing Science, College of Nursing, Gachon University, Incheon, Republic of Korea
[5]School of Nursing, Chinese Academy of Medical Sciences, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China
[6]Division of Adolescent and Transition Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States
[7]Department of Population and Quantitative Health Sciences, Division of Health Informatics and Implementation Science, University of Massachusetts Chan Medical School, Worcester, MA, United States
[8]Department of Population and Quantitative Health Sciences, Division of Epidemiology, University of Massachusetts Chan Medical School, Worcester, MA, United States
[9]School of Nursing, Hallym University, Chuncheon, Republic of Korea
[10]Department of Pediatrics, Albert Einstein College of Medicine, Bronx, NY, United States

Corresponding Author:
Minjin Kim, RN, PhD
College of Nursing
University of Cincinnati
3110 Vine St
PO Box 210038
Cincinnati, OH, 45221-0038
United States
Phone: 1 7202095559
Email: kim3m4@ucmail.uc.edu

Abstract

Background: Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) worldwide and is associated with various cancers, including cervical and oropharyngeal cancers. Despite the availability of effective vaccines, significant disparities in HPV vaccination rates persist, particularly among racial and ethnic minorities, such as Korean Americans. Cultural stigma, language barriers, and limited access to tailored health information contribute to these disparities.

Objective: This study aimed to develop and evaluate the usability of K-Bot, an artificial intelligence (AI)–powered, culturally tailored, bilingual (Korean and English) chatbot designed to provide culturally sensitive health information about HPV vaccination to Korean immigrants and Korean Americans.

Methods: K-Bot was developed using CloudTuring and Google Dialogflow. Its dialogues were created using Centers for Disease Control and Prevention (CDC) evidence-based HPV information and tailored to the Korean American population based on findings from previous studies. The evaluation and refinement process for K-Bot was organized into 3 phases: (1) expert evaluation by a multidisciplinary panel, (2) usability testing, and (3) iterative refinement based on feedback. An online survey collected demographics, HPV awareness, and vaccination status before 6 focus groups (N=21) sessions using semistructured questions guided by Peter Morville’s usability framework. Quantitative data were analyzed descriptively, and thematic analysis assessed usability, cultural relevance, and content clarity across 6 dimensions: desirability, accessibility, findability, credibility, usability, and usefulness.

Results: Participants had a mean age of 23.7 (SD 4.7) years, with most being female (n=12, 57.1%), second-generation individuals (n=13, 61.9%), and single (n=20, 95.2%). HPV awareness was high (n=19, 90.5%), vaccine knowledge was also high (n=18, 81.8%), but only 11 (52.4%) participants were vaccinated. Feedback-driven refinements addressed usability challenges, including simplifying navigation and adding visual elements. Participants described K-Bot as a promising tool for promoting HPV vaccination among Korean and Korean American users, citing its bilingual functionality and culturally tailored content as key strengths. Evidence-based information was valued, but participants recommended visuals to improve engagement and reduce cognitive load. Accessibility concerns included broken links, and participants proposed enhancements, such as animations, demographic-specific resources, and interactive features, to improve usability and engagement further.

Conclusions: Usability testing of K-Bot revealed its potential as a culturally tailored, bilingual tool for promoting HPV vaccination among Korean immigrants and Korean Americans. Participants valued its evidence-based information, cultural relevance, and bilingual functionality but recommended improvements, such as enhanced navigation, visual elements, and interactive features, to boost engagement and usability. These findings support the potential of AI-driven tools to improve health care access by addressing key barriers to care. Further research is needed to evaluate their broader impact and optimize their design and implementation for individuals with diverse health care needs.

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KEYWORDS

human papillomavirus; HPV vaccination; artificial intelligence; AI; chatbot intervention; Korean Americans; usability testing; culturally tailored intervention

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) worldwide, with the highest prevalence observed among young adults [1]. Persistent HPV infection can lead to various cancers, including cervical cancer, which remains a leading cause of cancer-related deaths among women aged 20-39 years [2]. Additionally, HPV is associated with oropharyngeal cancers, which are increasingly prevalent among men and tend to develop at younger ages compared to other HPV-related cancers [3].

To combat the burden of HPV-related diseases, the US Advisory Committee on Immunization Practices (ACIP) recommends routine HPV vaccination for adolescents aged 11-12 years, with catch-up vaccination for individuals aged 13-26 years who have not completed the vaccine series [4]. Recently, the 9-valent vaccine was approved in the United States for use in adults aged 27-45 years [5]. Korean Americans are at a relatively high risk for HPV-related cancers, yet they exhibit significant disparities in HPV vaccination rates [6,7]. Notably, Korean American women demonstrate a particularly low intention to receive the HPV vaccine, with only 34.6% expressing a willingness to get the vaccine in prior studies [8]. Our previous research further indicates that only 32% of participants aged 27-45 years have received the HPV vaccine at least once, with differences by sex (females: 35.3%; males: 12.5%) [9]. Korean Americans face several critical barriers to HPV vaccination, including cultural stigma surrounding STIs, language barriers, and al ack of culturally tailored health information. These challenges are compounded by limited knowledge and awareness of HPV and the benefits of vaccination, contributing to persistently low vaccination uptake, which contributes to lower vaccination rates [8-12]. In addition to this knowledge gap, several factors influence HPV vaccination intentions among Koreans and Korean Americans. These include parental recommendations for the HPV vaccine, the perceived benefits and severity of HPV infection, a history of cervical cancer, beliefs about cervical cancer screening for daughters, experiences with sexual activity, and sociodemographic factors (eg, occupation, education, and income) [7,8]. To address these challenges, culturally tailored interventions are essential to improve HPV vaccination uptake within this population, especially for communities that may encounter cultural and linguistic challenges in accessing health care information. For example, prior efforts have included culturally relevant health information that has demonstrated promise in increasing awareness and promoting vaccination by addressing cultural stigmas and misconceptions [9,13,14]. However, many of these approaches rely on traditional methods of information dissemination, which may lack the interactivity and personalization needed to address individual barriers effectively.

KakaoTalk is the most popular mobile messaging app in South Korea. It has become an integral part of daily communication and workplace interaction, offering various features beyond basic text messaging [10]. KakaoTalk has also been used in health research, demonstrating its potential as a platform for delivering health interventions. Studies have explored its role in supporting Korean American family caregivers [11] and promoting health interventions to Korean Americans with limited English proficiency [8], including efforts to promote HPV vaccination [12]. Additionally, KakaoTalk serves as a digital communal space for middle-aged Korean women [15], demonstrating its broad accessibility and significance across diverse Korean populations, from teenagers to older adults, both in South Korea and among Korean Americans.

Artificial intelligence (AI) chatbots have emerged as innovative tools for delivering personalized, leveraging advanced capabilities to address barriers in health communication [16]. Unlike static interventions, such as printed materials or one-size-fits-all campaigns, AI chatbots offer interactive, real-time engagement, making them particularly effective in addressing nuanced health behaviors and misconceptions [16]. The effectiveness of chatbot-based interventions in promoting behavior change is well supported in the literature. For instance, multiple studies have reported high levels of engagement, usability, and satisfaction with chatbot interventions targeting adolescents and adults [16-18]. Recent studies have explored innovative approaches to promote HPV vaccination, particularly among adolescents and young adults. Digital health interventions, including chatbots, have shown promise in improving knowledge and vaccination intentions [19-21]. Particularly, a study conducted in South Korea developed an eHealth communication intervention using a KakaoTalk chatbot, which shows promising usability scores among experts and adolescent girls [20].

Although existing studies demonstrate the potential of chatbots to influence health behaviors through interactive and personalized engagement, there remains a significant gap in culturally tailored chatbot interventions specifically designed for HPV prevention and cancer risk reduction. Despite the growing evidence base, no studies have focused on developing a chatbot that addresses the unique cultural and linguistic barriers faced by specific populations, such as Korean immigrants and Korean Americans.

To address these gaps, we aimed to develop K-Bot, an AI chatbot designed to deliver culturally tailored, bilingual (English and Korean) health information, specifically targeting Korean immigrants and Korean Americans—groups with unique cultural and linguistic barriers to HPV vaccination [8]. This study also aimed to evaluate the usability of K-Bot to assess how easily and effectively the tool can be used as a culturally sensitive, AI-powered chatbot providing real-time health information about HPV vaccination.

Methods

Study Design

The development and usability evaluation of K-Bot followed a structured, iterative process comprising 3 phases: chatbot development, expert evaluation, and usability testing. Evaluations were conducted with both a multidisciplinary expert panel and user groups to ensure the chatbot's clinical relevance, cultural sensitivity, and practical usability.

Ethical Considerations

All study procedures were approved by the Institutional Review Board (IRB) of the University of Cincinnati (IRB protocol 2022-0347). All study procedures were conducted following institutional guidelines and ethical standards for research involving human participants. Informed consent was obtained from all participants prior to their participation.

Chatbot Development

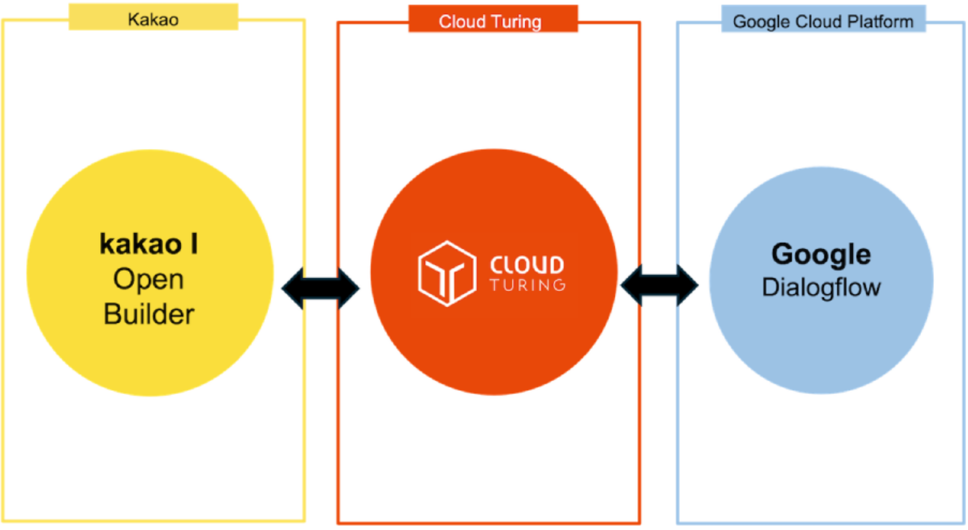
The development of the K-Bot chatbot was based on a structured and systematic process leveraging both advanced technology platforms and cultural tailoring to address HPV vaccination disparities among Korean Americans.

Platform Selection and Chatbot Design

K-Bot's development required a multidisciplinary team, including AI developers from South Korea who were integral to the implementation of the AI chatbot and its deployment on relevant platforms. The team also included experienced health researchers in designing and evaluating chatbots from South Korea, 2 health care professionals based in the United States and 2 Korean community representatives, who provided insights to ensure cultural relevance. This diverse team brought together expertise in AI, health care, and cultural adaptation to ensure the chatbot's relevance and effectiveness across both Korean and Korean American populations.

The chatbot was built using CloudTuring [22], a platform offering AI-driven solutions for advanced natural language understanding, and Google Dialogflow [23], a widely used conversational AI framework that enables natural language processing (NLP), intent recognition, and context-aware responses. The chatbot was integrated with the existing management system, allowing for continuous updates and improvement through the Kakao Chatbot Manager and Cloud Turing platforms (Figure 1).

Figure 1. K-Bot architecture and integration with the existing management system.

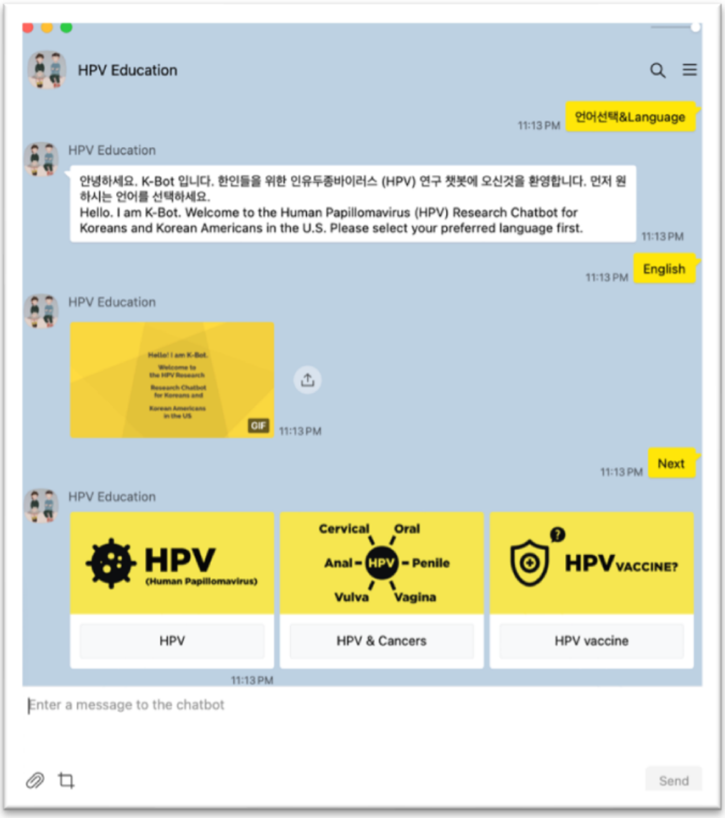


These tools facilitated bilingual interactions in English and Korean, supporting accurate communication and seamless user engagement. Deployment was carried out on the KakaoTalk messaging app (Figure 2), which is widely used by Koreans for communication [24], and a Wix-based website, requiring secure hosting and compliance with privacy standards. The development process spanned 5 months, with iterative refinements made based on expert and user feedback.

The chatbot's dialogues were designed based on evidence-based guidelines from the Centers for Disease Control and Prevention (CDC) and tailored to the Korean American population using findings from previous studies [12,25,26].

The chatbot was structured using a hierarchical organization of major, medium, and minor classifications, which guided the users toward their desired information. Each interaction was categorized under major topics (eg, HPV vaccine), followed by medium-level subcategories (eg, vaccine safety and side effects), and further segmented into minor classifications (eg, detailed explanations of side effects). This modular structure ensured logical navigation and efficient access to information, which is critical for users seeking health-related information.

Figure 2. K-Bot interface within the KakaoTalk app. HPV: human papillomavirus.

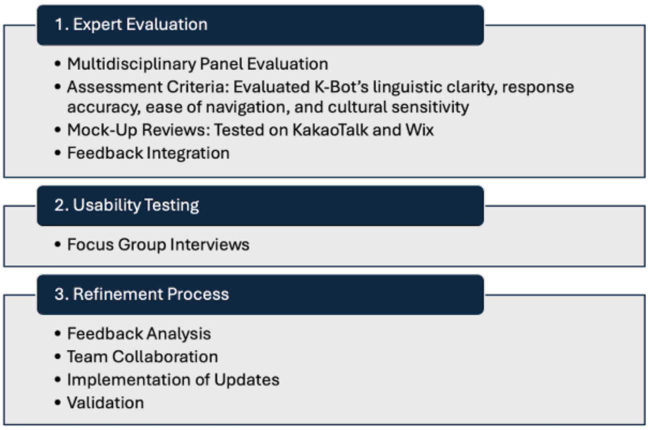


안녕하세요. K-Bot 입니다. 한인들을 위한 인유두종바이러스 (HPV) 연구 챗봇에 오신것을 환영합니다. 먼저 원하시는 언어를 선택하세요.
Hello. I am K-Bot. Welcome to the Human Papillomavirus (HPV) Research Chatbot for Koreans and Korean Americans in the U.S. Please select your preferred language first.

Structured Evaluation and Refinement Process

The evaluation and refinement of K-Bot followed 3 distinct phases: (1) expert evaluation, (2) usability testing, and (3) refinement (Figure 3).

Figure 3. Evaluation and refinement process of K-Bot.



1. Expert Evaluation
- Multidisciplinary Panel Evaluation
- Assessment Criteria: Evaluated K-Bot's linguistic clarity, response accuracy, ease of navigation, and cultural sensitivity
- Mock-Up Reviews: Tested on KakaoTalk and Wix
- Feedback Integration

2. Usability Testing
- Focus Group Interviews

3. Refinement Process
- Feedback Analysis
- Team Collaboration
- Implementation of Updates
- Validation

Expert Evaluation

A multidisciplinary panel conducted a comprehensive evaluation of K-Bot, leveraging expertise in health care, cultural studies, AI, and community engagement. The panel included a clinician specializing in HPV prevention, researchers with extensive knowledge of Korean culture and its influence on health behaviors, an AI specialist experienced in chatbot development, and students in health-related fields representing Korean community perspectives. This diverse composition enabled a holistic assessment, ensuring the chatbot's clinical relevance, cultural sensitivity, technical functionality, and alignment with community needs.

The evaluation process systematically assessed K-Bot's responses, navigation, and cultural appropriateness using predefined criteria. These criteria included linguistic clarity, response accuracy, ease of navigation, and the cultural framing of sensitive topics, such as HPV vaccination. The usability evaluation framework incorporated principles from the International Organization for Standardization (ISO) 9241-11 standards, emphasizing efficiency, effectiveness, and user satisfaction to ensure comprehensive assessment [27]. The chatbot's response design followed a structured methodology that incorporated synonyms, key phrases, and importance ratings on a scale of 1-5, with 5 indicating the highest priority for delivering critical information. Experts rated responses based on their relevance, clarity, and alignment with the cultural and informational needs of the target audience, ensuring the chatbot provided accurate and contextually appropriate replies.

The research team conducted mock-up reviews to evaluate the chatbot before usability testing. One review used the English version, and the other used the Korean version of the chatbot. Additionally, the team tested the chatbot on 2 different platforms: KakaoTalk and Wix. These sessions focused on identifying areas for improvement, such as simplifying technical terms, integrating culturally relevant idioms, and enhancing navigation flow to optimize the user experience before moving forward with usability testing involving participants.

Iterative improvements based on the research team's feedback were incorporated into the chatbot's design, prioritizing culturally sensitive topics and user-relevant queries. Linguistic clarity was enhanced by simplifying technical terms and integrating culturally relevant idioms to increase accessibility. These revisions were discussed and validated during research team meetings, confirming improvements in usability, cultural sensitivity, and alignment with the needs of Korean immigrants and Korean American users.

Usability Testing

Recruitment and Eligibility

Participants were recruited using a combination of the researchers' networks, a community-engaged approach, and social media platforms guided by the previous successful recruitment [6]. Recruitment efforts were centered around the research theme, "Let's Talk About HPV," which was designed to engage participants and emphasize the importance of learning about HPV and its vaccine. Potential participants who expressed interest in the study were contacted within 1 week by research personnel to confirm their eligibility. Eligibility criteria included (1) individuals aged 18-45 years, (2) possession of a mobile phone or a computer with internet access, (3) residence in the United States, and (4) fluency in English or Korean. Upon confirming eligibility, research personnel scheduled an interview and provided participants with a password-protected Zoom link via email.

Usability Testing Procedures

Usability testing was conducted between May and June 2022, involving 21 Korean American participants who were divided into 6 focus groups, with each group consisting of 2-5 individuals. The variation in group size allowed us to accommodate participants' availability and facilitate in-depth discussions. Data saturation was monitored by the facilitators throughout the sessions. Each focus group session lasted approximately 60-90 minutes. Only audio recordings were used for data analysis, ensuring that participants' identities remained confidential. Participants were encouraged to use pseudonyms instead of real names to promote anonymity. The primary objective of this study was to gather feedback on the K-Bot rather than to explore participants' awareness and attitudes toward HPV prevention. Therefore, the sensitive nature of HPV-related questions was minimal. Participants were informed about the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time without consequence.

Each usability testing session followed a structured protocol to ensure consistency and comprehensive data collection:

- Introduction: Participants were introduced to the study, its objectives, and the importance of their feedback in improving the chatbot's functionality and cultural relevance. The project's development history, including initial focus on Korean college women and subsequent expansion to a broader age range, including both men and women, was explained.
- Consent and survey: After reviewing the study information sheet and agreeing to participate, participants were provided with an online survey. This survey collected information about their sociodemographic characteristics, awareness of HPV, the HPV vaccine, and their vaccination status.
- Preinteraction discussion: Prior to interacting with K-Bot, participants were asked questions regarding their familiarity with HPV-related topics and any previous experience with chatbots. Specifically, we discussed whether they had heard of HPV or its vaccine and whether they believe they had received adequate information about the topic.
- Chatbot interaction: After completing the survey, participants received a link via email to interact with K-Bot. They were reminded that the chatbot was available in both English and Korean languages. At this stage of development, the K-bot experience consisted of 2 parts: a 32 question-and-answer (Q&A)–style survey, followed by the interactive chatbot. Participants were encouraged to document any errors, navigation challenges, or suggestions for improvement during their interaction. Additionally, K-Bot provided links to external resources, such as CDC

PDF files, to test its interoperability and ensure seamless access to supplementary health information.
- Postinteraction feedback: We asked participants questions guided by Peter Morville's honeycomb model [27], as shown in Table 1. Participants were asked about usability, ease of navigation, adequacy of information, reliability of chatbot responses, and integration with external resources. They also provided suggestions for improvement. After the interview, participants received a US $20 Amazon gift card as compensation for their time and input.

Table 1. Semistructured interview questions with Morville's usability framework.

Usability dimension	Definition	Corresponding interview questions
Usability	Ensures the system is easy to use and navigate	• How was your experience with K-Bot? Did you find it easy? • Were the buttons and navigation clear and easy to understand?
Usefulness	Determines whether the system provides valuable and relevant content	• Was there enough information provided by the chatbot?
Credibility	Evaluates the reliability and trustworthiness of the system's responses	• Were the responses from the chatbot reliable?
Findability	Assesses the ease of accessing information within the system	• Was it interoperable with external sources? • Were the PDF files for the CDCa resource pages loading and adequate?
Desirability	Examines the appeal and attractiveness of the system design	• What did you think about the overall design of the chatbot? • Did you find the chatbot visually appealing and engaging?
Accessibility	Ensures the system is available and usable for a diverse audience	• Was there any information you wish was included in the chatbot?
General feedback	Captures any additional participant input for further refinement	• Any additional comments?

Data Collection and Analysis

An online survey that takes 5-10 minutes was conducted prior to qualitative interviews to gather insights into participants' demographics (eg, age, sex, cultural identification, generational status, educational attainment, marital status, employment status, and annual household income), HPV awareness, and vaccination status. Quantitative data were analyzed using descriptive statistics with SPSS version 28 (IBM Corp). All focus group sessions were recorded using Zoom, and audio recordings were captured via Audacity [28] as backup. Transcriptions were manually prepared and saved in Microsoft Excel, with anonymized participant IDs to maintain confidentiality. We monitored the duration of participants' interactions with K-Bot, which typically lasted about 10-15 minutes. All data were stored securely on password-protected drives.

Qualitative data were manually analyzed using a systematic thematic analysis to identify recurring patterns in feedback. The analysis followed Braun and Clarke's 6-phase framework: familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing a report [29]. Transcripts were independently coded, guided by 2 researchers using Morville's usability framework, covering aspects such as usefulness, usability, findability, credibility, accessibility, desirability, and value. Coding discrepancies were resolved through discussion to ensure a systematic approach.

Refinement

The refinement process was structured to systematically integrate insights from usability testing into iterative improvements into the chatbot's design and functionality. Feedback collected during usability sessions was reviewed and categorized into thematic areas, including navigation, content clarity, and technical performance.

- Feedback analysis: All participant suggestions, navigation issues, and identified gaps were documented and categorized. For example, repeated difficulties with navigating back to previous sections were flagged as high-priority issues.
- Team collaboration: Key findings were shared with the chatbot development team during research team meetings. Actionable items were prioritized based on their potential impact on user experience and alignment with study objectives.
- Implementation of updates: Adjustments were implemented through CloudTuring. Navigation was improved by adding clearer button labels and a dedicated Help section to guide users. The content was expanded to include additional HPV-related information that participants indicated as missing. Machine learning algorithms were updated to improve response accuracy and ensure that the chatbot delivered contextually relevant answers.
- Validation: Updates were tested internally by the research team to ensure that changes effectively addressed the

identified issues, contributing to the dependability and confirmability of the intervention’s iterative development.

Results

Quantitative Findings

Sociocultural Demographic Characteristics

As presented in Table 2, participants had a mean age of 23.67 (SD 4.66) years. The majority were female (12/21, 57.1%), second-generation individuals (13/21, 61.9%), and single (20/21, 95.2%).

Table 2. Demographic characteristics of focus group participants (N=21).

Characteristics	Value
Age (years; range 18-37), mean (SD)	23.67 (4.66)
Sex, n (%)	
Female	12 (57.1)
Male	9 (42.9)
Cultural identification, n (%)	
Completely or more Korean than American	6 (28.5)
Equally Korean and American	9 (42.9)
More American than Korean	6 (28.6)
Generational status, n (%)	
First generation (born outside the United States)	8 (38.1)
Second generation (born in the United States)	13 (61.9)
Education, n (%)	
High school degree or equivalent	6 (28.6)
Some college, no degree	3 (14.3)
Bachelor’s degree	9 (42.9)
Master’s degree	3 (14.3)
Marital status, n (%)	
Single (never married)	20 (95.2)
Married or in a domestic partnership	1 (4.8)
Current employment status, n (%)	
Full time (≥40 hours)	9 (42.9)
Part time (≤39 hours)	2 (9.5)
Student	10 (47.6)
Annual household income (US $), n (%)	
<50,000	8 (38.1)
50,000-99,999	8 (38.1)
≥100,000	5 (23.8)

Awareness of HPV and HPV Vaccination

As presented in Table 3, most participants had heard of HPV (19/21, 90.5%) and the HPV vaccine (18/21, 81.8%). Half (11/21, 52.4%) of them had received the HPV vaccine, with 7 (63.6%) of the 11 participants completing all 3 doses.

Table 3. HPV[a] awareness and vaccination status of focus group participants by sex (N=21).

Characteristics	Female (n=12) frequency, n (%)	Male (n=9) frequency, n (%)
Heard of HPV before this study		
Yes	11 (91.7)	8 (88.9)
No	1 (8.3)	1 (11.1)
Heard of HPV vaccine or Gardasil before this study		
Yes	11 (91.7)	7 (77.8)
No	1 (8.3)	2 (22.2)
Received the HPV vaccine		
Yes	7 (58.3)	4 (44.4)
No	0	3 (33.3)
Do not know	5 (41.7)	2 (22.2)
Number of HPV vaccine doses received (n=11)		
1	0	1 (25.0)
2	2 (28.6)	1 (25.0)
3	5 (71.4)	2 (50.0)

[a]HPV: human papillomavirus.

Qualitative Findings and Refinement

Based on the preinteraction discussion and postinteraction feedback, participants highlighted the importance of K-Bot's bilingual functionality, expressing appreciation for its ability to deliver information in both English and Korean. Many found the information about HPV and the HPV vaccine to be helpful, with some sharing that they learned new details they were previously unaware of. Some participants who had completed middle and high school in Korea had never heard of HPV and its vaccine. Some participants also shared they came in with the preconception that the vaccine was primarily for women's health. However, after interacting with the chatbot, 1 (4.8%) female participant stated, "I feel like I would want my spouse, or partner, to have it." One male participant mentioned that he thought he would not be affected by HPV, but the interactions with K-Bot "put it into perspective that maybe I'm also prone to it." This positive change in sentiment toward the HPV vaccine was shared by other male participants in the focus groups.

The usability of the K-Bot intervention was evaluated through focus group interviews guided by Morville's usability framework:

- Usability: Focus group participants found that the Q&A format at the beginning of the interaction was time-consuming as some "stopped reading the info after answering the question" and found it "cumbersome." The Q&A section was removed and consolidated into the interactive portion. However, participants found the chatbot's button-based Q&A format simple and intuitive, with 1 (4.8%) participant mentioning it was like a "very guided Q&A session." Several requested more detailed information about complex topics, such as stress and HPV. To address this, expandable sections were introduced into the interactive K-Bot, allowing users to delve deeper into specific topics, while maintaining the simplicity of the button-based structure.
- Usefulness: External links to resources were valued for their credibility, but broken links were noted as a barrier to usability. All external links were repaired, and additional resources, including directories of health care providers, were added to ensure comprehensive support. Tailored resources were also developed to meet the needs of specific demographics, particularly first-generation Korean Americans. For instance, 1 (4.8%) participant voiced that "it would be helpful if you add the term [for HPV] that is used more generally in Korea" since they may not recognize the term "human papilloma virus" or "HPV."
- Credibility: The credibility of the chatbot was bolstered by its evidence-based content and integration with trusted sources, such as the CDC. However, participants emphasized the importance of culturally relevant information tailored to Korean Americans, especially for those more familiar with Korean resources. Automatic PDF file downloads were replaced with direct links to reputable sources as participants did not like "surprise downloads crowding the phone." This change ensured easier access, while maintaining trust, especially with concerns about the possibility of users not "trusting the information on the K-Bot." Additionally, culturally sensitive content and terms were refined to resonate with the target demographic.
- Findability: Participants appreciated the structured menus but reported difficulties navigating the menu items at the medium and minor classifications. For instance, 1 (4.8%) participant remarked, "I kept forgetting what I read versus what I did not read, because there were so many subcategories." To resolve this, the final menu options were simplified through consolidation of similar topics, and a search function was added to help users quickly locate relevant information. Visual cues, such as highlighted

buttons and GIFs, were also incorporated to guide users more effectively through the content.

- Desirability: To increase desirability, participants suggested incorporating visual elements to improve engagement and support users with varying health literacy. In response, GIFs and images were added to the chatbot interface. One participant commented, "The menu items were clear but could use more explanations for people who are not familiar with medical terms." Additional descriptions were added to clarify technical terms, and a "Back" button was introduced to enable users to revisit previously accessed information, enhancing overall navigation.
- Accessibility: Although participants found the chatbot intuitive, some noted challenges with language switching and navigation at the end of interactions. For example, 1 (4.8%) participant shared, "It was not immediately clear how to switch languages at the beginning." To address this, clearer instructions for language switching were integrated during onboarding, and the navigation flow was streamlined to ensure smooth transitions, particularly during extended interactions. Button formats were also standardized for greater usability.

Feedback from participants provided valuable insights into their interaction with the chatbot and informed specific refinements to enhance its effectiveness (Table 4). Key refinements were implemented based on usability testing to address the needs of Korean immigrants and Korean American users and optimize the intervention for promoting HPV vaccination.

Table 4. Findings from semistructured interviews and refinements.

Usability dimension	Findings	How the findings were addressed
Usability	• The button-based navigation was intuitive. • Participants suggested adding a "Back" button. • Some users were confused by the language selection.	• A "Back" button was introduced to enable participants to revisit previously accessed information. • Language-switching instructions were made clearer and added as part of the onboarding.
Usefulness	• Participants valued information about HPV[a] transmission and vaccination. • External links (eg, CDC[b] fact sheets) were credible and useful. • Suggestions included using visuals to reduce cognitive load.	• Animated GIFs were integrated to complement text-heavy content. • External links were checked, repaired, and updated. • Resources were tailored to specific demographics, especially first-generation Korean Americans.
Credibility	• Evidence-based content and links to trusted sources enhanced credibility. • Feedback emphasized culturally sensitive language and early trust building.	• Automatic PDF file downloads were replaced with direct links to trusted sources, such as the CDC. • Culturally relevant terms and tailored content for Korean Americans were refined. • An introductory message established credibility and outlined the chatbot's purpose.
Findability	• Menus were structured and effective but sometimes overwhelming. • A simplified navigation structure was recommended.	• The final menu options were simplified, and a search function was added to help users quickly locate relevant information. • Visual cues, such as highlighted buttons and GIFs, were incorporated to improve findability and guide users effectively.
Desirability	• Clear icons and buttons were appreciated. • Suggestions were made for animations and introduction videos to enhance engagement.	• Visual elements, including GIFs and images, were introduced to engage users. • Animations and a 2-minute introduction video were included to enhance user appeal.
Accessibility	• Bilingual support in English and Korean was well received. • Broken links hindered accessibility; regular updates were suggested.	• An email address for the bilingual researcher was added to allow participants to report any issues with broken links or accessibility.
General feedback	• Suggestions for demographic-specific content, clearer instructions, and interactive features were provided. • Misconceptions about the HPV vaccine being unnecessary for men were corrected. • Participants realized the importance of vaccinating at a young age.	• Demographic-specific resources and culturally sensitive information were added. • A brief instruction page and visual cues were included to guide users through the chatbot. • The culturally tailored K-Bot fostered a more open and informed dialogue, centered around increasing the awareness and understanding of HPV.

[a] HPV: human papillomavirus.

[b] CDC: Centers for Disease Control and Prevention.

Discussion

Principal Findings

This study examined the development and usability evaluation of K-Bot, an AI chatbot created to provide bilingual, culturally sensitive health information about HPV vaccination for Korean immigrants and Korean Americans. The study assessed the chatbot's usability in delivering accurate health information and identified both strengths and areas for refinement, contributing to the optimization of chatbot-based health interventions aimed at promoting behavior change and informing the development of more targeted and effective strategies in future implementation trials.

This study found that although participants exhibited high awareness of HPV and its vaccine, actual vaccine uptake remained low, particularly among male participants. Participants reported that K-Bot addressed this disparity by providing inclusive education, which is critical for promoting vaccine uptake among all individuals. Participants identified K-Bot's bilingual functionality and culturally tailored content as significant strengths, with the dual-language option allowing access to health information in both English and Korean. This finding highlights the necessity of linguistic inclusivity in digital health tools to engage diverse populations effectively. However, the usability evaluation revealed areas for improvement, including navigation complexity, challenges with language selection, and limited visual engagement. Although this study incorporated GIFs and images to improve visual engagement and support users with varying levels of health literacy, these enhancements alone may be insufficient to address the broader and more nuanced challenges faced by diverse user populations. Addressing these limitations through iterative design refinements and leveraging emerging technologies, such as multimodal conversational systems, could further optimize K-Bot's usability and impact on health behavior change.

Comparison With Prior Work

The findings of this study align with the existing literature, indicating that HPV vaccination is often perceived as primarily relevant to women, particularly within the Korean community [12,25,30]. Previous research has shown that cultural perceptions and public health messaging in Korea have historically targeted females, contributing to persistent disparities in vaccination rates by sex [31]. This misconception can be traced back to Korea's initial HPV vaccination program, which was launched in 2016, focusing exclusively on adolescent girls before expanding to include boys in 2024 [32]. This focus on vaccinating only specific groups likely influenced public attitudes among Koreans and Korean Americans, as immigrant health behaviors are often shaped by practices from their country of origin [12,25]. This exclusion of boys may have perpetuated misconceptions in Korean American communities, furthering barriers to vaccine uptake, particularly where familial and community norms strongly influence health decisions, [33]. Similar findings in previous studies suggest that these culturally ingrained beliefs can create significant barriers to HPV vaccination among males, necessitating targeted educational intervention [12]. Addressing these challenges requires inclusive education tailored to Korean Americans, which highlights the importance of HPV vaccination for all individuals in preventing disease and reducing transmission. Participants shared that the chatbot helped correct the belief that HPV vaccination is exclusively for women, a misconception that has been widely documented in the literature as a significant barrier to male vaccination [34]. Culturally tailored digital interventions, such as K-Bot, have the potential to play a critical role in addressing these challenges.

K-Bot's culturally tailored approach aligns with a growing body of research advocating for the use of culturally sensitive design elements. Studies have shown that culturally sensitive design elements, such as language adaptability, empathy, and humor, enhance user trust, engagement, and the overall efficacy of digital health interventions [35]. By integrating a culturally sensitive design, K-bot exemplifies the potential of AI-driven technologies to mitigate health care disparities by improving access to accurate, culturally relevant health information. The study also adds to the emerging evidence on the existing literature focusing on culturally tailored digital interventions in mitigating barriers to HPV vaccination. Although the domain of culturally adapted chatbots remains underexplored, this study reinforces the critical need for such interventions to address cultural stigmas and misconceptions surrounding HPV. The existing literature highlights the critical need for culturally sensitive interventions, especially given the deeply rooted cultural stigmas and misconceptions surrounding STIs in many Asian American communities [36,37]. These stigmas often act as significant deterrents, discouraging open discussions about HPV vaccination, particularly among Asian immigrant populations where cultural norms may further limit access to accurate health information [37]. By directly addressing these cultural and linguistic barriers, K-Bot represents an important advancement in leveraging AI-driven tools to deliver tailored health information and promote equitable access to preventative care.

Strengths and Limitations

This study's strengths lie in its rigorous, iterative design process, combining expert evaluation with participatory user feedback to optimize K-Bot's functionality. Integrating user feedback into iterative refinements follows the best practices in participatory design for digital health interventions [37], emphasizing the importance of collaborative frameworks in enhancing usability and user satisfaction.

This study has several limitations that should be considered when interpreting the findings. First, the limited sample size reduces the generalizability of the results, as the insights gained may not fully represent the broader population. Second, although K-Bot's culturally tailored design was well received by this specific group, its applicability to other Asian American subgroups or culturally diverse populations remains uncertain. Lastly, the study primarily relied on self-reported data, introducing potential biases, such as social desirability and recall bias, which may affect the accuracy of the findings.

Future Research Directions

The findings underscore K-Bot's potential as both a stand-alone intervention and an integrated tool within health care systems to address HPV vaccination disparities. Future research should focus on evaluating its feasibility and efficacy through rigorous trials, with particular attention to its scalability across diverse health care settings. Longitudinal studies are essential to assess K-Bot's sustained impact on vaccination uptake and behavior change. Expanding K-Bot to other Asian American subgroups would enhance its adaptability and engagement, addressing the heterogeneity within these populations. K-Bot's reliance on NLP, while effective in delivering structured and evidence-based information, presents limitations in managing open-ended queries. K-Bot was developed prior to the emergence of generative AI technologies, such as Chat Generative Pretrained Transformer (ChatGPT). The recent literature examining the application of ChatGPT in nursing education, practice, and research highlights several advantages of generative AI [38]. These capabilities suggest significant potential for enhancing K-Bot's functionality by enabling more dynamic, context-sensitive, and user-centered interactions. However, as noted in the literature, ethical considerations, such as minimizing misinformation and ensuring cultural sensitivity, must be prioritized to safeguard the intervention's credibility and trustworthiness [38]. Although K-Bot's reliance on NLP ensures accurate, evidence-based responses, its limited ability to manage open-ended queries highlights a need for integrating advanced AI technologies to better meet user needs. Additionally, usability feedback from this study may differ among various age groups, with younger users potentially being more tech-savvy than older adults. Future iterations of K-Bot could explore tailoring its interface and functionality to accommodate different subgroups, such as adolescents and parents, to enhance user engagement and satisfaction.

Conclusion

In conclusion, K-Bot exemplifies an innovative, culturally sensitive approach to addressing HPV vaccination disparities among Korean Americans. By delivering personalized, bilingual health information, K-Bot has successfully demonstrated its potential to overcome barriers related to language, stigma, and misinformation. Although the study's findings are encouraging, they are based on a smaller sample size, and further research is needed to validate these results across a broader and more diverse population. Refinement of the chatbot's usability and potential customization for different age groups and cultural contexts could enhance its effectiveness. The positive reception of K-Bot suggests it could be a scalable tool for public health interventions. Exploring the application of AI-driven chatbots in other populations remains a promising avenue for addressing health inequities and promoting equitable health care access.

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Data Availability

Data are presented in the main manuscript.

Conflicts of Interest

None declared.

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Abbreviations

ACIP: Advisory Committee on Immunization Practices
AI: artificial intelligence
CDC: Centers for Disease Control and Prevention
ChatGPT: Chat Generative Pretrained Transformer
HPV: human papillomavirus
NLP: natural language processing
Q&A: question-and-answer
STI: sexually transmitted infection

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Gender-Based Susceptibility to Mental Health Issues in Adolescents During the COVID-19 Pandemic: Descriptive Study

Young-Shin Lee*, PhD, RN; Minjeong Kim, PhD; Kim Moreno*, PhD

School of Nursing, San Diego State University, 5500 Campanile Dr., San Diego, CA, United States

*these authors contributed equally

Corresponding Author:
Young-Shin Lee, PhD, RN
School of Nursing, San Diego State University, 5500 Campanile Dr., San Diego, CA, United States

Abstract

Background: Adolescence, the transitional phase between childhood and adulthood, is a stressful, fragile, and critical period. While the COVID-19 pandemic introduced numerous stressors affecting the mental health of all age groups, adolescents are particularly vulnerable. However, there is limited research focusing on the impact of COVID-19 on this population.

Objective: This study aimed to explore the impact of COVID-19, coping strategies, depression, anxiety, and post-traumatic stress disorder (PTSD) in adolescents during the pandemic.

Methods: This web-based cross-sectional survey study included 217 adolescents in Southern California, USA, between 2020 and 2021. Self-report measures include demographic questionnaires, COVID-19 impact, types of coping strategies used during COVID-19, depression, anxiety, and PTSD analyses. The χ^2 tests were used for depression and anxiety, and ANOVA was used for PTSD analysis.

Results: Female gender was identified as a risk factor for depression, anxiety, and PTSD. Approximately 24.2% (52/217) of participants had a family member or someone close who was infected with COVID-19 during the pandemic, which was a significant factor for both anxiety and PTSD ($P<.05$). More than half of all the participants (56.8%, 109/217) were Asian Americans, but there was no significant difference in depression, anxiety and PTSD among different racial or ethnic groups ($P>.05$). About a quarter of the participants reported experiencing depression (49/217, 25.5%) or anxiety (46/217, 24.0%). The mean (SD) score for PTSD was 8.08 (5.70). Social media and the internet were the most frequently used coping strategies, with 67.3% of participants using each.

Conclusions: Considering our findings, prevention programs focusing on mental health, including routine screening, should be implemented at community level for adolescents. School programs fostering healthy social interactions and education on coping strategies should also be implemented for both families and adolescents.

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KEYWORDS

adolescent; anxiety; COVID-19; depression; post-traumatic stress disorder; mental health; coping strategies

Introduction

Pandemics and Mental Health of Adolescents

The COVID-19 pandemic has significantly affected everyone, particularly adolescents [1]. Adolescents, being in a crucial developmental stage, are particularly vulnerable to mental health issues. Their emotional regulation systems mature before those responsible for decision-making do, increasing their susceptibility to anxiety, aggression, and risky behaviors [2]. Socially, they rely more on peer interactions for development, with schools and community groups playing key roles in their socialization [3,4]. These interactions, vital for combating issues like low self-esteem and depression, were significantly disrupted by early COVID-19 public health recommendation including social distancing, limited interaction with peers, and school closures. Such disruptions could lead to long-term psychological and physiological impacts, highlighting the need to focus on adolescent mental health during the pandemic, given their vulnerability [4,5]. Therefore, it is important to understand the adolescent mental health status during COVID-19, given their susceptibility to mental health challenges.

The attention on adolescents' health during COVID-19 pandemics is limited, especially in the United States, with most studies conducted in China, Australia, and Japan [3,6-10]. Studies on Chinese adolescents during the COVID-19 pandemic reported depression rates between 19.7% and 43.7%, anxiety rates between 24.9% and 37.4%, and a post-traumatic stress disorder (PTSD) rate of 14.4% [6-9]. In Japan, Isumi et al. [10] reported a 1.34-fold increase in child suicide rates in May 2020 compared to March 2020. Australian adolescents saw significant rises in depression and anxiety, alongside drops in life satisfaction during the pandemic [3].

The shift to online learning and reduced physical and social activity has marked a drastic change in adolescents' lifestyles, contributing to increased screen time and more sedentary behaviors [11]. In the United States, there was a 50.6% rise in emergency department visits by adolescent girls for suicide attempts in February 2021 compared to 2019 [12]. Interestingly, US Hispanic adolescents with mental health issues before the COVID-19 pandemic experienced a significant decrease during the pandemic, possibly due to enhanced family interactions. However, the results of this study may not be generalized to the diverse US adolescents because of the large proportion of the Hispanic sample [1].

Coping Strategies of Adolescents During COVID-19

Research on how adolescents adapted to restrictions on social and outdoor activities during the COVID-19 pandemic is scarce. One study highlighted that common coping strategies of young adults aged 18‐24 years included “just staying indoors” followed by “talking to people,” “maintaining a positive outlook,” and “trying to do some online school work” [13]. Another study found that children and adolescents engaged in spiritual/emotional activities; cognitive/social activities with family at home; exercise; and managing healthy sleep [14]. Despite the numerous stressors impacting the mental health of US adolescents during COVID-19, there was a gap in research specifically addressing the prevention and the mental health consequences for this at-risk group. Thus, examining the link between COVID-19 and mental health among US adolescents is crucial.

This study aims to investigate the association of COVID-19, coping mechanisms, and mental health challenges among adolescents in California during the pandemic. The specific aims are (1) to describe the prevalence of COVID-19 within the family or among someone close (through ties of kinship or affection); (2) to describe coping strategies used by adolescents; and (3) to identify whether demographic variables and being personally impacted by COVID-19 are related to depression, anxiety, and PTSD.

Methods

Ethical Considerations

This study was approved by the Institutional Review Board of the San Diego State University (HS-2020-0199). Both English and Spanish versions of the parent consent form were provided and signed by parents. All participants' identities were kept confidential. An electronic gift card of US $5 was sent to participants.

Study Design and Setting

This study is a descriptive study using a cross-sectional design to identify the relationship between COVID-19 and mental health issues among adolescents in California. The web-based survey was conducted between October 2020 and February 2021, targeting adolescents in Southern California, United States. The inclusion criteria for this study were (1) boys and girls between 12 and 17 years old; (2) the ability to communicate verbally and/or in writing in English; (3) has access to an electronic device to complete the survey; and (4) both parent and participant provided consent for the survey study. The principal investigator assessed the participants' eligibility. A convenience sampling method was used to recruit potential participants, including school nurses from Hispanic or Black backgrounds, parent associations, student science clubs, and by distributing flyers in shopping malls. A web-based self-report survey was developed using Qualtrics survey software (Qualtrics XM), and a survey link was sent to potential participants.

Measures: Demographic Questionnaire

We included the gender (male and female), age (12‐14 years old and 15‐17 years old), and race/ethnicity (non-Hispanic White, Asian, and Hispanic).

COVID-19 Impact

The impact of COVID-19 was assessed using two questions with responses of yes/no: (1) family member/household infection with COVID-19, and (2) close contact death due to COVID-19. These were combined into a single variable if participants responded yes to either question. Regarding the coping strategies during COVID-19, participants indicated yes/no for various coping methods, including social media, internet use, video/computer games, sleep, eating, TV watching, phone calls, outdoor/indoor activities (walking, gardening, or shopping, etc.), indoor activities, and reading (books, newspapers, or magazines, etc.).

Mental Health Problems

The patient health questionnaire-4 (PHQ-4) was used to assess depression and anxiety using a 4-item, 4-point Likert scale. The depression subscale (PHQ-2) and anxiety subscale (GAD-2) each consist of 2 items, with scores ranging from 0 to 6. A score of 3 or greater on either subscale indicates a positive result for depression of generalized anxiety disorder (GAD). The PHQ-4 has established reliability and validity across diverse populations [15,16]. The impact of event scale-6 (IES-6) is a shorten version of the impact of event scale-revised (IES-R), comprising 6 items rated on a 5-point Likert scale to measure PTSD symptoms. The total scores range from 0 to 24, with higher scores indicating more severe post-traumatic stress reactions. The reliability and validity of the IES-6 have been established across various populations [17].

Data Analysis

Descriptive statistics including the mean and SD were computed for all variables using the SPSS (version 27.0, IBM Corp). The χ^2 tests were used to assess proportions of depression and anxiety by demographic variables and the COVID-19 impact. ANOVA analyses were employed to compare the mean PTSD score across demographic variables and the COVID-19 impact. The significance level for all statistical analyses was set at .05.

Results

As of March 2021, a total of 217 adolescents participated in this study, including 108 males (50.2%), and 18% in the younger age group (12‐14 years old); Asian Americans were the largest ethnic group (109/217, 56.8%), followed by non-Hispanic White (52/217, 27.1%) and Hispanic (31/217, 16.1%; Table 1). Regarding the COVID-19 impact, approximately 24.2% (52/217) of the participants had a family member or someone close who had tested positive for COVID-19 or died from it.

Table . Demographic characteristics of participants and impact of COVID-19 (N=217).

Variable	n (%)
Gender	
Male	108 (50.2)
Female	107 (49.8)
Age	
Younger (12 - 14 years old)	39 (18.0)
Older (15 - 17 years old)	178 (72.0)
Race/Ethnicity	
Non-Hispanic White	52 (27.1)
Asian	109 (56.8)
Hispanic	31 (16.1)
COVID-19 impact	
Family or someone close tested positive for COVID-19	
Yes	52 (24.2)
No	163 (75.8)

Among the types of coping strategies, the use of social media and internet were the most common (146/217, 67.3%); followed by video or computer games, sleeping, eating, and TV watching (118/217, 54.4%); indoor activities (53/217, 24.4%); and reading books or magazines, which was the lowest (52/217, 24%; Table 2).

Table . Types of coping strategies during the COVID-19 pandemic (N=217).

Variable	n (%)[a]
Social media use	146 (67.3)
Internet use	146 (67.3)
Video or computer games	131 (60.4)
Sleeping	124 (57.1)
Eating	119 (54.8)
Watching TV	118 (54.4)
Talking with someone over the phone	94 (43.3)
Outdoor activities (walking, gardening, or shopping, etc.)	91 (41.9)
Indoor activities	53 (24.4)
Reading (books, newspapers, or magazines, etc.)	52 (24)

[a] Multiple responses were permitted.

Regarding the impact of COVID-19, the overall prevalence of depression was 25.5% (49/217) and that of anxiety was 24% (46/217); the overall mean (SD) score of PTSD was 8.08 (5.70; Table 3).

Table . Differences in depression, anxiety, and post-traumatic stress disorder (PTSD) by demographic characteristics and the COVD-19 impact (N=217).

Variable	Depression (PHQ-2[a] score ≥3)			Anxiety (GAD-2[b] score ≥3)			PTSD (IES-6[c])		
	n (%)	χ^2 (*df*)	*P*	n (%)	χ^2 (*df*)	*P*	Mean (SD)	F test (*df*)	*P*
Gender									
Male	19 (17.6)	7.28 (1)	<.05	14 (13.0)	13.88 (1)	<.001	6.87 (5.10)	10.60 (1)	<.01
Female	36 (33.6)			37 (34.6)			9.34 (6.01)		
Age									
Younger (12-14 years)	13 (31.0)	0.52 (1)	.47	11 (26.2)	0.06 (1)	.82	8.35 (5.78)	0.11 (1)	.74
Older (15-17 years)	48 (25.5)			46 (24.5)			8.02 (5.70)		
Race/Ethnicity									
Non-Hispanic White	16 (30.8)	1.41 (2)	.5	14 (26.9)	0.61 (2)	.74	7.94 (5.41)	0.04 (2)	.96
Asian	27 (24.8)			26 (23.9)			8.12 (5.74)		
Hispanic	6 (19.4)			6 (19.4)			8.29 (5.74)		
COVID-19 impact: family or someone close was diagnosed with COVID-19									
Yes	19 (35.2)	3.68 (1)	.055	20 (37.0)	7.33 (1)	<.01	10.17 (6.31)	9.99 (1)	<.01
No	36 (22.1)			31 (19.0)			7.39 (5.33)		
Total	49 (25.5)			46 (24.0)			8.08 (5.70)		

[a] PHQ-2: depression subscale.

[b] GAD-2: anxiety subscale.

[c] IES-6: impact of event scale.

Female participants compared to male participants reported a significantly higher prevalence for depression (33.6% vs 17.6%, respectively) and anxiety (34.6% vs 13%, respectively; *P*<.05) and significantly higher mean (SD) scores for PTSD (9.34 [6.01] vs 6.87 [5.10], respectively; *P*<.01).

However, there were no significant differences in depression, anxiety, and PTSD (*P*>.05) among participants between age groups (12-14 and 15-17 years old) and racial/ethnic groups (Non-Hispanic White, Asian, and Hispanic). Participants who had a family member or someone close diagnosed with COVID-19 reported a significantly higher prevalence for anxiety compared to their counterparts (20/54, 37% vs 31/163, 19%, respectively; *P*<.01) and significantly higher mean scores for PTSD (10.17 vs 7.39, respectively; *P*<.01). The group experiencing COVID-19 did not show a significant difference in depression (35%) compared to those unaffected by COVID-19 (22%; *P*=.55).

Discussion

Findings and Comparison With Previous Works

The present study examined the association of the 2020-2021 COVID-19 pandemic with adolescent depression, anxiety, and PTSD, as well as their coping strategies. Of the demographic variables, only female gender showed associations with all three mental health issues. These findings are consistent with findings from the United States and other countries [6,9,18]. While previous studies in China suggested older adolescents reported more mental health problems during the COVID-19 pandemic [8,9], our study found no significant age-related differences in mental health. The impact of COVID-19 on mental health among younger adolescents in the United States remains uncertain, warranting further studies. Notably, over half of the participants (56.8%) were Asian Americans, possibly influenced by heightened interest in the COVID-19 study due to prevalent anti-Asian discrimination and violence during the pandemic compared to other racial/ethnic groups.

Given that most studies about COVID-19 and adolescent mental health have been conducted in China [6,8,9], it is essential to prioritize studies on Asian American adolescents to comprehend their mental health. Although our study did not reveal significant racial/ethnic mental health disparities, we recommend further research in this area.

In this study, 24.2% of the participants reported having a family member or someone close diagnosed with COVID-19, with a significantly higher prevalence of both anxiety and PTSD. However, while the impact of depression was higher among families affected by COVID-19 compared to those not affected by COVID-19 (35% vs 22%), the significance level was marginally significant (*P*=.055), possibly due to the sample size. This finding is similar to other studies that reported having a family member or friend diagnosed with COVID-19 was significantly related to higher levels of anxiety [6].

The depression rate (25.5%) in the current study was double the pre-COVID-19 prevalence of major depressive episodes among US adolescents (13.3%) [19]. Similarly, the prevalence of anxiety (24%) was comparable to rates (24.9%) reported in China [8,9]. Our participants' mean PTSD scores of 8.08 approached the potential cutoff scores of 10 on the IES-6 scale [17]. However, comparisons with other studies were challenging due to differences in PTSD measurement tools and limited studies during the COVID-19 pandemic among adolescents [7]. Therefore, further studies are needed to examine the prevalence of depression, anxiety, or PTSD that targets the US adolescent population, given the inconsistent findings.

As coping strategies to overcome stress during the pandemic, most participants in this study used social media and/or the internet, playing video or computer games, while fewer than half engaged in outdoor or indoor physical activities. This aligns with an Australian study where adolescents increased inactivity as well as social media and internet use during the COVID-19 pandemic were linked to reduced happiness [11]. Online connection itself has both positive and negative impacts on social relationships and mental health. However, it is evident that pandemic prevention orders—physical distancing, stay-at-home orders, and school closures—have led to increased screen time and increased use of the internet and smartphone as well as decreased physical activity among school-age children and adolescents, all of which can lead to decreased interpersonal relationship and social support. To address this, it is crucial to promote healthier coping strategies and encourage social interaction despite physical distancing. Examples of healthy coping strategies include (1) socially interactive networking to help adolescents stay connected with each other in their community [13,20,21], (2) participating in physically active indoor activities through virtual networking [13], and (3) healthy sleep management [14].

Limitations

The use of convenience sampling, online surveys, and self-reported questionnaires may limit the generalizability of our findings and could lead to underreporting of mental health issues due to stigma. Additionally, the study is limited in its inclusion of gender-diverse and cultural factors, which may restrict the extent of perspectives captured. Nonetheless, this pioneering study offers valuable insights into the mental health of US adolescents during the 2020 - 2021 COVID-19 pandemic, including a significant representation of Asian American adolescents.

Relevance for Clinical Practice

Given the increased prevalence of depression, anxiety, and PTSD in adolescents identified in this study, it is essential to develop, implement, and expand prevention programs focusing on mental health. This includes routine screening and early detection in primary care and psychiatric/mental health care settings for both adolescents and their families. School nurses need to be aware of the impact of the COVID-19 pandemic on adolescents' mental health. School-based programs that augment and/or complement adolescents' use of online devices with more interactive and creative activities should be developed and implemented in collaboration with adolescents and their families. Collaboration and cooperation between health care settings, schools, families, and students should be encouraged to help identify students at risk.

Conclusion

Approximately 25% of participants who had a family member or someone close to them diagnosed with COVID-19 were significantly associated with anxiety and PTSD. Participants in this study heavily relied on social media and the internet a lot more than any other coping strategies, and also experienced increased rates of anxiety and PTSD during the pandemic. Implementing prevention programs with routine screening, early detection, and referrals for mental health support is crucial. Additionally, school and home-based activities to enhance social interaction and healthy coping strategies among adolescents and their families should be both developed and encouraged.

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Conflicts of Interest

All authors declare no conflict of interest related to this study.

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Abbreviations

GAD: generalized anxiety disorder
GAD-2: anxiety subscale
IES-6: impact of event scale
PHQ-2: depression subscale
PHQ-4: patient health questionnaire-4
PTSD: post-traumatic stress disorder

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Exploring Clinical Decision-Making Competencies of Emergency Nurses in Trauma Care in Indonesia: Qualitative Study

Saharuddin Saharuddin[1]; Elly Nurachmah[1]; Masfuri Masfuri[1]; Dewi Gayatri[1]; Amelia Kimin[1]; Muhammad Sakti[2]; Sanisah Binti Saidi[3]; Sri Yona[1]

[1]Faculty of Nursing, Universitas Indonesia, Gedung Pascasarjana FIK UI & Laboratorium, Jl. Prof. Dr. Bahder Djohan, Kampus UI Depok, Depok, Indonesia

[2]Faculty of Medicine, Universitas Hasanuddin, Makassar, Indonesia

[3]Faculty of Nursing, International Islamic University Malaysia, Kuantan, Malaysia

Corresponding Author:
Saharuddin Saharuddin
Faculty of Nursing, Universitas Indonesia, Gedung Pascasarjana FIK UI & Laboratorium, Jl. Prof. Dr. Bahder Djohan, Kampus UI Depok, Depok, Indonesia

Abstract

Background: Clinical decision-making is vital for emergency nurses, especially in trauma care that requires swift, accurate actions. In Indonesia, where resources are limited, little is known about how nurses manage such challenges.

Objective: This study aimed to explore the clinical decision-making competencies of emergency nurses in trauma care, focusing on challenges, strategies, and influencing factors.

Methods: This was a qualitative study using semi-structured interviews with 16 emergency nurses, complemented by observations and document analyses. Data were analyzed thematically, with triangulation, thereby ensuring validity.

Results: Six key themes emerged: (1) recognize cues; (2) analyze cues; (3) prioritize hypothesis; (4) generate solutions; (5) take actions; and (6) evaluate outcomes. These highlight the adaptive and multidimensional nature of decision-making in emergencies.

Conclusions: The decision-making of emergency nurses integrates analysis, prioritization, collaboration, and reflection. Enhanced training, such as simulation-based learning, and addressing systemic barriers can improve competencies. Policymakers should provide adequate resources and robust standards to support nurses under pressure.

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KEYWORDS

clinical decision-making; emergency nursing; trauma care; Indonesia; emergency nurse

Introduction

Clinical decision-making is at the core of nursing practice, particularly in emergency departments (EDs), which demand speed and accuracy. In these settings, nurses must recognize clinical cues, prioritize actions, make rapid decisions, and evaluate outcomes to ensure patient safety and quality of care [1]. These decisions are often made in complex and uncertain situations where errors can have fatal consequences [2].

Numerous studies have highlighted the importance of experience, intuition, and situational awareness in nurses' decision-making. Intuition is frequently used by experienced nurses through pattern recognition developed over years of clinical practice. In contrast, less experienced nurses tend to rely on more structured analytical approaches [2,3]. Additionally, clinical decision-making is influenced by organizational factors, workplace culture, education, and individual autonomy [4].

Although clinical decision-making has been extensively studied, most research has focused on developed countries. Research in Indonesia indicates that nurses in EDs face challenges such as resource limitations, high patient loads, and inadequate training [5]. Furthermore, clinical experience and the use of advanced medical technology are critical factors in enhancing decision-making capabilities in emergency situations [2]. However, there remains a knowledge gap in understanding how nurses in developing countries manage these challenges in daily practice.

This study aims to explore the clinical decision-making competencies of emergency nurses in trauma care in Indonesia, focusing on the challenges, strategies, and supporting factors that influence their clinical decisions. Using a qualitative approach, this research seeks to contribute new insights to the global understanding of nurses' clinical decision-making in high-pressure environments

Methods

Study Design

This study employed a qualitative approach with an exploratory design to gain an in-depth understanding of the clinical decision-making competencies of ED nurses in trauma care. Data were collected through semi-structured in-depth interviews with 16 ED nurses with at least 2 years of work experience in provincial referral hospitals in Indonesia.

Data Collection

In-Depth Interviews

Interviews were conducted in person using open-ended questions designed to explore nurses' experiences in recognizing patient cues, prioritizing actions, and evaluating intervention outcomes. Each interview lasted 45 - 60 minutes and was recorded for further analysis with the participants' consent.

Observation

Observations were carried out in ED settings during active working hours to document how nurses recognized clinical signs, interacted with medical teams, and made clinical decisions in real-time situations.

Documentation

Relevant documents such as triage protocols, medical records, and operational policies were analyzed to support data from interviews and observations.

Data Analysis

Data were thematically analyzed through verbatim transcription, coding, theme development, and triangulation of interviews, observations, and documents to ensure validity and capture nurses' experiences influencing clinical decision-making in EDs.

Ethical Considerations

Ethical approval was obtained from the University of Indonesia Ethics Committee (KET-036/UN2.F12.DI.2.1/PPM.00.02/2024), and all participants provided informed consent after understanding the study's purpose, confidentiality, and their right to withdraw without consequences. The data were de-identified.

Results

Theme 1: Recognize Cues

Subtheme 1.1: Identifying Key Data

Nurses prioritized vital signs such as respiratory rate and blood pressure. One participant stated, "I usually start by looking at their breathing, whether it's normal or not. If there are additional sounds, it needs immediate attention" (R2). Observations confirmed that prioritization of vital signs was supported by triage protocols.

Subtheme 1.2: Integrating Clinical Information

Nurses used data from medical histories and families. "If the patient is unconscious, we ask the family if there's a history of conditions like heart disease," explained a participant (R9). Patient documentation indicated that such data helped establish initial interventions.

Theme 2: Analyze Cues

Subtheme 2.1: Correlating Symptoms with Clinical Conditions

Symptoms such as limb pain were analyzed as indications of fractures. "If there's significant swelling and the patient can't move, it's usually a fracture," noted one nurse (R6). This finding aligned with observed actions in cases of extremity trauma.

Subtheme 2.2: Projecting Risks of Complications

Nurses predicted complications such as internal bleeding. "Sometimes patients appear stable, but we need to consider possible bleeding," remarked a participant (R13). Clinical documentation supported these evaluations.

Theme 3: Prioritize Hypothesis

Subtheme 3.1: Justifying Priorities

Priority decisions were based on the critical condition of patients. "If the patient is short of breath, we prioritize them because they can quickly go into respiratory arrest," said one respondent (R7). Observations showed that priorities were determined using triage algorithms.

Subtheme 3.2: Team Collaboration

Collaboration with doctors and medical teams was crucial for setting priorities. "We always discuss critical conditions with the doctors," said a nurse (R4). Team meeting documentation demonstrated alignment in decision-making.

Theme 4: Generate Solutions

Subtheme 4.1: Adapting Care Plans

Nurses modified plans based on changes in patients' conditions. "We continuously evaluate. If there's a change, we adjust," said a respondent (R10). Observations noted immediate actions for adaptation.

Subtheme 4.2: Adhering to Nursing Standards

Interventions were carried out following standard operating procedures. "We always refer to protocols, for example, for IV insertion," stated a nurse (R11). Protocols documented consistent application of standards.

Theme 5: Take Actions

Subtheme 5.1: Dynamic Monitoring

Nurses regularly monitored changes in vital signs. "After the intervention, we recheck to see if there's improvement," said one participant (R5). Observations noted that evaluations were conducted every 15 minutes in critical cases.

Subtheme 5.2: Response-Based Modifications

If outcomes were unsatisfactory, plans were revised. "If oxygen saturation remains low despite oxygen therapy, we consider other interventions," said a respondent (R20). Documentation showed the use of evaluation results to adjust actions.

Theme 6: Evaluate Outcome

Subtheme 6.1: Real-Time Documentation

Nurses documented all actions immediately after implementation. “Whatever we do, it must be written immediately,” said one participant (R2). Electronic medical record systems supported this process.

Subtheme 6.2: Patient and Family Education

Education was provided to improve patients’ understanding. “We explain the procedures to reassure families,” noted a respondent (R7). Observations recorded frequent family involvement in care processes.

Discussion

Principal Findings and Comparison With Previous Works

This study identified 6 key themes underlying emergency nurses’ clinical decision-making competencies in the management of trauma patients. The findings provide a comprehensive picture of the decision-making process that is not only reactive, but also proactive and reflective, according to the complexity of the situation in the ED. This emphasizes that clinical decision-making is a multidimensional competency that requires the integration of knowledge, clinical experience, intuition, and communication and collaboration skills.

The first and second themes, recognizing clinical cues and analyzing signs and symptoms, emphasize the importance of keen observation and critical analysis under highly dynamic conditions. This is in line with the clinical decision-making model developed by Tanner [1], which emphasizes the process of pattern recognition and situational awareness as the main foundations of clinical decision-making [6]. In addition, this finding also reinforces Benner and Tanner’s [3] concept that underlines the role of experience in building clinical intuition that helps nurses make quick and appropriate decisions in critical circumstances.

In problem prioritization, nurses not only rely on objective data from vital signs and medical history, but also apply empirical frameworks such as triage systems and emergency protocols [4]. Interprofessional collaboration was the key to success in this process, in line with the literature that shows that effective communication between medical teams contributes significantly to the reduction of clinical errors and improved patient outcomes [7].

The implementation of the care plan and the evaluation of outcomes highlighted the need for flexibility in responding to real-time changes in the patient’s condition. This adaptive approach is encouraging a continuous decision-making process based on the monitoring and reflection of clinical data [8,9]. The ability to modify interventions based on patient response also reflects the professionalism and ethical responsibility of nurses who are not only protocol-oriented, but also in the real context of the patient [10].

Strong documentation and education support the effectiveness of the decision-making process [11]. Accurate documentation not only ensures the continuity of care but also serves as legal evidence and a means of communication between teams [12,13]. Patient and family education, despite time constraints in the ED, is instrumental in improving adherence and social support, both of which are important in the recovery phase [14,15]. This is in line with the principle of holistic care that integrates physical, psychological, and social aspects in patient care.

Limitations

The focus on hospitals in Indonesia with specific local resource and cultural characteristics limits the broad generalizability of the findings. The limitations of qualitative data in the form of potential subjective bias of participants and researchers need to be anticipated by triangulation methods, and the results need to be validated more broadly in future studies.

Future research should employ mixed methods and expand samples across diverse health care settings. The SAHAR (steps to acquaintance of hypothesis in achieving recovery) model, derived from this study, should be refined and tested as a training intervention to enhance clinical decision-making, particularly in high-pressure environments like EDs.

Conclusions

This study presents the clinical decision-making process of emergency nurses in trauma care and introduces the SAHAR model as a novel framework to enhance adaptive decision-making. The integration of this model into nursing education and clinical practice is recommended to improve decision-making competencies, supported by adequate resources and standardized procedures. Further research is needed to validate and refine the model across diverse health care settings.

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Conflicts of Interest

None declared.

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Abbreviations

ED: emergency department
SAHAR: steps to acquaintance of hypothesis in achieving recovery

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Effectiveness of a Participatory and Culturally Tailored Learning Program for Coronavirus Prevention in Muslim Older Adults With Hypertension and Diabetes: Quasi-Experimental Study

Sutteeporn Moolsart[1*], BSc, MSc, DrPH; Choochat Phuangsomjit[2*], BEd, MEd, PhD

[1]School of Nursing, Sukhothai Thammathirat Open University, 9/9 Mhu 9, Bang Phut Subdistrict, Pak Kret District, Nonthaburi, Thailand
[2]School of Education, Sukhothai Thammathirat Open University, 9/9 Mhu 9, Bang Phut Subdistrict, Pak Kret District, Nonthaburi, Thailand
[*]all authors contributed equally

Corresponding Author:
Sutteeporn Moolsart, BSc, MSc, DrPH
School of Nursing, Sukhothai Thammathirat Open University, 9/9 Mhu 9, Bang Phut Subdistrict, Pak Kret District, Nonthaburi, Thailand

Abstract

Background: Respiratory infections have increased globally over time, with older adults being the most susceptible demographic. Programs based on cultures and experiences strongly correspond with useful, real-world applications.

Objective: This study evaluated a participatory and culturally based learning program's effect on awareness, knowledge, and preventive behaviors regarding coronavirus and health care among Muslim older adults with hypertension and diabetes in Thailand.

Methods: The quasi-experimental study used a 2-group pretest-posttest design with participants aged 60‐80 years with hypertension and diabetes. The sample included 35 in the experimental group and 32 in the control group. An interactive 6-week learning program focusing on coronavirus prevention and health care was developed by incorporating Muslim cultural perspectives and Kolb experiential learning model, alongside standard care. The control group received only standard care. Data were collected via a questionnaire covering general information, awareness, knowledge, and preventive behaviors related to coronavirus prevention and health care. The content validity indices of sections II, III, and IV were 0.98, 0.99, and 0.96, respectively. The Cronbach α coefficients of awareness and behaviors were 0.89 and 0.86, respectively, while the KR-20 for knowledge was 0.86. Data analysis was conducted using the *t* test, Mann-Whitney *U* test, and Wilcoxon signed-rank test.

Results: The results indicated that, after participating in the program, the awareness, knowledge, and preventive behaviors related to coronavirus and health care among older adults in the experimental group significantly improved compared to their preprogram levels and to those in the control group, with a *P* value <.01.

Conclusions: The program effectively improved coronavirus prevention and health care among Muslim older adults. It could be broadly applied in similar contexts and to other severe respiratory diseases.

Trial Registration: Thai Clinical Trials Registry TCTR20250112007; https://www.thaiclinicaltrials.org/show/TCTR20250112007

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KEYWORDS

Thailand; participatory and culturally based; learning program; coronavirus; older adults; Muslim

Introduction

During the coronavirus pandemic, older adults were particularly vulnerable and faced multiple challenges, including limited access to health care, increased isolation, and emotional distress [1,2]. Muslim older adults were considered a high-risk group for coronavirus infection due to their regular participation in communal religious activities, such as weekly mosque prayers, physical greetings, and daily worship rituals [3]. In Muslim-majority countries such as India, Sri Lanka, and Bangladesh, significant numbers of coronavirus infection cases were reported [4]. In Thailand, although the Sheikhul Islam issued preventive guidelines [5], tensions arose between religious practices and public health recommendations [6]. These included dilemmas regarding mosque attendance, social distancing, and following imams via online platforms. Understanding the cultural and spiritual beliefs of Muslims is essential for delivering effective and respectful health care. Older Muslims, particularly those with limited access to digital media, often receive inadequate health information, which can result in poor compliance with preventive measures.

Older adults often live with chronic conditions such as hypertension, diabetes, and cardiovascular disease, which significantly increase their risk of severe outcomes from coronavirus infection [7,8]. A systematic review reported that individuals with these conditions have a 2- to 4-fold higher risk of severe illness and mortality [9]. Despite this evidence, many studies have overlooked the specific needs and perspectives of high-risk older adults, particularly those with multimorbidity [10].

Promoting coronavirus prevention education among older adults with comorbidities was essential [11]. Thailand’s cultural and religious diversity, particularly in provinces such as Nonthaburi, added complexity to public health efforts. Nonthaburi reported a high number of coronavirus infection cases during the outbreak, with Muslims constituting the second-largest religious group after Buddhists. A pilot study conducted in Pak Kret District, Nonthaburi Province, Thailand, surveyed 124 Muslim households and revealed that 64.5% (80/124) of older adults had hypertension and 39.5% (49/124) had diabetes. Despite demonstrating high levels of awareness and knowledge, strong preventive behaviors, and moderate motivation to learn, 45.2% (56/124) of participants reported having contracted coronavirus. Notably, knowledge (r=0.543) and willingness to learn (r=0.465) were significantly correlated with preventive behavior. Awareness, however, showed a small nonsignificant correlation (r=0.126) at P>.01. Between 2020 and 2022, many Muslim older adults were surrounded by individuals with limited knowledge and inadequate preventive practices [12]. Therefore, interventions should target awareness, knowledge, and behavior at the individual, family, and community levels to promote sustainable and appropriate health practices in older adults with comorbidities.

Enhancing participatory and culturally grounded learning was essential for promoting coronavirus prevention among vulnerable Muslim older adults [13,14]. A learner-centered approach, tailored to their cultural context, helps increase receptiveness to new knowledge. Understanding their beliefs and lived experiences fosters trust and facilitates the exchange of skills, supporting long-term improvements in awareness, knowledge, and preventive behavior—even in the event of a future outbreak.

However, a literature review revealed a lack of prevention programs specifically designed for this group. Most existing studies focus on Thai Buddhist older adults and emphasize knowledge enhancement [15] and coronavirus health literacy [16-18]. These programs typically last 4 to 12 weeks and involve lectures, skill training, media use, group activities, self-management, and LINE-based knowledge sharing (LINE Corporation). Results consistently show significant improvements in preventive behavior.

Internationally, technology-based services such as mobile health and telehealth have been shown to benefit older adults by supporting treatment, information access, self-monitoring, and counseling [19,20]. Yet, prior research has predominantly focused on individual-level interventions. More attention should be paid to environmental and social influences, as infection is often spread to older adults by people in their immediate surroundings.

This study aimed to evaluate the effectiveness of a participatory and culturally sensitive learning program for coronavirus prevention and health care among vulnerable Muslim older adults in Thailand with comorbid hypertension and diabetes. The program was designed based on David A. Kolb's experiential learning cycle—experience, reflection, concept, and application [21]—and was integrated with Muslim cultural values. Understanding how Islamic beliefs influence health practices is essential in providing effective care for Muslim patients. Nurses and health care providers must be culturally competent and sensitive to these beliefs in order to deliver equitable care. This approach not only fosters individual potential but also promotes social equity for vulnerable older adults. In the long term, culturally grounded participatory learning programs may help prevent severe respiratory viral infections among ethnic older populations with chronic diseases.

Methods

Study Design

The study design was quasi-experimental, specifically a 2-group pretest-posttest design. The research was carried out for 6 weeks to investigate the effectiveness of the participatory and culturally based learning program for coronavirus prevention plus usual standard care for older adults with comorbid hypertension and diabetes. The study was registered at the Thai Clinical Trials Register (TCTR20250112007).

Study Participants

The sample group consisted of Muslim older individuals with comorbid hypertension and diabetes. It was divided into 2 groups: the experimental group, which lived in Tha It Subdistrict, Pak Kret District, and the control group, residing in Lahan Subdistrict, Bang Bua Thong District, Nonthaburi Province. The 2 areas were selected through simple random sampling from 19 Muslim communities of Nonthaburi province. Both subdistricts had comparable contextual characteristics.

To determine the sample size, the G*power program [22] was used to estimate the effect size from a study on the impact of a health literacy promotion program on disease prevention behaviors among older Thai Buddhists in Bangkok [17] and Phra Nakhon Si Ayutthaya [18], which yielded effect sizes of 4.52 and 3.02. This resulted in sample sizes of 7 and 14 for each group. Therefore, for this study, the effect size was estimated at 0.90, using a t test for the difference between 2 independent means (2 groups), with an alpha error probability of .05 and a power ($1 - \beta$ error probability) of .95. The program calculated a sample size of 56, resulting in 28 individuals per group. To prevent sample loss, the researcher increased the sample size by 40%, resulting in 40 individuals per group.

Systematic random sampling was used to recruit older adults from the community. Eligible individuals were invited to participate in the program by community health volunteers, who visited every second household (ie, skipping one house) in the community.

Inclusion criteria were Muslim older adults aged 60 ‑ 80 years with comorbid hypertension and diabetes, residing in Tha It Subdistrict, Pak Kret District, or Lahan Subdistrict, Bang Bua Thong District, Nonthaburi Province, both male and female, without cognitive impairments, capable of understanding and communicating in Thai, and without significant thinking problems or depression. Exclusion criteria included participation for less than 6 consecutive weeks, prior coronavirus infection, serious illness preventing participation, or withdrawal from the program.

Research Tools

The experimental implementation tool consisted of a participatory and culturally based learning program to prevent coronavirus disease and enhance health care for older adults. This program was a set of activities aimed at controlling the factors that caused the spread of coronavirus disease and self-care for health, with a learner-centered approach. It focused on using the learning-by-doing method as the foundation for developing the learning process. It drew out the learners' abilities and encouraged them to participate in teaching activities and think critically to solve problems. Second, a team of researchers thoughtfully developed the coronavirus prevention and health care manual. The content of food and exercise was adapted to Muslims. Third, videos titled "7 Steps of Hand Washing," "Chair Exercises," "Food for Hypertension and Diabetes," and "Stress Control," publicly shared on YouTube (Google LLC), were applied. Fourth, material and equipment such as masks, food models, salt meters, and PowerPoint (Microsoft Corp).

The data collection tool included a questionnaire on awareness, knowledge, and preventive behaviors regarding the coronavirus disease for older adults, which was developed by the researchers. It consisted of 4 sections: (1) general information: this section consisted of open-ended and closed-ended questions, totaling 15 items. (2) Awareness of preventing coronavirus infection and health care consisted of 15 items. The questions were a 5-point rating scale of least aware, somewhat aware, moderately aware, very aware, and most aware. (3) Knowledge of preventing coronavirus infection and health care, assessing memory and understanding of preventing coronavirus infection and health care, with 20 multiple-choice questions. The questions were in the format of correct-uncertain-incorrect. The interpretation of knowledge was divided into 3 levels according to the concept of Bloom et al [23] as follows: below 60% (0.00 - 11.00 points) was little, 60% - 79.99% (12.00 - 15.00 points) was moderate, and 80% and above (16.00 - 20.00 points) was very good. (4) Preventive behaviors against coronavirus and health care, divided into 5 areas: prevention of coronavirus, dietary habits, exercise, stress management, and medication adherence, totaling 40 items. The questions were in the form of a 5-point rating scale: never practiced at all, practice occasionally, occasionally practice, almost always practice, and practice regularly. The interpretation of awareness and behaviors was least aware or practice (1.00 - 1.50), somewhat aware or practice (1.51 - 2.50), moderately aware or practice (2.51 - 3.50), very aware or practice (3.51 - 4.50), and most aware or practice (4.51 - 5.00).

The participatory learning program and the questionnaire were validated by 5 experts in nursing, public health, medicine, or evaluation. The content validity indices of the awareness, knowledge, and behavior sections were 0.98, 0.99, and 0.96, respectively. The Cronbach α coefficients of awareness and behaviors were 0.89 and 0.86, respectively, while the KR-20 for knowledge was 0.86.

Interventions

The program activities were based on Muslim culture and Kolb steps: experience, reflection and discussion, concept, and experimentation or application (Figure 1). The activities included 3 main components managed by the researcher: first, workshops were conducted for the experimental group of older adults at the Darul Aman School meeting room in Tha It Subdistrict, Pak Kret District, Nonthaburi Province. The 6-week program included workshops conducted 3 times, specifically on Fridays during the first, fourth, and sixth weeks, prior to the participants attending Friday prayers. The details of the workshop activities are presented in Table 1. In this table, each week began with a review and compilation of participants' information and prior experiences.

Figure 1. A participatory and culturally based learning program for coronavirus prevention and health care for Muslim older adults with hypertension and diabetes.

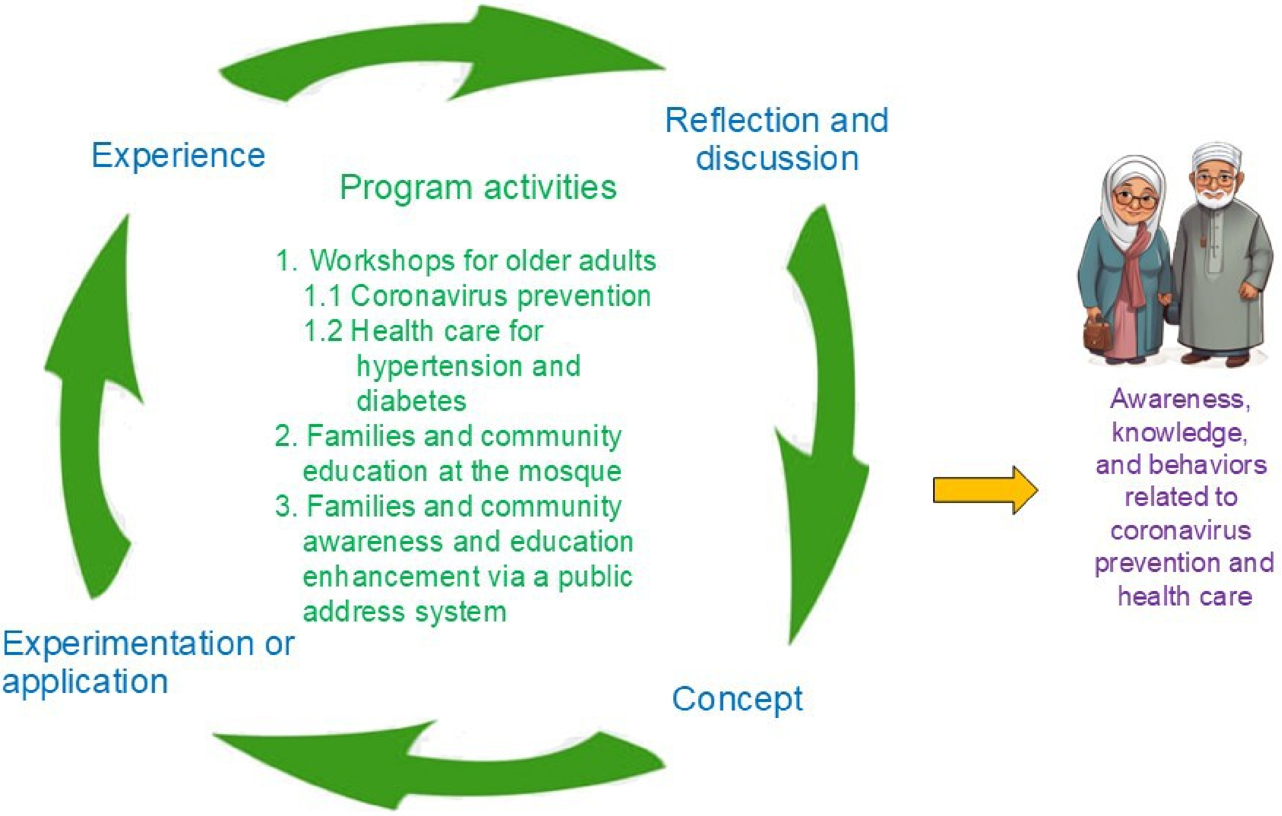


Table . Workshop activities in a participatory and culturally based learning program for coronavirus prevention and health care among Muslim older adults.

Program activities	Duration (min)
Week 1	
Lecture: risk of coronavirus infection in older adults	30
Experience sharing and reflection on coronavirus prevention	30
Health care for coronavirus prevention	30
Mask selection and wearing training	30
Week 4	
Experience sharing and reflection on the application of coronavirus prevention in daily life	30
Antigen Test Kit (ATK) testing training	30
Creating nutritious diet plans	45
Exercise training	15
Week 6	
Strengthening application knowledge about coronavirus prevention	30
Understanding coronavirus vaccines	30
Encouraging self-care commitment	30

Second, community education was conducted over a 6-week period, once a week on Fridays after prayers, from 1:30 PM to 2 PM (30 min per session), totaling 6 sessions. The aim was to prevent coronavirus infections within families and communities, particularly by protecting older adults and ensuring proper care for individuals with hypertension and diabetes. At the mosque, both the Imam and professional nurses—respected figures within the Muslim community—delivered sessions to raise awareness and disseminate health knowledge among individuals, families, and the broader community.

Third, community and family awareness were further enhanced using a public address system over the same 6-week period. Broadcasts were made twice a week, every Monday and Wednesday morning (10 - 15 min per session), totaling 12 sessions. These broadcasts aimed to provide concise education on coronavirus prevention and health care management for individuals with chronic diseases and their families, promoting the integration of preventive behaviors into daily life.

Usual care for coronavirus prevention, provided by government employees, included the DMHTT strategy: social distancing (D), mask-wearing (M), handwashing (H), temperature checking (T), and testing (T). Medication, nutrition, exercise, mood management, and abstinence from alcohol and tobacco were the mainstays of care for diabetes and hypertension. Both the control group and the experimental group were subjected to these strategies.

Data Collection

After proceeding to request an ethics certificate for research involving human participants from the School of Nursing, Sukhothai Thammathirat Open University, the researcher requested permission from the Islamic Religious Organization, the Public Health Office, the District Municipality, and the Subdistrict Administrative Organization to conduct research in the setting. Coordinate with the subdistrict health promotion hospital to conduct the research in a sample group of older adults with hypertension and diabetes as an experimental and control group according to the inclusion criteria, totaling 40 people each. Work with Darul Aman School to set up the space for the 6-week program for the older adults that would be held there from January 13 to February 24, 2023. Nurses and local health volunteers served as study assistants and collected the data.

Statistics Analysis

The data were analyzed using SPSS software (IBM Corp). General information, awareness, knowledge, and preventive behaviors were analyzed with descriptive statistics, including frequency, percentage, mean, and SD. The pre-experimental data were tested for normal distribution using the Kolmogorov-Smirnov test, following the assumptions of *t* test statistics. The variables of awareness and preventive behaviors were normally distributed, while knowledge did not follow a normal distribution. As a result, a nonparametric test was used to compare differences in knowledge data.

Ethical Considerations

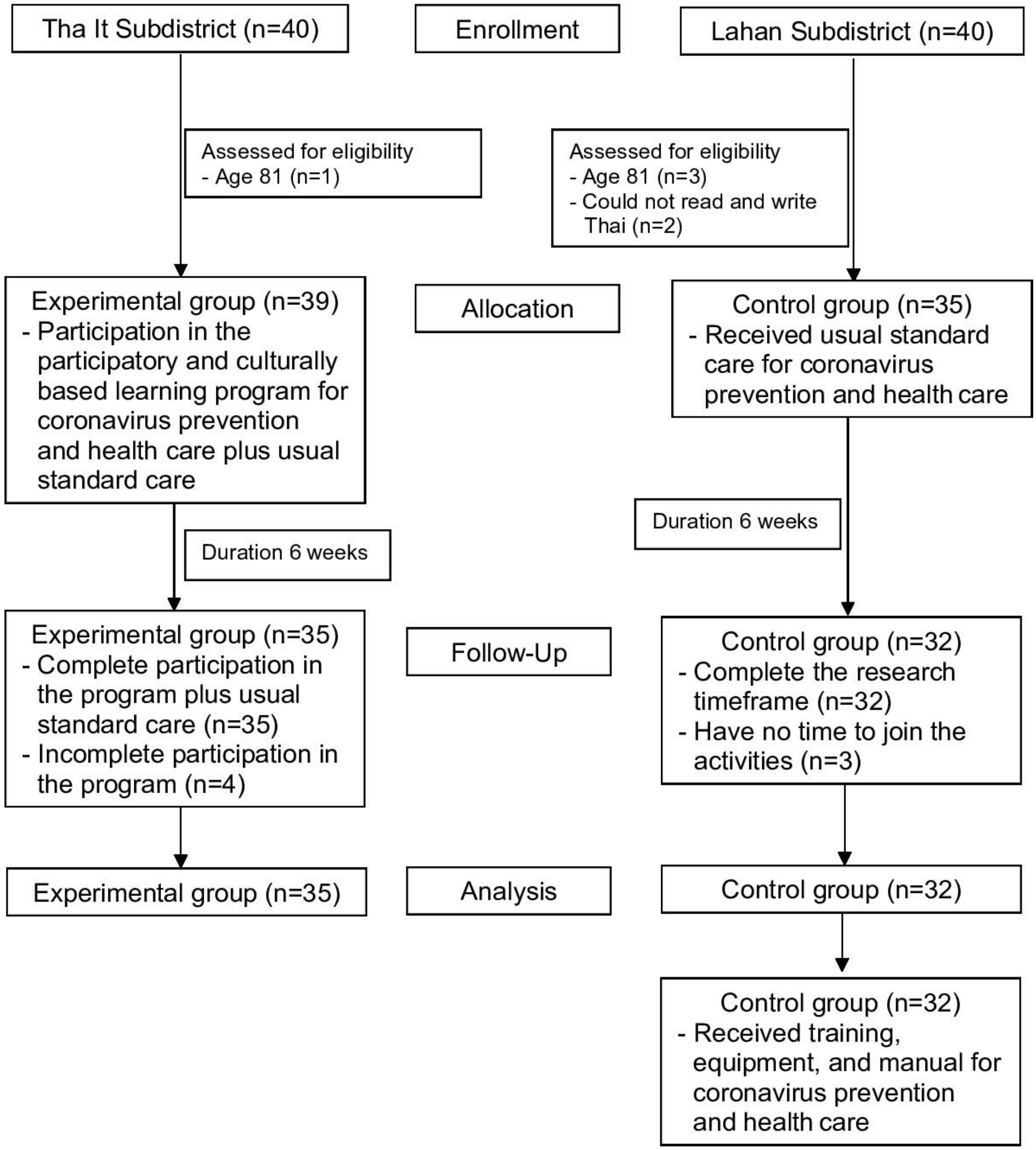
This study was approved by the Ethical Committee of the School of Nursing, Sukhothai Thammathirat Open University (Reference No. NS 1/2566, dated January 12, 2023) and registered with the Thai Clinical Trials Registry (TCTR20250112007). All participants provided written informed consent after being informed about the study's objectives, procedures, potential risks and benefits, confidentiality measures, and their rights as research participants. Participation was voluntary, and individuals were given sufficient time to consider their involvement and discuss it with their families. Participants were provided with transportation allowance and refreshments, including snacks and lunch, during study activities. They were assured of their rights to withdraw at any time without consequence. All collected data were kept strictly confidential and used solely for research purposes in accordance with institutional and international ethical guidelines.

Results

Overview

A total of 74 older adults who met the inclusion criteria attended the program as scheduled, with 39 participants assigned to the experimental group and 35 participants to the control group. At the end of the 6-week program, retention rates were 89.7% (n=35) in the experimental group and 91.4% (n=32) in the control group (Figure 2).

Figure 2. A Consolidated Standards of Reporting Trials flow diagram of selecting the participants in the study.



Sociodemographic and Background of Participants

The demographic and health characteristics of participants are presented in Table 2. The majority of the experimental group was female (77%, 27/35) compared to 66% (21/32) in the control group. The average age was similar between groups (66.11 years in the experimental group and 68.25 years in the control group), with most participants aged 60 ‐ 65 years. Most were married and had completed primary education. A small proportion in the experimental group (9%, 3/35) had no formal education. Most participants were unemployed, though the experimental group had more employed individuals, mainly as casual laborers or housemaids.

Table . Demographic and health characteristics of the experimental and control groups.

Demographic and health characteristics	Experimental group	Control group	Chi-square or *t* test (*df*)	*P* value
Sex, n (%)			χ^2=1.092 (1)	.30
Male	8 (23)	11 (34)		
Female	27 (77)	21 (66)		
Age (years), mean (SD; range)	66.11 (4.70; 60-76)	68.25 (4.74; 60-79)	*t*=1.850 (65)	.07
Age group (years), n (%)				
60 - 65	19 (54)	10 (31)		
66 - 70	7 (20)	11 (35)		
71 - 75	8 (23)	10 (31)		
75 - 80	1 (3)	1 (3)		
Marital status, n (%)			χ^2=0.322 (1)	.57
Single or widow or separate	14 (40)	15 (47)		
Couple	21 (60)	17 (53)		
Education, n (%)			χ^2=4.037 (2)	.13
Uneducated	3 (9)	0 (0)		
Primary level	29 (82)	26 (81)		
Over than primary level	3 (9)	6 (19)		
Occupation, n (%)			χ^2=12.319 (1)	≤.01[a]
Unemployed	15 (43)	27 (84)		
Employed	20 (57)	5 (16)		
Duration of hypertension, mean (SD; range)	8.18 (4.34; 1-20)	12.17 (8.99; 2-45)	*t*=2.266 (65)	.03
Duration of hypertension, n (%)				
Less than 5 years	11 (31)	9 (28)		
6 - 10 years	18 (52)	10 (31)		
More than 10 years	6 (17)	13 (41)		
Duration of diabetes, mean (SD; range)	8.03 (5.87; 1-20)	12.10 (9.07; 1-45)	*t*=2.187 (65)	.03
Duration of diabetes, n (%)				
Less than 5 years	15 (43)	9 (28)		
6 - 10 years	12 (34)	10 (31)		
More than 10 years	8 (23)	13 (41)		
Family experience with coronavirus infection, n (%)			χ^2=2.364 (1)	.12
Never	15 (43)	8 (25)		
Having experiences	20 (57)	24 (75)		

Demographic and health characteristics	Experimental group	Control group	Chi-square or *t* test (*df*)	*P* value
Participant's experience with coronavirus infection, n (%)			χ^2=0.558 (1)	.46
Never	19 (54)	14 (44)		
Having experiences	16 (46)	18 (56)		

[a]*P*<.01.

The majority in both groups had been living with hypertension and diabetes for 6 - 10 years, with the control group having had the conditions for about 4 years longer on average. Over half of the families in both groups had experienced coronavirus infection (57% in the experimental group and 75% in the control group), and nearly half of the older adults themselves had been infected. There was a statistical difference in occupation as well as the duration of hypertension and diabetes between the experimental and control groups at P<.01.

The Comparison of Awareness, Knowledge, and Behavior Related to Coronavirus Prevention and Health Care

Before participating in the program, the experimental group had significantly lower mean knowledge scores than the control group (*P*<.01). However, after the intervention, the experimental group showed significantly higher knowledge scores compared to the control group (*P*<.01; Table 3).

Table . Comparison of mean knowledge, awareness, and preventive behaviors regarding coronavirus prevention and health care between the experimental and control groups at pre- and postprogram participation.

Variables	Experimental group (n=35)		Control group (n=32)		*Z/t* [a]	*P* value
	Mean (SD)	Level	Mean (SD)	Level		
Knowledge						
Preprogram participation	12.68 (0.36)	Moderate	16.75 (0.92)	Good	−6.135	<.01[b]
Postprogram participation	16.34 (1.73)	Good	14.97 (3.03)	Moderate	−3.157	<.01[b]
Awareness						
Preprogram participation	3.94 (0.36)	Good	4.03 (0.49)	Good	−0.834	.41
Postprogram participation	4.42 (0.44)	Good	4.08 (0.54)	Good	2.896	<.01[b]
Behaviors						
Preprogram participation	3.57 (0.38)	Good	3.96 (0.19)	Good	−5.360	<.01[b]
Postprogram participation	4.17 (0.45)	Good	3.87 (0.46)	Good	2.647	.01[b]

[a]The Mann-Whitney *U* test was used to compare knowledge scores, while independent *t* tests were used to compare awareness and behavior scores.

[b]*P*<.01.

Regarding awareness, there was no significant difference between the experimental and control groups before the program. However, the experimental group had significantly lower behavior scores than the control group at baseline (*P*<.01). Following the intervention, the experimental group demonstrated significantly higher levels of both awareness and preventive behaviors compared to the control group (*P*<.01; Table 3).

After participating in the program, the experimental group demonstrated a significant increase in knowledge regarding coronavirus prevention and health care compared to their preprogram scores. In contrast, the control group showed a significant decrease in mean knowledge scores (*P*<.01; Table 4).

Table . Comparison of mean knowledge, awareness, and preventive behaviors related to coronavirus prevention and health care before and after program participation in the experimental and control groups.

Variables	Preprogram participation		Postprogram participation		*Z/t* [a]	*P* value
	Mean (SD)	Level	Mean (SD)	Level		
Knowledge						
Experimental group	12.68 (0.36)	Moderate	16.34 (1.73)	Good	−4.276	<.01[b]
Control group	16.75 (0.92)	Good	14.97 (3.03)	Moderate	−4.139	<.01[b]
Awareness						
Experimental group	3.94 (0.36)	Good	4.42 (0.44)	Good	5.033	<.01[b]
Control group	4.03 (0.49)	Good	4.08 (0.54)	Good	0.456	.65
Behaviors						
Experimental group	3.57 (0.38)	Good	4.17 (0.45)	Good	5.680	<.01[b]
Control group	3.96 (0.19)	Good	3.87 (0.46)	Good	−0.836	.41

[a] The Wilcoxon signed-rank test was used to compare knowledge scores, while paired *t* tests were used to compare awareness and behavior scores.

[b] *P*<.01.

In addition, the experimental group exhibited significant improvements in both awareness and preventive behaviors related to coronavirus following the intervention (*P*<.01). Meanwhile, the control group showed no significant changes from their preprogram levels (Table 4).

Discussion

Principal Findings

This study demonstrated that a participatory and culturally based learning program significantly enhanced awareness, knowledge, and preventive behaviors related to coronavirus and chronic disease care among vulnerable Muslim older adults in Thailand. The program was developed using Kolb experiential learning theory, which emphasized active participation through concrete experience, reflective observation, abstract conceptualization, and active experimentation [21]. The improved outcomes in the experimental group highlight the value of culturally tailored and learner-centered approaches in health promotion.

The knowledge, awareness, and practice included proper mask use, handwashing, ATK testing, DASH and low-carb diet selection, and tailored exercises such as arm swings and chair-based movements to strengthen calf muscles and improve glucose metabolism. While this study did not assess blood glucose levels or overall health outcomes, previous research demonstrated that activating the soleus muscle through low-intensity contractions while sitting significantly reduced postprandial glucose and insulin levels [24], suggesting that such localized muscular activities may support metabolic health in older adults with diabetes.

In alignment with prior studies [15-18,25], the inclusion of group discussion, skill-building, and culturally congruent practices fostered deeper engagement and behavior change. Moreover, the involvement of trusted community leaders—particularly the Imam—strengthened message acceptance, consistent with findings from diabetes education programs in Muslim communities [25,26].

A unique strength of this study was its integration of religious, cultural, and familial structures into the learning process. By conducting workshops in mosques before or after prayer and using public broadcasting systems in the community, the intervention reached not only the participants but also their families and neighbors. This expanded reach likely supported knowledge dissemination and encouraged family members to reinforce preventive practices at home, in line with previous studies showing the importance of social support in influencing older adults' behaviors [27]. Also, the literature found that the level of understanding and positive information evaluation status associated with coronavirus protective behaviors of the Chinese older adults [28].

Although coronavirus is no longer a global emergency, the threat of future outbreaks of respiratory viruses remains. This program serves as a prototype for adapting culturally based, community-led interventions to promote preventive behaviors for other infectious diseases, such as influenza, respiratory syncytial virus, or emerging zoonoses. The program's experiential and reflective nature also lends itself well to modifying content while maintaining the underlying structure, especially for communities where cultural values shape health behaviors.

However, careful adaptation is essential. For instance, video content must be reviewed for cultural appropriateness, background music should be avoided, and prayer times respected. Postprayer educational sessions must be concise due to time constraints. Furthermore, Islamic rituals—such as bowing during worship—cannot be altered, though modifications such as using a cloth or alternative greetings were accepted by some older adults. These findings underscore the need for an interdisciplinary, culturally sensitive approach. As Attum et al [26] emphasized, Muslims view health as a gift from God, with spiritual well-being often prioritized alongside physical health. This perspective shapes their response to illness and health interventions. Songwathana et al [29] similarly found that Muslim older adults grounded their health behaviors in spiritual meaning and a belief in living naturally and peacefully in old age.

Study Limitations

This study was conducted in a specific Muslim community in Thailand, and thus, cultural and environmental factors may limit its generalizability to other regions or religious groups. Participants were selected by geographical clusters, which may have introduced selection bias. In addition, the program did not assess clinical outcomes such as blood pressure, blood glucose levels, or BMI, limiting insights into long-term health impacts.

Implications for Nursing Practice

Nurse practitioners and primary care teams can implement participatory and culturally responsive health education programs tailored to older adults with chronic diseases. Such programs should be extended over a longer period to allow for the measurement of clinical outcomes and behavior sustainability. Moreover, they can be adapted to address other infectious diseases in multicultural settings, particularly those affecting vulnerable populations with limited health access. This approach aligns with the expanded role of nurses in health promotion, community engagement, and chronic disease management during and beyond the coronavirus pandemic [30,31].

Conclusions

Participatory and culturally based learning programs have positively impacted older adults with hypertension and diabetes by enhancing their awareness, knowledge, and behaviors regarding coronavirus prevention and health care. Implementing similar initiatives in communities across Thailand could contribute to the long-term prevention of severe respiratory diseases.

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Authors' Contributions

SM was responsible for manuscript writing, conducting the literature review, data collection, data analysis, and drafting the results and discussion sections. CP contributed to the literature review and collaborated on writing the results and discussion sections.

Checklist 1
CONSORT checklist.
[PDF File, 232 KB - apinj_v9i1e71671_app1.pdf]

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Work Experience and Anger Management in Nurses: Cross-Sectional Analysis Based on Benner’s Novice to Expert Theory

Donya Rahmati[1], MD; Payam Nikjo[2], MSc; Hamzeh Zahabi[1], BSc; Zohreh Karimi[1], BSc; Leila Solouki[1], MSc

[1]Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

[2]Department of Nursing, School of Nursing and Midwifery, Kermanshah University of Medical Sciences, No. 72 Shahid Beheshti Blvd, Kermanshah, Iran

Corresponding Author:
Payam Nikjo, MSc
Department of Nursing, School of Nursing and Midwifery, Kermanshah University of Medical Sciences, No. 72 Shahid Beheshti Blvd, Kermanshah, Iran

Abstract

Background: Nursing is an emotionally demanding profession where unmanaged anger can compromise patient care and teamwork. While clinical experience is thought to enhance emotional regulation, the relationship between work experience and anger management remains poorly understood.

Objective: This study aimed to assess whether work experience predicts anger management ability among nurses, using Benner’s Novice to Expert Theory as a guiding framework.

Methods: A descriptive cross-sectional study was conducted in 2024 involving 265 nurses working in hospitals affiliated with Kermanshah University of Medical Sciences, Kermanshah, Iran. Stratified random sampling was used based on hospital wards. Data were collected using a demographic questionnaire and the State-Trait Anger Expression Inventory-2. Statistical analyses included Pearson correlation analysis, *t* tests, ANOVA, and multiple linear regression analysis. Normality was tested using the Kolmogorov–Smirnov test. The sample size was determined using parameters referenced in prior studies and confirmed with G*Power software (Heinrich-Heine-University Düsseldorf).

Results: Although nurses with more experience reported slightly higher anger control scores, the correlation between work experience and anger management was not significant (r=−0.079, P=.18). Regression analysis revealed that shift type and job security significantly predicted anger regulation, independent of experience level.

Conclusions: Work experience alone does not ensure improved anger management among nurses. Organizational factors such as shift scheduling and employment stability may have a greater influence on emotional regulation. Institutions are encouraged to provide structured support and stress management training, especially for early-career nurses.

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KEYWORDS

anger management; work experience; Benner’s theory; emotional regulation; nurses

Introduction

Anger is a fundamental human emotion that often arises in response to perceived threats, injustice, or high-stress environments. In the nursing profession, where emotional labor is constant and high-stakes decisions are routine, the ability to regulate anger is not just a personal asset—it is a professional necessity. Poor anger management in clinical settings can compromise patient safety, disrupt team dynamics, and ultimately lead to burnout and attrition [1].

Burnout, particularly its emotional exhaustion component, is widely prevalent among nurses. Systematic reviews report that 31% of nurses experience moderate to severe burnout, especially in high-pressure hospital environments [2]. The severity of burnout typically manifests across 3 dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment [3]. These dimensions are known to impair emotional self-regulation and increase the risk of reactive behaviors such as unregulated anger [4].

Despite the clinical importance of emotional regulation, including anger control, the factors that shape these abilities in nurses are not fully understood. While many assume that clinical experience enhances emotional resilience, research on the relationship between work experience and anger management has produced inconsistent findings [5]. Some studies indicate that experienced nurses exhibit better self-control and composure under pressure [6], while others suggest that accumulated stress may actually erode emotional regulation over time [7]. This inconsistency highlights a critical gap in the literature that merits focused investigation.

Benner’s Novice to Expert Theory offers a well-established framework for understanding professional development in nursing [8]. The model describes 5 progressive stages—novice, advanced beginner, competent, proficient, and expert—each characterized by increasing autonomy, situational awareness, and decision-making capabilities [9]. Importantly, Benner argues that these cognitive and clinical advancements are intertwined with psychological and emotional maturity [10]. As nurses advance in their careers, they are presumed to gain not only technical proficiency but also stronger coping mechanisms, including improved anger regulation [1].

This study is innovative in its integration of Benner’s theoretical stages with the construct of anger management—an intersection that has rarely been explored in empirical research. We aim to address this gap in the literature by investigating whether nurses’ anger control improves in tandem with their progression through Benner’s professional stages.

Based on Benner’s model, we hypothesize that nurses with greater work experience—corresponding to higher levels in the novice-to-expert continuum—will demonstrate significantly better anger management skills than their less experienced counterparts.

Methods

Study Design and Setting

This study used a descriptive cross-sectional design conducted in 2024 among nurses working in public hospitals affiliated with Kermanshah University of Medical Sciences, Kermanshah, Iran.

Participants and Sampling

The study population consisted of clinical nurses working across multiple departments, including the emergency department, intensive care unit, surgical wards, and internal medicine units. A stratified random sampling technique was used, in which hospital wards served as the strata. Within each stratum, participants were randomly selected in proportion to the number of staff in each unit to ensure representativeness.

The inclusion criteria were being employed in a clinical nursing role at one of the participating hospitals, having a minimum of 6 months of work experience, being willing to participate and provide oral informed consent, and completing all study questionnaires.

Exclusion criteria were having a self-reported history of diagnosed psychological disorders, currently using mood-altering medications, and failure to complete the questionnaires.

These criteria were determined to increase internal validity and minimize confounding effects related to pre-existing emotional regulation deficits.

The minimum required sample size—computed based on a previous study assessing anger management in clinical staff [11], with an SD of 6.73 in anger control scores, and assuming a type I error of 5%, power of 80%, and effect size of 0.3—was determined to be 265 participants. G*Power software (version 3.1; Heinrich-Heine-University Düsseldorf) was used to verify this estimation.

Data Collection Instruments

Two instruments were used for data collection: (1) a demographic questionnaire was used to collect data on age, gender, marital status, educational level, work experience (in years), shift type, hospital unit, and perceived job security; and (2) the State-Trait Anger Expression Inventory-2 (STAXI-2), developed by Spielberger, which consists of 57 items measuring multiple dimensions of anger including state anger, trait anger, and anger expression/control [12]. The Persian version of the STAXI-2 was validated by Asghari et al [13], with content validity confirmed by expert review and internal consistency measured by a Cronbach α of 0.84. In this study, the reliability of the instrument was reassessed and yielded an α coefficient of .85, confirming its suitability for the sample.

After obtaining ethical approval, the researchers coordinated with hospital administrators and distributed questionnaires in both printed and web-based formats. For the web-based version, participants accessed a secure form through the hospital’s intranet system using their unique staff codes to avoid duplicate entries. Data collection was conducted over a 3-week period.

Data Analysis

Data were analyzed using SPSS (version 24; IBM Corp). Descriptive statistics (means, SDs, and frequencies) were reported for demographic variables. Inferential statistical analyzes included Pearson correlation (for relationships between continuous variables), independent samples *t* tests and 1-way ANOVA (to compare anger scores across demographic groups), and multiple linear regression (to identify predictors of anger management). Normality of the data was assessed using the Kolmogorov–Smirnov test. A *P* value of <.05 was considered significant in all analyses.

Ethical Considerations

Prior to data collection, verbal informed consent was obtained from all participating nurses. The study was approved by the Research Ethics Committee of Kermanshah University of Medical Sciences (ethical approval code IR.KUMS.REC.1402.627). Participants were assured of the confidentiality and anonymity of their responses, and they had the right to withdraw from the study at any stage without any consequences. All participant data were fully anonymized. No compensation was provided to the participants.

Results

Anger Management Across Experience Levels

Participants were categorized into 5 groups based on Benner’s Novice to Expert theory. As shown in Table 1, there was a progressive increase in anger management scores across experience levels, from novice to expert. However, this trend was not significant.

A Pearson correlation test was used to examine the relationship between total years of work experience and anger management scores. The result showed a nonsignificant weak negative correlation (r=−0.079, P=.18).

Table . Mean anger management scores by experience level.

Benner level	Experience (years)	Nurses, n	Score, mean (SD)
Novice	0 - 1	35	121.4 (15.8)
Advanced beginner	1 - 3	82	129.2 (14.3)
Competent	3 - 5	101	133.5 (12.7)
Proficient	5 - 10	50	138.1 (10.9)
Expert	>10	22	142.7 (9.3)

Comparative Analysis Based on Demographic Variables

An independent samples *t* test showed no significant difference in anger management scores between male (n=97) and female (n=168) participants (mean difference –2.5; t_{261}=−1.32; P=.19). However, a 1-way ANOVA revealed a significant difference based on shift type ($F_{2,262}$=6.12, P<.001), with nurses on rotational shifts having lower scores than those on fixed shifts.

Multiple Regression Analysis

A multiple linear regression analysis was conducted to evaluate whether work experience, shift type, and job security predicted anger management. The model was significant ($F_{3,261}$=8.47; P<.001; R^2=0.22; Table 2).

Only shift type and job security were significant predictors. Work experience was not a significant predictor when other variables were controlled.

Although a descriptive trend indicated an improvement in anger management with more experience, the correlation was not significant. Rotational shifts and lack of job security were significantly associated with lower anger control. Work experience alone was not a reliable predictor when organizational variables were considered.

Table . Multiple linear regression predicting anger management.

Predictor variable	B (SE)	β	*t* test (*df*)	*P* value
Work experience (years)	−0.12 (0.09)	−.06	−1.34 (261)	.18
Shift type (rotational)	−5.27 (1.32)	−.21	−3.99 (261)	<.001
Job security (none)	−4.83 (1.11)	−.19	−4.35 (261)	<.001

Discussion

Principal Findings

This study aimed to explore whether work experience predicts anger management among nurses, framed within Benner's Novice to Expert theory. While descriptive trends supported theoretical expectations—indicating higher anger control in more experienced nurses—the absence of statistical significance complicates a straightforward interpretation.

Benner's model suggests that professional growth includes not only cognitive and technical advancement but also the evolution of emotional intelligence and situational awareness. From this perspective, an expert nurse should demonstrate greater emotional regulation than a novice [9,14]. However, our findings suggest that the translation of experience into emotional competence is not automatic, especially in environments marked by chronic stressors such as shift rotation and job insecurity.

The results echo those of studies showing that structural and organizational factors can override individual traits or experience. For instance, nurses working rotational shifts—regardless of their experience—reported significantly lower anger control. This aligns with research linking circadian disruption to poor emotional regulation [15]. Similarly, job insecurity was a strong negative predictor, supporting prior findings that emotional regulation is highly sensitive to perceived occupational stability.

Contrary to studies that have demonstrated a clear positive association between years of practice and anger control, our findings corroborate those suggesting that experience alone may be insufficient without parallel support systems [11]. This challenges the assumption that time in service naturally fosters better coping and invites a rethinking of how emotional skills are developed in clinical practice.

From a theoretical standpoint, our study highlights a gap between expected development (as described by Benner) and observed outcomes, which may be due to organizational neglect of emotional skill-building. If institutions fail to foster psychological safety, even expert-level nurses may struggle with emotional demands [16,17].

Our findings advocate for a dual-track model: one where clinical experience is complemented by intentional emotional training, such as structured anger management programs, mindfulness-based stress reduction, or resilience workshops. Moreover, policies aimed at reducing shift variability and reinforcing job security may prove more effective than relying solely on experience to shape emotional capacity.

Limitations and Directions for Future Research

The cross-sectional design of this study limits causal inferences. Future longitudinal studies are essential to determine whether anger regulation skills improve over time or stagnate under persistent stressors. Additionally, emotional control was assessed using self-report instruments, which may not capture behavioral expressions or moment-to-moment reactivity. Future work should consider multimethod approaches, including peer assessment or biometric indicators.

Moreover, this study did not examine potential mediating variables such as emotional intelligence, personality traits, or organizational climate, which may shape the relationship between experience and emotional regulation. Exploring these variables through moderated regression models or qualitative interviews could provide richer insights.

Conclusion

This study examined the link between work experience and anger management among nurses using Benner's developmental framework. Although experienced nurses reported higher anger control scores, no significant correlation was found between years of practice and emotional regulation when organizational variables were controlled.

The findings suggest that professional maturity does not automatically translate into emotional regulation, especially in environments characterized by rotational shift work and job insecurity. These two factors were found to be stronger predictors of anger control than clinical experience itself.

This insight challenges traditional assumptions embedded in nursing education and workforce planning, which often presume that experience alone fosters emotional competence. Instead, the results advocate for a more intentional approach to emotional skill development within nursing practice.

Our key recommendation is that health care institutions should not rely solely on experience as a proxy for emotional regulation. Implementing targeted anger management training, promoting stable employment contracts, and reducing rotational shift burdens may yield greater improvements in nurse well-being and patient care outcomes [18].

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Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' Contributions

Data curation: PN and DR
Formal analysis: PN and DR
Writing—original draft: HZ, ZK, and LS
Writing—review and editing: DR, HZ, LS, PN, and ZK

Conflicts of Interest

None declared.

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Abbreviations

STAXI-2: State-Trait Anger Expression Inventory-2

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Influencing Factors of New Nurses' Competency Following Participation in a Preceptorship Program: Cross-Sectional Study

Lusia Dian Wahyu Winarti[1], MKep; Krisna Yetti[2], DNS; Tuti Afriani[2], DNS; Enie Novieastari[2], DNS

[1]St Carolus Hospital, Jakarta, Indonesia

[2]Department of Fundamental of Nursing and Nursing Science, Faculty of Nursing, Universitas Indonesia, Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat, Indonesia

Corresponding Author:
Tuti Afriani, DNS
Department of Fundamental of Nursing and Nursing Science, Faculty of Nursing, Universitas Indonesia, Kampus FIK UI, Jl. Prof. Dr. Bahder Djohan, Depok, Jawa Barat, Indonesia

Abstract

Background: Preceptorship programs have been implemented in several hospitals across Indonesia to support new nurses during their transition period in the workplace. Many factors influence new nurses successfully transitioning into this new role. However, few studies have examined the factors that affect new nurses' competency.

Objective: This study aimed to identify the factors influencing the competency of new nurses in a preceptorship program.

Methods: This study used a quantitative approach with a cross-sectional design. Participants were 169 nurses who had been employed for less than 1 year in 2 hospitals. Participants were nurses undergoing an orientation period who were part of a preceptorship program. The study used instruments developed by the researchers and their team, which were tested for validity and reliability. The variables were self-efficacy, new nurses' adaptation, preceptor commitment, preceptor competency, and mentoring method. Data were analyzed using descriptive statistics, the χ^2 test, and multiple logistic regression.

Results: The median age of the 169 participants was 24 years, with the ages ranging from 22 to 30 years. Most of the participants were female (n=136, 80.5%), held a bachelor's degree (n=164, 97%), and had worked at Hospital X for 0 to 6 months (n=128, 75.7%). In terms of training experience, most participants had completed Basic Cardiac Life Support training (n=142, 84%). The independent variables that influenced new nurses' competency were gender (P=.02), training (P=.05), mentoring method (P=.001), preceptor commitment (P=.03), and preceptor competency (P=.001). A multiple logistic regression test further indicated that the mentoring method (P=.001; α=.05; OR .198), preceptor commitment (P=.03; α=.05; OR .296), and preceptor competency (P=.001; α=.05; OR .202) were influential variables for new nurses' competency.

Conclusions: The mentoring method, preceptor commitment, and preceptor competency were identified as the factors that most strongly influence new nurses' competency. These results can be used to develop more effective preceptor programs. An effective preceptorship program requires preceptors who demonstrate both professional competence and personal characteristics. Preceptors have to possess adequate knowledge and skills to support the development of new nurses' competency.

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KEYWORDS

determinant; new nurse competency; preceptorship program; preceptor commitment; preceptor competency

Introduction

Many factors influence the success of new nurses in undertaking a new role. A preceptorship program was designed to provide support for new nurses in their first year of delivering nursing care. The transition from student nurse to staff nurse is stressful for new nurses [1]. Work-related stress can occur in new nurses; therefore, efforts to minimize stress are a challenge for preceptors [2]. A study found that an environment with optimal learning and positive guidance provides the opportunity for students to acquire skills and receive regular feedback [3]. New nurses who cannot perform their competencies properly will reduce the quality of nursing services and patient safety in hospitals [4].

The transition from nursing student to staff nurse can be stressful or cause transition shock [5]. Factors that significantly affect transition shock are age, self-efficacy, work unit, desired unit, and the nurse's work environment [6]. To reduce the transition shock of new nurses, it is necessary to provide a program to increase their self-efficacy [7]. Efforts should be made to ensure efficient human resource management and effective interventions by developing a global nursing competency improvement program based on nurse compassion competency and transcultural self-efficacy [8].

A previous study stated that preceptorship has an impact on learning and professional development in new nurses [9]. The orientation process requires a program that supports nurses through the transition phase, increasing self-confidence and competence [10]. New nurses have varied experiences, which extend to the quality of the orientation program and the role of the preceptor [11].

The preceptorship program is an opportunity for new nurses to develop and carry out assertive communication [12]. The competencies of a good preceptor include knowledge of individual learning processes, reflection skills, and giving effective feedback [13]. Well-trained preceptor nurses provide psychological stability to new nurses, increase job satisfaction, and promote organizational socialization [14]. The most important topics in nurse preceptor training were identified as critical thinking, prioritization, teaching techniques, conflict management, and teamwork [15]. In Indonesia, the preceptorship program has never been evaluated; besides that, there is no standardization of the preceptorship method, which is an obstacle to implementing the preceptorship program in hospitals. Another study found that preceptorship programs affected the work expectations, work environment, and turnover intention of new nurses [16].

Methods

Study Design

This study used a nonexperimental quantitative design with a cross-sectional approach. A self-report questionnaire was delivered by e-form at one point in time.

Population

The population was new nurses at 2 hospitals with less than 1 year of service. Total sampling was used for this study. We selected these 2 hospitals because they are in the same city and have both implemented preceptorship programs. Total sampling was used to reach a larger number of respondents because the number of new nurses at one time in one hospital was not large enough. To reduce bias, we used enumerators to collect data.

Respondent inclusion criteria were new nurses who have worked for less than 1 year at hospitals. Respondents were undergoing an orientation period and preceptorship program. Respondents were only excluded if they were unwilling or absent when the data were collected.

Data Collection

Respondents involved in this study were nurses from 2 hospitals. Hospital X had 107 nurses who participated and Hospital Y had 62 nurses.

Measurement

The instrument is separated into 7 parts, namely respondent characteristics, self-efficacy [17], adaptation of new nurses, preceptorship methods [18], preceptor commitment [19], preceptor competence [20], and new nurses’ competency [21]. This instrument for new nurses’ competency was developed by the research team because we could not find a suitable instrument for new nurse competencies according to the standards in Indonesia. This instrument consists of 36 questions and has a validity value above the calculated *r* value, greater than the table *r* value (0.3). Meanwhile, Cronbach α was .989. We conducted a reliability test for new nurse self-efficacy (r=.934), new nurse adaptation (r=.878), preceptor competence (r=.996), preceptorship method (r=.948), and preceptor commitment (r=.807). The validity test is considered valid if the value of *r* count is greater than the table value of *r* (.361); therefore, all items were declared valid [22].

Ethical Considerations

This research received ethical clearance from the Research Ethics Committee of the National Cardiovascular Center Harapan Kita Jakarta (letter number LB.02.01A/II/039/KEP039/2023).

Results

Demographic Characteristics

In this study, 169 new nurses participated, with a median age of 24 years. The youngest nurse was 22, while the oldest was 30. Most of the participants were female (n=136, 80.5%), had a bachelor’s degree (n=164, 97%), and had worked at a hospital for 0 - 6 months (n=128, 75.7%). The nurses and midwives already had Basic Cardiac Life Support training (n=142, 84%; Table 1).

Table . Demographic characteristics of the new nurse respondents (N=169).

	Hospital X, n (%)	Hospital Y, n (%)	Total, n (%)
Median age (min-max)	24.0 (22–30)	25.0 (22–34)	24 (22-30)
Gender			
Male	23 (21.5)	10 (16.1)	33 (19.5)
Female	84 (78.5)	52 (83.9)	136 (80.5)
Education			
Bachelor degree	107 (100)	57 (91.9)	164 (97)
Diploma	0 (0)	5 (9.1)	5 (3)
Length of work (months)			
0 - 6	106 (99.1)	22 (35.5)	128 (75.7)
6 - 12	1 (0.9)	40 (64.5)	41 (24.3)
Training experiences			
BTCLS[a]	95 (88.8)	47 (75.8)	142 (84)
Patient safety	5 (4.7)	0 (0)	5 (3)
Other	7 (6.5)	15 (24.2)	22 (13)

[a] BTCLS: Basic Trauma Cardiac Life Support.

Values of the Study Variables

Table 2 shows that the adaptation of new nurses and mentoring method had a lower median (both 2.9) than other variables (3.0), although the lowest minimum value was for preceptor commitment (1.5).

Researchers used the median value as a cutoff for determining whether each component was considered positive (more than the median score) or negative (less than the median score).

Table . Values of variables (N=169).

Variables	Items	Range	Median (min-max)
Self-efficacy	15	1-4	3.0 (2.4-4)
Adaptation of new nurses	24	1-4	2.9 (2.5-3.8)
Mentoring method	35	1-4	2.9 (2.2-3.9)
Preceptor commitment	8	1-4	3.0 (1.5-4)
Preceptor competence	95	1-4	3.0 (2.5-4)
New nurse competence	36	1-4	3.0 (2.6-4)

Relationship Between the Preceptorship Program and New Nurse Competencies

As shown in Table 3, we found that the variables that were significantly related to the new nurse competencies were self-efficacy (*P*=.001), adaptation of new nurses (*P*=.001), mentoring methods (*P*=.001), preceptor commitment (*P*=.001), preceptor competence (*P*=.001), gender (*P*=.02), and training (*P*=.05).

Table . The relationship between the preceptorship program, demographic characteristics, and new nurse competencies (N=169).

	New nurse competencies			Odds ratio	95% CI	*P* value[a]
	Less, n (%)	Good, n (%)	Total, n (%)			
Self-efficacy (15 items)						
Negative (≤3.0)	68 (75.6)	22 (24.4)	90 (100)	10.475	5.1438 - 21.356	<.001
Positive (>3.0)	18 (22.8)	61 (77.2)	61 (77.2)			
Adaptation of new nurses						
Negative (≤2.9)	61 (70.9)	25 (29.1)	86 (100)	5.36	2.924 - 10.960	<.001
Positive (>2.9)	25 (30.1)	58 (69.9)	83 (100)			
Mentoring methods						
Negative (≤2.9)	71 (82.6)	23 (27.7)	94 (100)	12.348	5.917 - 25.769	<.001
Positive (>2.9)	15 (17.4)	60 (72.3)	75 (100)			
Preceptor commitment						
Negative (≤3.0)	78 (90.7)	30 (36.1	108 (100)	17.225	7.330 - 40.477	<.001
Positive (>3.0)	8 (9.3)	53 (63.9)	61 (100)			
Preceptor competence						
Negative (≤3.0)	72 (83.7)	19 (22.9)	91 (100)	17.23	8.036 - 37.343	<.001
Positive (>3.0)	14 (16.3)	64 (77.1)	78 (100)			
Age						
≤25 y	5 (51.9)	51 (48.1)	106 (100)	1.113	.597 - 2.077	.86
>25 y	31 (49.2)	32 (50.8)	63 (100)			
Gender						
Male	10 (30.3)	23 (69.7)	33 (100)	0.343	.152–.776	.02
Female	76 (55.9)	60 (44.1)	136 (100)			
Education						
Bachelor degree	84 (51.2)	80 (48.8)	164 (100)	1.575	.256 - 9.674	.68
Diploma	2 (40)	3 (60)	5 (100)			
Length of work						
0 - 6 mo	64 (50)	64 (50)	128 (100)	0.864	.427 - 1.748	.82
6 - 12 mo	22 (53.7)	19 (46.3)	41 (100)			
Training experiences						
BTCLS[b]	73 (51.4)	69 (48.6)	142 (100)	—[c]	—	.05
Patient safety	0 (0)	5 (100)	5 (100)			
Other	13 (59.1)	9 (40.9)	22 (100)			

[a] Significant if α<.05.

[b] BTCLS: Basic Trauma Cardiac Life Support.

[c] Not applicable.

Factors Affecting the New Nurses' Competency During the Preceptorship Program

As displayed in Table 4, we found in the final model that the independent variables (mentoring methods, preceptor commitment, and preceptor competence, gender, and training) simultaneously had a significant effect on the competence of new nurses (there must be at least 1 independent variable that influences the dependent variable, significant if α<.05).

Table . Factors affecting the new nurses’ competencies during the preceptorship program (N=169).

Variable	B	SE	Wald test	*P* value	Exp(B)	95% CI
Constant	1.583	0.679	5.441	.02	4.871	
Mentoring methods	–1.619	0.506	10.232	.001	0.198	0.073–0.534
Preceptor commitment	–1.216	0.56	4.711	.03	0.296	0.099–0.889
Preceptor competence	–1.599	0.5	10.239	.02	0.202	0.076–0.538
Gender	1.011	0.657	2.988	.08	2.75	0.873-8.657
Training	0.853	0.657	1.684	.19	2.346	0.647 - 8.504

Discussion

Principal Findings

This study found that mentoring methods, preceptor commitment, preceptor competency, gender, and training were factors that influenced new nurses’ competency. A previous study stated that nurse mentors who have expertise and use a supportive approach can promote a healthy work environment [23]. Another study found 7 core competencies of nurse preceptors: teaching traits, clinical nursing profession, communication and collaboration, teaching pedagogy, reaction of contingency, critical thinking and reflection, and consultation on academic writing [24]. Previous research found that transition shock and perceptions of supervisors were significantly correlated with new nurses’ competency [25,26].

New nurses are expected to be able to adapt to the clinical environment, interact effectively, build strong partnerships with other professionals, and be able to make correct clinical decisions [27]. The mentor must be competent and have strong personal character traits and be able to think critically [28].

An important role of preceptors in the preceptorship program is to build new nurse competencies. A previous study stated that new nurses did not feel confident in performing many procedures independently without support from their supervisor (a manager, registered nurse, or mentor) [29].

In this study, the perception of new nurses regarding mentoring methods was still lacking (44.2% of new nurses gave a positive response to the mentoring method item). This was due to the lack of guidance in the orientation, classroom learning, mentoring, and evaluation phases. Another study found that updated guidance methods, including the application of evidence-based practice, can stimulate students to learn more about the cases they handle. This method can increase student knowledge [30]. In our study, the majority of preceptors had implemented the preceptorship method well, although there were still 18% who were not good [31].

The results of the statistical analysis showed that preceptor commitment had an effect on new nurse competencies. Another study found that there are low levels of role commitment among new mentors in Taiwan [32,33]. However, they act as good guides because this is an opportunity to teach, improve their teaching skills, share their knowledge, gain personal satisfaction, help new nurses and nursing students to integrate into the unit, and enhance their professional knowledge. A preceptor’s commitment to their role is associated with obtaining the benefits, appreciation, and support associated with this role. According to preceptors, to optimize the effectiveness of the nurse preceptorship program, it is necessary to understand that benefits, rewards, recognition, and support for preceptees must be an integral part of planning these programs [19].

Implications and Limitations

An effective preceptorship program requires preceptors who have specific professional factors and personal characteristics. A clear evaluation process was planned from the start, incorporating feedback from preceptors and preceptees to make further improvements to the preceptorship program in the future. There is no standardization of preceptor competency; therefore, basic national competency standards for becoming a preceptor must be developed.

A limitation of this study is that the new nurse competency instrument was created by the researchers. This instrument is not yet standardized.

Conclusions

Mentoring methods, preceptor commitment, preceptor competency, gender, and training were factors that influenced new nurses’ competency. Results from this research could be considered by hospitals’ nursing divisions when determining strategies to increase the competency of new nurses. Preceptorship programs are an important part of this strategy, where preceptor competence, preceptor commitment, and mentoring methods are a priority. New nurses must receive proper training to improve their competency before they enter the workforce.

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Conflicts of Interest

None declared.

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The Effect of Using Virtual Reality on School-Age Children’s and Caregivers’ Anxiety in the Emergency Room: True Experimental Study

Enjelita Karujan, PCNS; Dessie Wanda, PhD; Efa Apriyanti, MSc

Faculty of Nursing, Universitas Indonesia, Gedung Pendidikan dan Laboratorium, Jl. Prof. Dr. Bahder Djohan, Depok, Indonesia

Corresponding Author:
Dessie Wanda, PhD
Faculty of Nursing, Universitas Indonesia, Gedung Pendidikan dan Laboratorium, Jl. Prof. Dr. Bahder Djohan, Depok, Indonesia

Abstract

Background: Being treated in an emergency room (ER) could be a stressful experience and trigger anxiety in children. Virtual reality (VR) is a technology-based distraction technique that can be used for school-age children.

Objective: In this study, we aimed to identify the effect of using VR in reducing anxiety in school-age children in the ER and identify the relationship between caregivers’ and school-age children’s anxiety.

Methods: This study employed a true experimental design using a post-test-only control group involving 66 children aged 6 - 12 years, randomly selected according to the inclusion and exclusion criteria. The intervention group, consisting of 33 children, received VR intervention, and the control group, consisting of 33 children, received standard care. Three respondents dropped out. Data analysis employed descriptive statistics, independent *t* tests, one-way ANOVA, and Pearson correlation analysis.

Results: Most respondents were boys (39/66, 61.9%), accompanied by their mother (34/63, 54%), and had prior experience admitted to the ER (31/63, 49.2%). The anxiety in school-age children in the intervention group (mean 17.71, SD 3.013) was lower than that in the control group (mean 22.31, SD 3.167). There was a significant difference in the anxiety mean scores between the intervention group and the control group ($t_{(61)}=-5.907$, $P<.001$). The mean (SD) of the caregivers’ anxiety in the intervention and control groups were 46.06 (9.413) and 54.44 (9.112), respectively. There was a moderate relationship between caregivers’ and school-age children’s anxiety ($r=.532$, $P<.001$).

Conclusions: This study has proven that VR can reduce school-age children’s anxiety.

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KEYWORDS

anxiety; caregivers; children; emergency room; virtual reality

Introduction

Being admitted to the emergency room could be a stressful experience and could cause anxiety in children and their families [1]. When entering the emergency room, children had unpleasant experiences due to the bright lights, unusual sounds, different smells, strangers, and busy environments [2]. A study showed that 77.4% of school-age children being treated in the emergency department experienced anxiety [3]. Nursing interventions, such as distraction techniques, are needed to reduce anxiety and improve comfort for children. Distraction is a non-pharmacological technique that can be used to reduce anxiety in children that is easy to implement and effective in reducing anxiety [4].

VR is one of the distraction techniques where children are given goggles and a headset to view a virtual display from a computer [5]. A study conducted on 142 children aged 7 - 12 years who received venipuncture showed that VR was effective in reducing children’s anxiety [6]. This result is in line with the results of research conducted on 40 children aged 6 - 12 years who will undergo abdominal surgery, which showed that VR was effective in reducing preoperative anxiety levels [7].

Watching a video using VR involves more than one sense, vision, and hearing, making VR more attractive to hold on children’s attention compared to other techniques that only involve one sense, such as music (hearing) or picture books (vision) [8]. The presence of parents can be a source of motivation and can strengthen children [9]; therefore, parents’ anxiety relates to children’s anxiety [10]. In light of this, a study about the use of VR to reduce anxiety in school-age children treated in emergency rooms is needed.

Methods

Study Design

This study was a true experiment study using a post-test-only control group design.

Sample

This study involved 66 children aged 6 - 12 years, with urgent and non-urgent triage, compos mentis (conscious), no respiratory or circulatory emergencies, no disturbance in the head and face area, and being able to communicate. The sample size was calculated using the sample size formula for hypothesis testing of the means of two independent populations based on literature [11]. The effect size was 3,4 based on previous research [12]. Samples were selected using simple random sampling by applying one drawing for each day of admission.

Instrument

The instruments used were the demographic questionnaire, the short form of the Chinese version of the State Anxiety Scale for Children (CSAS-C) [13] to measure children's anxiety, and the State Anxiety Inventory (SAI) [14] to measure caregivers' anxiety.

Intervention

After passing the triage assessment, respondents in the intervention group received a VR intervention for 10 minutes. They watched an animated video of Pororo the Little Penguin about the situation in the emergency room. The tool used was entry-level, low-immersive VR (smartphone and headset Sinecon VR Box).

Data Collection

Data collection for this study was conducted between February until May 2023. After passing the triage assessment, the researcher assessed which respondents matched the inclusion and exclusion criteria. The researcher explained the purpose and benefits of the research as well as the procedures that will be passed by the prospective respondent and ask for their consent. The child's anxiety was measured immediately after the intervention. Meanwhile, the companion's anxiety was measured after the child completed the procedure in the emergency room.

Data Analysis

The data were analysed using IBM SPSS Statistics 20, with a significance level of 0.05. Univariate analysis was performed using distribution of frequencies and percentages and mean-standard deviation for categorical and numerical data, respectively. The analysis of the children's anxiety differences between the intervention and control groups used the independent *t* test.

Ethical Considerations

Ethical approval was obtained from the hospital where the study was conducted (Ethical approval number: 017/EC/KEPK-KANDOU/II/2023). Consent was obtained from the accompanying persons and from the children, when possible. No names were provided by the respondents. Following completing the questionnaire, all respondents received a gift of US $2 from the researcher.

Results

Figure 1 describes the sampling technique applied. Sixty-six envelopes were provided, half containing a paper labeled "intervention" and the other half labeled "control". Three respondents dropped out due to rejection on completing the questionnaire, making the total number of samples was 63. The participants were 63 school-aged children. Participant characteristics are presented in Table 1. Most of the respondents were boys (39/66, 61.9%), had been admitted to the emergency room in the hospital previously (31/63, 49.2%), and were accompanied by their mother (34/63, 54%).

Figure 1. CONSORT diagram. VR: virtual reality.

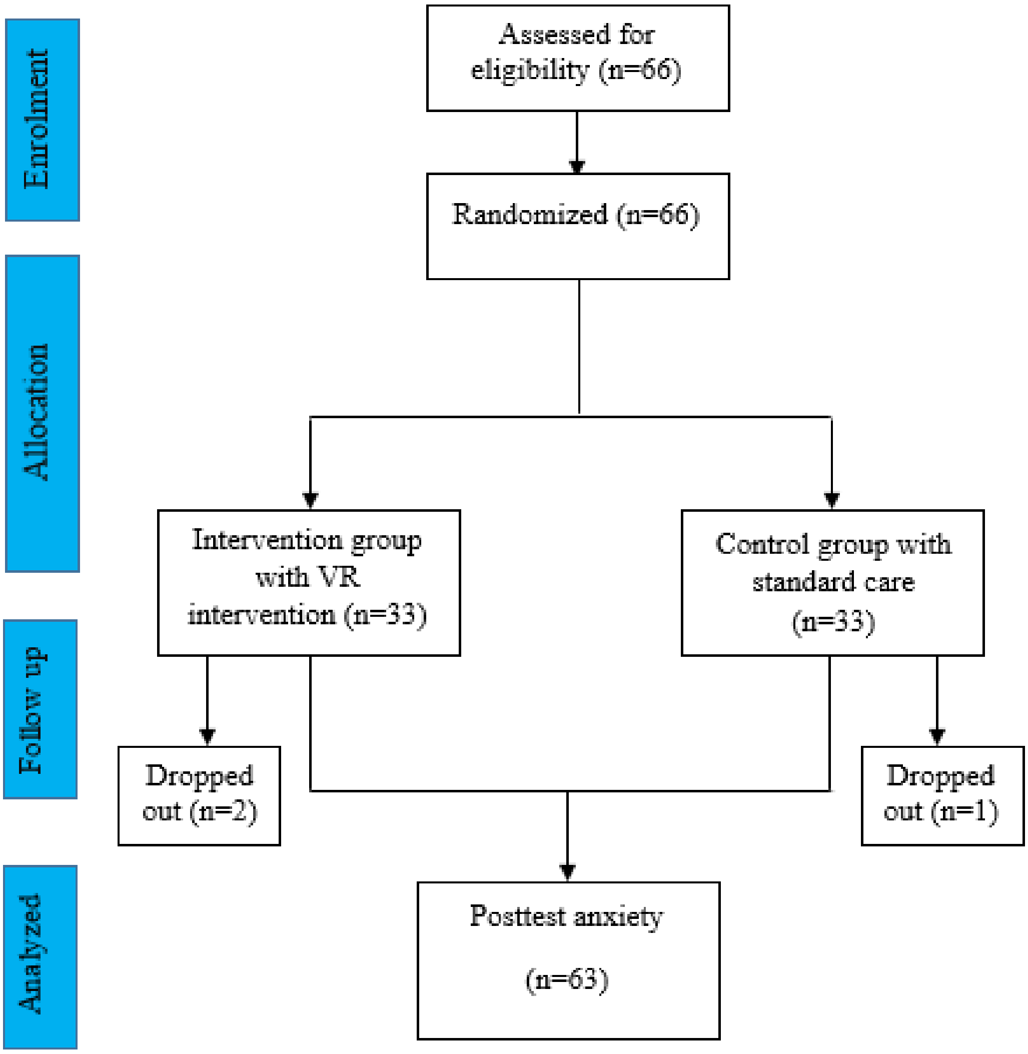

Table . Distribution of respondent characteristics.

Variable	Intervention	Control	Total	*P* value
Sex, n (%)				.050[a]
Boy	17 (54.8)	22 (68.8)	39 (61.9)	
Girl	14 (45.2)	10 (31.2)	14 (38.1)	
Emergency care experience, n (%)				.614[a]
Never had experiences	5 (16.1)	6 (18.8)	11 (17.4)	
In the hospital where the research was conducted	13 (41.9)	18 (56.2)	31 (49.2)	
In another hospital, other than the research location	8 (25.8)	6 (18.8)	14 (22.3)	
In the hospital where the research was conducted and also in another hospital	5 (16.1)	2 (6.2)	7 (11.2)	
Caregiver				.679[a]
Mother	19 (61.3)	15 (46.9)	34 (54)	
Father	1 (3.2)	1 (3.1)	2 (3.2)	
Mother and father	7 (22.6)	10 (31.2)	17 (27)	
Mother or father and other family	3 (9.7)	6 (18.8)	9 (14.3)	
Other family member	1 (3.2)	0 (0)	1 (1.6)	
Caregiver anxiety score, mean (SD)	46.06 (9.413)	54.44 (9.112)		.780[a]

[a] homogeneity test results with the Levene test.

The children's anxiety in the intervention group (mean 17.71, SD 3.013) was lower than that of the children in the control group (mean 22.31, SD 3.167). There was a significant difference in the anxiety mean scores between the intervention group and the control group ($t_{(61)}=-5.907$, *P*<.001). The effect size of this study was 4.6 (95% CI 6.161 to 3.045), which were higher than the effect size used as a reference, meaning that the use of VR was significant both from statistical and clinical reasons.

There was a moderate relationship between caregivers'anxiety and school-age children's anxiety (*r*=.532, *P*<.001). The mean (SD) caregiver anxiety was 46.06 (9.413) in the intervention group and 54.44 (9.112) in the control group.

Discussion

Principal Findings

The use of VR could reduce anxiety in school-age children treated in the emergency room (*P*<.001). This result coincides with the study involving children undergoing surgery, which found a difference in preoperative anxiety between children who received VR intervention and those who did not (*P*<.05) [7].

VR is a diversion method where the child is given tools resembling glasses and headsets to view virtual images from a computer [5]. In the era of digital technology, VR can support nurses in implementing nursing care for patients [12]. These findings show significant differences in anxiety between the control and intervention groups. The mean score of the intervention group was lower than that of the control group. The children who received the VR intervention focused on the video they were watching [5]. Watching video using VR involves more than one sense, namely, vision and hearing. This made the use of VR more attractive to the children's attention compared to distraction techniques that only involved one sense, such as music (hearing) or picture books (vision) [8]. The children enjoyed the video presented using VR; therefore, their anxiety was reduced.

There was a moderate relationship between caregivers' anxiety and school-age children's anxiety (r=.532, P<.001). The presence of parents can be a source of motivation and strengthen children [9]. Parents' anxiety is related to children's anxiety [10]. When the child's anxiety decreased, the parent's anxiety also decreased.

Limitations

This study did not measure the anxiety score before the intervention due to permission granted from the research location. The anxiety measurement before the intervention would delay the treatment that the patient would receive. Apart from that, the intervention was only given for 10 minutes, so the researchers were concerned that giving questionnaires twice, both for children and caregivers, in a short time interval could cause discomfort.

Conclusions

The findings of this study show that the use of VR could reduce anxiety in school-age children treated in the emergency room. Therefore, the authors recommend that hospital management establish a policy related to the use of VR in managing children's anxiety.

Acknowledgments

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Conflicts of Interest

None declared.

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Abbreviations

CSAS-C: Chinese version of the State Anxiety Scale for Children
SAI: State Anxiety Inventory
VR: virtual reality

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Understanding the Implementation of Family-Centered Care in COVID-19 Isolation Rooms Through Pediatric Nurses' Experiences: Qualitative Descriptive Study

Siti Wahyuni[1], PCNS; Dessie Wanda[2], PhD; Happy Hayati[2], MD

[1]Sardjito Hospital, Sinduadi, Mlati, Sleman, Di Yogyakarta, Indonesia

[2]Faculty of Nursing, University Indonesia, FIK UI Campus, Jl. Prof. Dr. Bahder Djohan, Depok, West Java, Indonesia

Corresponding Author:
Dessie Wanda, PhD
Faculty of Nursing, University Indonesia, FIK UI Campus, Jl. Prof. Dr. Bahder Djohan, Depok, West Java, Indonesia

Abstract

Background: Even though the COVID-19 pandemic has passed, the implementation of regulations in pediatric isolation rooms during the COVID-19 pandemic put enormous pressure on the practice of family-centered care (FCC). For nurses in isolation rooms for children with COVID-19, it was a challenge to implement FCC, which is an approach to child health care that supports the strengths of families and increases the involvement of parents to provide the best care outcomes.

Objective: This study aimed to explore nurses' experiences in implementing FCC in isolation rooms caring for children with COVID-19.

Methods: A qualitative descriptive design was used based on semistructured interviews with 11 nurses who met the inclusion criteria and worked in 1 of 3 isolation rooms caring for children with COVID-19 in a tertiary hospital in Indonesia. Interviews were recorded and transcribed, then analyzed using thematic analysis.

Results: Three themes were generated, including improving psychological well-being, encouraging family involvement, and making arrangements for communication.

Conclusions: Communication was key to the implementation of FCC in pediatric isolation rooms, and it provided positive results, so it should continue to be implemented even after the pandemic has passed.

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KEYWORDS

child; COVID-19; family-centered care; nurses; isolation room

Introduction

Isolation rooms for children with COVID-19, and the regulations that were placed on them during the pandemic, were a threat to the implementation of family-centered care (FCC) [1], an approach that facilitates healing by supporting the strengths of families and improving the involvement of parents, thereby providing positive experiences for children [2]. In isolation rooms, only one parent was allowed to wait for the patient, and the patient was not allowed to receive visits, which put them at risk of mental health impacts due to the limited emotional support they received [3]. Restrictions on physical visits to the isolation room can reduce coping and resilience, which can further affect family involvement [4]. Regulations in the isolation rooms were strict, including the use of personal protective equipment (PPE) and limited interaction, leading to work overload [1] and concerns about contracting COVID-19 among nurses. Nurses need strategies for implementing FCC and maintaining family integrity to increase parental support and involvement [5]. FCC is an approach to child health care that emphasizes respectful, collaborative partnerships between health care professionals and families to meet their physical, emotional, social, and developmental needs [2]. The implementation of FCC in COVID-19 isolation rooms became a challenge to nurses during and after the pandemic. The objective of this study was to explore in depth the experiences of nurses in implementing FCC in isolation rooms for children with COVID-19.

Methods

Procedure and Participants

This was a qualitative descriptive study. Eleven participants were selected from a total of 42 nurses who cared for pediatric patients with COVID-19 in the isolation rooms of a tertiary hospital using a purposive sampling method. Inclusion criteria were a minimum of 5 years of working in a pediatric ward, 2 months of working in a COVID-19 isolation room, and obtaining an adequate score on a questionnaire testing their knowledge of FCC (minimum score of 60; range 0 - 100). The questionnaire was validated using a Pearson product-moment correlation (≥0.514). The reliability test used Cronbach α, with a result of 0.86 [6]. In addition to meeting the inclusion criteria, the participants also met criteria for research sample variation, including age, education, length of work in COVID-19 isolation rooms, length of work in the pediatric ward, and FCC knowledge score; the aim was to provide a deep, accurate understanding of the existing phenomenon [7].

Ethical Considerations

Ethical approval was obtained for this study from the Medical and Health Research Ethics Committee of Universitas Indonesia (KE/FK/0325/EC/2023). This study followed the ethical principles outlined in the international and national guidelines on ethical standards and procedure for research with human beings. All matters related to research ethics were outlined in the research explanation sheet, including that if a participant experienced any physical or psychological discomfort, they could report this to the researcher, who would turn off the voice recorder and provide the participant with time to rest. The interview and voice recording resumed if the participant gave their consent. Participants had the right to be treated fairly, and the researchers guaranteed their privacy throughout the study. All participant information and identities are kept confidential, and the results of the study are reported using pseudonyms for anonymity. Participants' identities and names are known only to the researchers and the research supervisor. Participants were allowed to refuse to participate or withdraw from the study at any time without any consequences or sanctions. If any questions made them uncomfortable, they had the right to refuse to answer. Participants received compensation in the form of feedback on the implementation of family-centered care, souvenirs (blankets and mugs), and internet data packages worth US $5 for being contacted via WhatsApp, video call, or Zoom as a token of appreciation for their willingness to participate in the study.

Collection of Data

Data were collected in 2023 through semistructured interviews using a voice recorder and field notes, and then the data were transcribed. Bracketing and avoidance of leading were used, and the data analysis used thematic analysis [8]. First, the researchers familiarized themselves with the data. Second, they generated initial codes that appeared relevant to the research question. Third, they searched for themes representing significant patterns in the data and started organizing the codes into overarching themes and subthemes. Fourth, the researchers reviewed the themes to ensure that they were coherent and accurately represented the data. Fifth, the researchers defined and named the themes to refine and develop each theme. Finally, the researchers produced the report. Trustworthiness of the data was achieved through credibility, transferability, dependability, and confirmability [7]. To achieve credibility, the researchers built mutual trust with the participants and conducted member checking; transferability was ensured through purposive sampling and recruiting participants with varied characteristics; dependability was accomplished by carrying out a structured data analysis and inquiry audit through consultation with a supervisor as the internal reviewer; and confirmability was attained by peer review of the research results.

Results

Overview

All participants had high education and adequate knowledge about FCC, which is essential for professionalism and clinical practice, as well as for implementation of FCC [9]. Participant characteristics are shown in Table 1.

Table . Participant characteristics (N=11).

Characteristics		Participants, n (%)
Age (years)		
	36 - 35	3 (27)
	36 - 45	6 (55)
	46 - 55	2 (18)
Nursing education		
	3-year diploma	8 (72)
	4-year bachelor's degree	3 (28)
Length of time working as a nurse (years)		
	≤10	1 (9)
	>10	10 (91)
Length of work in pediatric COVID-19 rooms (years)		
	≤1	6 (55)
	>1	5 (45)
Family-centered care knowledge		
	Enough	6 (55)
	Good	5 (45)

Themes

This research generated 3 themes, illustrated in Table 2: improving psychological well-being, encouraging family involvement, and making arrangements for communication.

Table . Themes generated during interviews.

Theme	Description	Illustrative quotes
Improving psychological well-being	Nurses calming children and supporting parents as they calm children	• “In the isolation setting, many expressions are not captured...with the PPE, it’s like we’re creating a barrier.” [Participant 11] • “We try to listen to them...advice the mother to accompany the child, reassuring the child so they are not afraid.” [Participant 8] • “...playing together to reduce trauma to children” [Participant 11] • “We explain the child’s condition, support the parents to be patient, and pray.” [Participant 8]
Encouraging family involvement	Involvement was achieved by first providing health education	• “We need to work together with parents...so that all plans can be implemented well.” [Participant 10] • “Mom can help take medicine, because mom or family knows how to persuade children, right? Whatever it is, we must inform them...nursing plan, procedure, infection prevention...” Participant 11] • “Later, if there’s a problem like choking...please tell us.” [Participant 4] • “We educate several times because parent don’t immediately understand.” [Participant 10] • “...we speak in a language that is easy to understand...” [Participant 11]” • “...to be well-received.” [Participant 7]
Making arrangements for communication	Due to the excessive amount of work, communication in the isolation rooms was carried out simultaneously and communication aids were used	• “The activities here are busy, so we plan activities simultaneously.” [Participant 7] • “Family had already been informed in the early stages of hospitalisation...” [Participant 5] • “We use CCTV to monitor patient, a nurse call system to ensure effective communication, a handphone to coordinate logistics fulfillment with the patient’s family...etc” [Participant 3]

Discussion

Nurses understand that parents and children feel anxiety in the hospital environment and from wearing complete PPE [10], so they strengthen FCC [11] by listening to the parents’ feelings [12], thereby calming them and their children so they can adapt to the hospital environment [4]. Nurses encourage family involvement [13] because the parents are the ones who best understand their children [10] and are most competent in their care; their function as caregivers must therefore continue [14]. Participation of parents reduces anxiety in both children [5] and parents [15], ensuring that the children’s psychological needs are met [16] and facilitating healing [17].

Nurses have previously considered how far they should involve parents in child care [11,18]. Parents need information [19] in language that is easy to understand and comprehend [20], and they must receive this information at an early stage of their child’s hospitalization [3]. If the parents are not trained and educated, procedural errors can occur [16]. Ensuring that families have the same views as health practitioners is also a condition for cooperation [21] and for parents to be involved effectively in decision-making [22]. Moreover, this helps carry out nursing care without mistakes [3].

Communication became a major challenge during the COVID-19 pandemic due to the use of PPE and work overload [1,23]. Masks and face shields reduced the volume and clarity of spoken language, making it difficult to hear soft tones of voice or read facial expressions [16]. Human contact relies on gentle touch [24]. Telecommunication (eg, telephone, video calls, or WhatsApp messages) became a solution that supported emotional conversations between patients, families [25], and health practitioners. It reduced contact between the patient and health practitioner and supported the continuity of health management [3]. The use of closed-circuit television combined with a nurse call system was found to be more effective [26] in facilitating communication in isolation rooms [27]. In addition, it helped family members outside the room to directly see the condition of the child and family member in the isolation room, making them feel calmer [27]. In this study, parents were not interviewed to determine their views on their experiences as compared to those of the nurses, as we only targeted nurses. This may have limited the solidity of our conclusions, and our findings may not be fully generalizable. Nevertheless, we found that communication was the key to implementing FCC, and it provided positive results in pediatric isolation rooms, so it should continue to be implemented even after the pandemic has passed. Institutional support is needed to develop nurses' communication.

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Conflicts of Interest

None declared.

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Abbreviations

FCC: family-centered care
PPE: personal protective equipment

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Growth and Development Status of Children Post–COVID-19 Infection: Cross-Sectional Questionnaire Study

Herlina Febrianti; Dessie Wanda; Efa Apriyanti

Faculty of Nursing, Universitas Indonesia, Kampus UI Depok Jawa Barat, Depok, Indonesia

Corresponding Author:
Dessie Wanda
Faculty of Nursing, Universitas Indonesia, Kampus UI Depok Jawa Barat, Depok, Indonesia

Abstract

Background: COVID-19 may impact children's growth and development, potentially leading to various health issues.

Objective: This study aimed to identify factors associated with the growth and development status of children under 5 years of age after COVID-19 infection.

Methods: This cross-sectional study included 292 children under five years of age assessed after COVID-19 infection. All participants had negative results via polymerase chain reaction (PCR) test and were hospitalized at a type A hospital in Jakarta between July 2021 and December 2022. Participants were selected using purposive sampling techniques.

Results: Male sex and the age group of 25 - 36 months were significantly associated with growth status. The most dominant factor associated with child development was the presence of comorbidities.

Conclusions: This study recommends improving hospital discharge planning and strengthening community health services to support children's growth and development after discharge.

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KEYWORDS

child; COVID-19; growth; development; developmental status

Introduction

COVID-19 in children is generally milder than in adults [1], although comorbidities can worsen outcomes. Data indicate that 50.9% of children had mild symptoms, and 38.3% experienced moderate symptoms, with infants being the most likely to develop acute or critical illness, followed by preschool-aged children [2]. Beyond the direct health effects, the pandemic has also posed significant threats to children's growth and development.

COVID-19 has affected various developmental domains, including language [3,4], independence, and motor skills [4]. Growth and developmental trajectories are influenced by gender across all ages [5]; during the pandemic, gender also shaped behavioral responses, with adolescent girls particularly prone to depression and loneliness [6-8].

Lockdown measures contributed to increased screen time among children and adolescents [9,10], limiting social interactions and increasing risks of acute stress disorder, anxiety, and depression [11-14]. Isolation also led to weight gain due to reduced physical activity and overeating [4,9,11].

To date, no studies have comprehensively addressed the effects of COVID-19 on children's growth and development. This study aims to identify factors associated with post–COVID-19 growth and development in children.

Methods

Study Design

This was an analytical cross-sectional study.

Sample

The study sample included 292 children selected with the purposive sampling method. Inclusion criteria were: under five years of age, three months post–COVID-19 infection, negative PCR test results, and hospitalization for COVID-19 between July 2021 and December 2022. If a respondent had passed away or their parents declined participation, they were excluded from the study.

Instrument

The instruments used included a demographic questionnaire and the Prescreening Developmental Questionnaire (PDQ), based on age groups.

Data Collection

Respondent data were retrieved from the medical records of a top referral hospital in Jakarta. Addresses were provided to enumerators for direct data collection at each respondent's home.

This study involved 15 enumerators, who underwent training sessions covering PDQ administration, weight and height measurements. Inter-rater reliability was assessed using Cohen κ, with values ranging from 0.61 to 1. The lowest κ value recorded among the enumerators was 0.783, indicating a high degree of consistency between the researcher and enumerators.

Data Analysis

The data were analyzed using SPSS software (version 25.0; IBM Corp). Normality testing was conducted using the Kolmogorov-Smirnov test for numerical data, which yielded *P*<.05, indicating non-normal distribution. Bivariate analysis of categorical data was performed using the χ^2 test. Numerical-categorical data were analyzed using the Mann-Whitney test. Multivariate analysis was conducted by multiple logistic regression.

Ethical Considerations

Ethical approval was obtained from the Fakultas Kedokteran Universitas Indonesia (FKUI) - Cipto Mangunkusumo Hospital Ethical Committee (approval number: KET-668/UN2.F1/ETIK/PPM.00.02/2023). Informed consent was obtained from the parents, and all patients' identities were kept confidential. To protect participant privacy and confidentiality, all personal identifiers were removed during data collection, and the data were fully anonymized before analysis. Access to the raw data was restricted to authorized research personnel only. Participation in the study was entirely voluntary, and no compensation was offered for involvement.

Results

The characteristics of the respondents and their growth and developmental status post–COVID-19 infection are presented in Table 1.

Table . The distribution of children's characteristics and growth and developmental status post–COVID-19 infection.

Variables	Respondents (N=292)
Age (months), n (%)	
49 - 60	51 (17.5)
37 - 48	64 (21.9)
25 - 36	88 (30.1)
12 - 24	89 (30.5)
Gender, n (%)	
Girl	132 (45.2)
Boy	160 (54.8)
Comorbidity, n (%)	
No	120 (41.1)
Yes	172 (58.9)
Severity, n (%)	
Asymptomatic	16 (5.5)
Mild – moderate	235 (80.5)
Severe – critical	41 (14)
Length of stay (day), median (IQR)	3 (1-28)
Growth (weight-for-age), n (%)	
Normal weight	186 (63.7)
Underweight	106 (36.3)
Growth (length/height-for-age), n (%)	
Normal stature	157 (53.8)
Short stature	135 (46.2)
Development, n (%)	
Normal or typical	100 (34.2)
Atypical	192 (65.8)

Most respondents had normal weight-for-age (n=186, 63.7%) and length/height-for-age (n=157, 53.8%). However, 192 (65.8%) of respondents identified as having a potential health concern classified as atypical according to the PDQ.

Further analysis was conducted to identify the correlation between physiological factors (ie, age, gender, severity, comorbidities) as well as situational factors (eg, length of stay) and children’s growth and developmental status. As shown in Table 2, underweight status was the most common among children aged 25 - 36 months (n=43, 48.9%), male sex (n=60, 37.5%), no comorbidities (n=46, 38.3%), and with severe to critical illness (n=18, 43.9%); only age was significantly associated with weight-for-age growth (*P*<.05).

Table . The correlation between physiological and situational factors with children’s weight-for-age post–COVID-19 (n=292).

Variables	Respondents (N=292), n	Growth status			
		Normal weight (n=186)	Underweight (n=106)	OR (95% CI)	*P* value
Age (months), n (%)					
49 - 60	51	43 (84.3)	8 (15.7)	Ref	—[a]
37 - 48	64	41 (64.1)	23 (35.9)	3.02 (1.21 - 7.5)	.02
25 - 36	88	45 (51.1)	43 (48.9)	5.14 (2.17 - 12.17)	<.001
12 - 24	89	57 (64)	32 (48.9)	3.02 (1.26 - 7.2)	.01
Gender, n (%)					.73
Girl	132	86 (65.2)	46 (34.8)	Ref	
Boy	160	100 (62.5)	60 (37.5)	1.12 (0.69 - 1.81)	
Comorbidity, n (%)					.63
No	120	74 (61.7)	46 (38.3)	Ref	
Yes	172	112 (65.1)	60 (34.9)	0.86 (0.53-1.4)	
Severity, n (%)					
Asymptomatic	16	10 (62.5)	6 (37.5)	Ref	—
Mild-moderate	235	153 (65.1)	82 (34.9)	0.89 (0.31-2.55)	.83
Severe-critical	41	23 (56.1)	18 (43.9)	1.3 (0.4-4.27)	.66
Length of stay (days), median (IQR)	292	3 (1-28)	3 (1-19)	1.02 (0.95-1.08)	.31

[a] Not applicable.

As shown in Table 3, short stature was the most common among children aged 12 - 24 months (n=43, 48.3%), boys (n=77, 48.1%), those with comorbidities (n=82, 47.2%), and those with mild to moderate illness (n=110, 46.8%).

Table . The correlation between physiological and situational factors with children's length/height-for-age post–COVID-19.

Variables	Respondents (N=292), n	Growth status			
		Normal stature (n=157)	Short stature (n=135)	OR (95% CI)	*P* value
Age (months), n (%)					
49 - 60	51	31 (60.8)	20 (39.2)	Ref	—[a]
37 - 48	64	34 (53.1)	30 (46.9)	1.37 (0.65 - 2.89)	.41
25 - 36	88	46 (52.3)	42 (47.7)	1.42 (0.7 - 2.85)	.33
12 - 24	89	46 (51.7)	43 (48.3)	1.45 (0.7 - 2.92)	.30
Gender, n (%)					.55
Girl	132	74 (56.1)	58 (43.9)	Ref	
Boy	160	83 (51.9)	77 (48.1)	1.18 (0.75 - 1.88)	
Comorbidity, n (%)					.64
No	120	67 (55.8)	53 (44.2)	Ref	
Yes	172	90 (52.3)	82 (47.2)	1.15 (0.72 - 1.84)	
Severity, n (%)					
Asymptomatic	16	10	6	Ref	—
Mild-moderate	235	125	110	1.47 (0.52 - 4.17)	.47
Severe-critical	41	22	19	1.44 (0.44 - 4.7)	.55
Length of stay (days), median (IQR)	292	3 (1-28)	3 (1-21)	0.99 (0.94-1.06)	.50

[a] Not applicable.

According to Table 4, atypical development was most frequently observed among children aged 37 - 48 months (n=44, 68.8%), boys (n=111, 69.4%), those with comorbidities (n=121, 70.3%), and those with severe to critical illness (n=32, 78%).

Table . The correlation between physiological and situational factors with children’s developmental status post–COVID-19.

Variables	Respondents (N=292), n	Developmental status			
		Typical (n=100)	Atypical (n=192)	OR (95% CI)	*P* value
Age (months), n %					
49 - 60	51	18 (35.3)	33 (64.7)	Ref	—[a]
37 - 48	64	20 (31.3)	44 (68.8)	1.2 (0.55 - 2.62)	.65
25 - 36	88	32 (36.4)	56 (63.6)	0.96 (0.47 - 1.96)	.90
12 - 24	89	30 (33.7)	59 (66.3)	1.07 (0.52 - 2.21)	.85
Gender, n (%)					.19
Girl	132	51 (38.6)	81 (61.4)	Ref	
Boy	160	49 (30.6)	111 (69.4)	1.43 (0.88 - 2.32)	
Comorbidity, n (%)					.06
No	120	49 (40.8)	71 (59.2)	Ref	
Yes	172	51 (29.7)	121 (70.3)	1.64 (1 - 2.67)	
Severity, n (%)					
Asymptomatic	16	7 (43.8)	9 (56.3)	Ref	—
Mild-moderate	235	84 (35.7)	151 (64.3)	1.4 (0.5 - 3.89)	.52
Severe-critical	41	9 (22)	32 (78)	2.77 (0.81 - 9.57)	.11
Length of stay (days), median (IQR)	292	3 (1-26)	3 (1-28)	1.09 (1 - 1.19)	.26

[a] Not applicable.

Multivariate models refined these findings, as presented in Tables 5-7 regarding growth and development status. For weight-for-age, age remained the sole independent predictor. After adjustment, children aged 25 - 36 months had approximately five times the odds of being underweight compared to those aged 12 - 24 months (*P*<.001), and children aged 49 - 60 months had about 3 times the odds. No other factors were retained.

Table . The final model of dominant factors associated with weight-for-age child growth status post–COVID-19.

Variables	Weight-for-age growth			
	β	OR	95% CI	*P* value
Intercept	–1.682	0.186	—[a,b]	<.001
Age (months)				
49 - 60	Ref	Ref	Ref	—
37 - 48	1.104	3.02	1.21–7.5	.02
25 - 36	1.636	5.14	2.17 - 12.2	<.001
12 - 24	1.104	3.02	1.26 - 7.2	.01

[a] The 95% CI is not mentioned because the intercept usually has limited practical interpretation, especially in multivariate models where "all predictors = 0" may not be a meaningful or realistic scenario. Therefore, the focus is generally placed on the predictor variables, as they provide more relevant information regarding associations with the outcome.

[b] Not applicable.

Table . The final model of dominant factors associated with length/height-for-age child growth status post–COVID-19.

Variables	Length/height-for-age growth			
	β	OR	95% CI	*P* value
Intercept	–.105	0.9	.34 - 3.24	.82
Age (months)				
49 - 60	—[a]	Ref	Ref	—
37 - 48	.045	1.05	0.34 - 3.24	.94
25 - 36	–.545	0.57	0.19 - 1.81	.35
12 - 24	–.028	0.97	0.33-2.85	.96
Gender	–.541			.36
Girl		Ref	Ref	
Boy		0.58	0.18 - 1.86	
Age and gender		2.49	—	
37 - 48 months and boy	.408			.60
25 - 36 months and boy	1.458			.05
12 - 24 months and boy	.675			.35

[a] Not applicable.

Table . The final model of dominant factors associated with child development status post–COVID-19.

Variable	β	OR	95% CI	*P* value
Intercept	–.021	0.978	—[a]	.94
Comorbidity	.542			.03
No		Ref	Ref	
Yes		1.72	1.05 - 2.82	
Length of stay (days)	.095	1.1	1.01 - 1.2	.03

[a] The 95% CI is not mentioned because the intercept usually has limited practical interpretation, especially in multivariate models where "all predictors = 0" may not be a meaningful or realistic scenario. Therefore, the focus is generally placed on the predictor variables, as they provide more relevant information regarding associations with the outcome.

For length-for-age, the final model included an age–gender interaction: boys aged 25 - 36 months were significantly more likely to be short-statured than older boys (adjusted odds ratio [aOR] 2.49, *P*=.05). The other age or sex subgroups or any comorbidity or severity variables did not have a significant effect on stature after adjustment.

Regarding developmental status, children with comorbid conditions had significantly higher odds of atypical development (aOR 1.72, 95% CI 1.05 - 2.82). Additionally, each extra hospital day slightly increased this risk (aOR 1.10, 95% CI 1.01 - 1.20) per day. Age, sex, and illness severity were not significant predictors of development in the adjusted model.

The severity variable was excluded from the final multivariate model as it was not a candidate for retention due to *P* value >.25, exceeding the usual cutoff for inclusion in the multivariate model (as described in Table 4).

Discussion

Principal Findings

This study found no significant association between age and child development, contrasting with prior findings linking nutritional status to early developmental outcomes. Galasso & Wagstaff [15] reported a positive correlation between nutrition and development in children under 5 years of age [15], while Shrestha et al [16] emphasized the risks of wasting and underweight status [16]. Although early malnutrition is associated with poor cognitive and motor outcomes [17], our null findings may reflect differences in age distribution, sample characteristics, or developmental assessments.

In contrast to Androutsos et al [9] and Xiao et al [18], who found behavioral issues in children aged 6 - 7 years during and after lockdowns, we found no link between age or COVID-19 severity and development. This discrepancy could be due to milder illness in our cohort or differing definitions of severity.

While previous literature often shows gender disparities—such as boys being more prone to stunting due to biological and sociocultural factors [5,8]—we found no significant gender effect. This may be attributed to our sample size, local caregiving practices, or statistical adjustments that controlled for confounding variables.

Although comorbidities such as malnutrition and coronary heart disease increase COVID-19 mortality risk in children [19], our study found no association between these comorbidities and growth or development. This could be due to the low prevalence of those comorbidities (ie, malnutrition and coronary heart disease), milder disease, or differences in comorbidity definitions.

Severe malnutrition is widely linked to developmental delays, with some studies reporting delays in more than >60% of affected children. However, our severity variable was not significant, possibly due to inconsistent classification, low disease severity among children, or the influence of statistical controls diminishing its apparent effect.

Respiratory and neurological impacts of COVID-19, as reported by Bögli et al [20], did not emerge as significant in our cohort—possibly due to the predominance of mild presentation. Coronary heart disease is known to impair motor development due to chronic hypoxia [21], and febrile seizures in children with epilepsy can lead to neurological damage [22]. These conditions, while important, were infrequent in our population.

Finally, while Ludvigsson [1] argued it was too early to determine if children under 3 years of age are more vulnerable to COVID-19, newborns remain at higher risk due to immature immune systems and lack of maternal antibodies [23].

Limitations

Discharged patient records were no longer accessible via the electronic health records, and medical records officers were only available until 9 PM daily, leading to delayed data retrieval.

Conclusions

Age was significantly correlated with child growth. Significant correlations were also found between comorbidities and length of stay and child development. To improve child health outcomes post–COVID-19, comprehensive discharge planning should be provided to families to ensure continuous stimulation, and community health care services should be optimized to offer follow-up care and monitoring for children posthospitalization.

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Conflicts of Interest

None declared.

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Abbreviations

aOR: adjusted odds ratio
PDQ: Prescreening Developmental Questionnaire

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Short Paper

Factors Influencing Resilience in Siblings of Children With Disabilities: Cross-Sectional Study

Hazrina Adelia[1,2], BSN, MSN, RNCS; Nur Agustini[1], BSN, MPsych, PhD; Efa Apriyanti[1], BSN, RN, MS

[1]Department of Pediatric Nursing, Faculty of Nursing, Universitas Indonesia, Depok, Indonesia

[2]Diploma Program in Nursing, Faculty of Pharmacy and Health Sciences, Universitas Abdurrab, Pekanbaru, Indonesia

Corresponding Author:
Nur Agustini, BSN, MPsych, PhD
Department of Pediatric Nursing
Faculty of Nursing
Universitas Indonesia
FIK UI Campus, Jl. Prof. Dr. Bahder Djohan
Depok, 16424
Indonesia
Phone: 62 85711278889
Email: nuragustini.fikui@gmail.com

Abstract

Background: Siblings, who have the longest relationship with individuals with disabilities, may experience both negative and positive impacts. While some siblings face emotional challenges, others exhibit personal growth. The concept of resilience offers insight into these differing responses.

Objective: This study aims to analyze factors influencing the resilience of siblings of children with disabilities.

Methods: A cross-sectional study was conducted with 118 sibling-parent pairs from 7 special schools in Padang, Indonesia, using random sampling. Siblings completed 3 questionnaires: the Child and Youth Resilience Measure-Revised, a modified version of the Multidimensional Measure of Religiousness/Spirituality, and the Multidimensional Scale of Perceived Social Support. Parents completed a demographic form and the Parenting Style and Dimensions Questionnaire. Data were analyzed using chi-square tests, Mann-Whitney tests, and logistic regression with model diagnostics.

Results: Resilience was significantly associated with parenting style (*P*=.009), social support (*P*=.005), and spirituality (*P*=.001). In multivariate analysis, spirituality was the most influential predictor of high resilience (odds ratio [OR]=.39, 95% CI 0.17-0.94), followed by social support (OR=.31, 95% CI 0.12-0.83), and parenting style (OR=.09, 95% CI 0.01-0.83). The logistic regression model had a good fit (Hosmer-Lemeshow p=0.821) and explained 39.2% of the variance in sibling resilience (Nagelkerke R^2=0.392).

Conclusions: Spirituality played a key role in promoting resilience among siblings of children with disabilities. Nursing interventions should consider culturally grounded approaches that enhance spiritual, emotional, and family support systems to build resilience in this population.

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KEYWORDS

disability; children; sibling; spirituality; resilience

Introduction

The sibling relationship is one of the most intense and influential interpersonal bonds across the lifespan [1]. While much attention is given to parents and the child with the disability, siblings also endure significant emotional, social, and psychological impacts. Numerous studies have reported that siblings of children with disabilities face a higher risk of emotional distress, including anxiety and depression [2], low self-esteem [3], and poor psychosocial functioning [4]. In contrast, some siblings of children with chronic illnesses demonstrated greater empathy, altruism [5], independence, and responsibility [6]. This variation suggests the presence of internal and external factors that influence how siblings adapt and respond to stress.

One framework that helps explain these divergent outcomes is resilience theory [7]. Resilience is defined as the ability to function and develop in a healthy manner in the face of misfortune and stress [8]. Polk's [7] resilience theory identifies 4 patterns that shape resilience: dispositional (eg, optimism), relational (eg, social support), situational (eg, coping context), and philosophical (eg, values and spirituality).

Although numerous studies have examined resilience in children with disabilities, far fewer have focused on the healthy siblings who live alongside them. Moreover, existing research often examines individual factors in isolation, without comparing their relative contribution to resilience within a culturally specific context. This represents a critical gap, particularly in non-Western settings where communal and spiritual values are deeply embedded in daily life.

This study aims to analyze multiple psychosocial and spiritual factors to identify which one has the strongest influence on the resilience of siblings of children with disabilities. The analysis is guided by Polk's framework and grounded in the cultural context of Indonesian families.

Methods

Research Design

This study was cross-sectional study.

Sampling and Participants

The study used a simple random sampling method with a balanced representation across selected schools. First, a complete list of special schools (*Sekolah Luar Biasa*) in Padang was compiled. From this list, schools were randomly selected to ensure geographic and institutional diversity. Within each selected school, researchers identified eligible families based on the following inclusion criteria: (1) parents had more than 1 biological child, with at least 1 child formally diagnosed with a disability; (2) a sibling aged 7-17 years lived in the same household; and (3) both the sibling and their parent were able and willing to participate. Families were excluded if the sibling had a disability or chronic illness, or if cognitive or language barriers prevented questionnaire completion. To maintain balance, when a disabled child had more than 1 eligible sibling, 1 sibling was randomly chosen to participate, ensuring that each family contributed only 1 data point.

Instruments

This study used 5 instruments. Parents completed two questionnaires: (1) a demographic data questionnaire and (2) the Parenting Style and Dimensions Questionnaire. Siblings completed three questionnaires: (1) Child and Youth Resilience Measure-Revised; (2) Multidimensional Religiousness/Spirituality, modified linguistically for clarity with children (the instrument demonstrated acceptable validity, with item-total correlation coefficients ranging from 0.484 to 0.809, and good reliability, as indicated by a Cronbach α of .748); and (3) the Multidimensional Scale of Perceived Social Support.

Data Collection

Data were collected from May to June 2023. The researcher and research asssistant assisted the siblings or parents who were having problems reading the questionnaire.

Data Analysis

Descriptive statistics, Mann-Whitney tests, chi-square or Fisher tests, and binary logistic regression (backward method) were applied. Model diagnostics included Nagelkerke R^2 and the Hosmer-Lemeshow test.

Ethical Considerations

Ethical approval was obtained from the ethics committee of the Faculty of Nursing, University of Indonesia (KET-101/UN2.F12.D1.2.1/PPM.00.02/2023). Written informed consent was collected from parents and assent from children aged 7-12 years. To guarantee privacy, the parent and sibling questionnaires were completed in separate locations. In addition, to maintain anonymity and confidentiality, the questionnaires were coded.

Results

Participant Profile

The study included a total of 118 sibling-parent pairs participated (Table 1).

Table 1. Participant profile (N=118).

Characteristics	Value
Gender of sibling, n (%)	
Male	67 (56.8)
Female	51 (43.2)
Parenting style, n (%)	
Democratic	109 (92.4)
Authoritarian	6 (5.1)
Permissive	3 (2.5)
Social support, n (%)	
High	90 (76.3)
Intermediate	28 (23.7)
Age gap (years), median (min-max)	4 (0-12)
Age category of sibling, n (%)	
School age	26 (22)
Adolescent	92 (78)
Knowledge, n (%)	
Understand	115 (97.5)
Do not understand	3 (2.5)
Birth order of sibling, n (%)	
Firstborn child	47 (39.8)
Middle child	34 (28.8)
Youngest child	37 (31.4)
Type of disability of sibling, n (%)	
Physical	2 (1.7)
Intellectual	71 (60.2)
Mental	18 (15.3)
Sensory	27 (22.9)
Multiple	0 (0)
Spirituality, n (%)	
High spirituality	71 (58.7)
Low spirituality	47 (41.3)

Resilience

Table 2 shows that 71 out of 118 (60.2%) of siblings had high resilience levels.

Table 2. Resilience of siblings (N=118).

Resilience	Participants, n (%)
High	71 (60.2)
Low	47 (39.8)

The Relationship of Dependent and Independent Variables

In bivariate analysis (Table 3), resilience was significantly associated with parenting style (*P*=.009), social support (*P*=.005), and spirituality (*P*=.001).

Table 3. Relationship between independent variable and resilience (N=118).

Variable	High resilience, n (%)	Low resilience, n (%)	*P* value	OR[a]	95% CI
Gender[b]					
Male	42 (62.7)	25 (37.3)	.65	1.27	0.61-2.68
Female	29 (56.9)	22 (43.1)			
Age group[b]					
School age	14 (53.8)	12 (46.2)	.60	0.72	0.30-1.72
Adolescent	57 (62)	35 (38)			
Parenting style[c]					
Democratic	70 (64.2)	39 (35.8)	.009[d]	—[e]	—
Authoritarian	1 (16.7)	5 (83.3)			
Permissive	0 (0)	3 (100)			
Birth order[b]					
Firstborn child	31 (66)	16 (34)	.22	—	—
Middle child	22 (64.7)	12 (35.3)			
Youngest child	18 (48.6)	19 (51.4)			
Social support[b]					
High	61 (67.8)	29 (32.3)	.005[d]	0.26	0.11-0.64
Moderate	10 (35.7)	18 (64.3)			
Knowledge[b]					
Know	70 (60.9)	45 (39.1)	.56	3.11	0.27-35.32
Do not know	1 (33.3)	2 (66.7)			
Socioeconomic[b]					
High income	32 (64)	18 (36)	.59	0.76	0.36-1.60
Low income	39 (57.4)	29 (42.6)			
Type of disability[c]					
Physical	1 (50)	1 (50)	.97	—	—
Intellectual	42 (59.2)	29 (40.8)			
Mental	10 (55.6)	9 (44.4)			
Sensory	18 (66.7)	9 (33.3)			
Spirituality[b]					
High	52 (73.2)	19 (26.8)	.001[d]	0.25	0.11-0.54
Low	19 (40.4)	28 (59.6)			
Age gap[f]	—	—	.99	—	—

[a] OR: odds ratio.

[b] Chi-square analysis.

[c] Fisher analysis.

[d] Statistically significant (*P*<.05).

[e] Not applicable.

[f] Mann-Whitney analysis.

Factors Influencing Resilience

Multivariate logistic regression (Table 4) showed that spirituality, social support, and parenting style were significant predictors of sibling resilience. Children with high spirituality were 61% less likely to have low resilience (OR=0.39, 95% CI 0.17-0.94, *P*=.04), while those with strong social support had 69% lower odds (OR=0.31, 95% CI 0.12-0.83, *P*=.02). Democratic parenting showed the strongest effect, with a 91% reduction in odds of low resilience (OR=0.09, 95% CI 0.01-0.83, *P*=.03). All confidence intervals excluded 1, confirming statistical significance. The model showed good fit (Hosmer-Lemeshow p=0.821) and explained 39.2% of variance (Nagelkerke R^2=0.392).

Table 4. Logistic regression of factors influencing resilience (N=118).

Variable	B	SE	Wald	*P* value	OR[a]	95% CI
Spirituality	–0.93	0.44	4.44	.04	0.39	0.17-0.94
Social support	–1.16	0.50	5.41	.02	0.31	0.12-0.83
Parenting style	–2.41	1.13	4.51	.03	0.09	0.01-0.83
Constant	1.36	0.31	19.87	<.001	3.90	—[b]

[a] OR: odds ratio.

[b] Not applicable.

Discussion

Principal Findings

This study identified spirituality, perceived social support, and parenting style as significant factors of resilience among siblings of children with disabilities. According to Polk's [7] resilience theory, resilience arises from the interaction of 4 patterns: dispositional (personal traits), relational (supportive relationships), situational (contextual coping), and philosophical (belief systems and values). The significant factors found in this study align closely with these domains.

Consistent with prior research, parenting style was significantly associated with child resilience. Previous studies have shown that parenting style is significantly associated with resilience, particularly among adolescents from low-income families [9] and those with posttraumatic symptoms [10]. Democratic parenting aligns with the relational pattern, offering both structure and warmth that foster emotional security and adaptive functioning. This also aligns with studies showing that positive parenting practices foster behavioral health in youth facing stress or developmental challenges [11].

Social support, another component of the relational pattern, also contributed significantly, especially support from family. High levels of perceived family support have been associated with better emotional regulation and problem-solving skills in children facing adversity. In collectivist cultures such as Indonesia, the role of extended family and community support tends to be stronger than in Western contexts, making this finding culturally meaningful. This is consistent with findings from adolescents with type 1 diabetes in Indonesia, where strong family support was shown to enhance resilience, reduce stress, and promote adaptive coping in managing psychosocial and physical challenges [12].

Spirituality, within the framework of Polk's philosophical resilience pattern, emerged as the most influential factor in this study. It is viewed as a developmental process that begins in childhood and evolves over time [13]. Among the Minangkabau community of West Sumatra, spirituality is deeply embedded in daily life through prayer, rituals, and communal religious practices. Central to this integration is the cultural philosophy *Adat Basandi Syarak, Syarak Basandi Kitabullah*, which harmonizes Islamic teachings with local tradition and informs core values such as mutual cooperation, deliberation, respect for elders, and discipline. These values are transmitted through both formal education and traditional learning institutions like *surau*, contributing to the moral and spiritual formation of children [14]. In this context, spirituality functions as a culturally grounded interpretive framework, enabling children to find meaning in life events and adversity. In this context, spirituality functions as a culturally grounded interpretive framework, enabling children to find meaning in life events and adversity [15]. The strong role of spirituality in this study aligns with Polk's philosophical resilience pattern and reflects its cultural embeddedness.

Beyond this local context, research shows that adolescents' spirituality is shaped by culturally specific moral frameworks, such as the "ethic of divinity" in religious societies [16]. Additionally, existential concerns, whether spiritual, religious, or secular, affect mental health across cultures, including in secular settings like Denmark [17]. Studies have shown that spiritual distress is common among vulnerable groups, such as young female cancer survivors [18]. These findings support the integration of existential and spiritual dimensions into psychosocial care for families managing chronic conditions.

These findings affirm Polk's theoretical proposition that resilience is multidimensional, shaped by internal capacities, external relationships, contextual realities, and personal belief systems. Future studies should examine how these domains interact across diverse cultural and developmental contexts.

Nursing Implications

Health care professionals should incorporate culturally sensitive, resilience-based interventions into early childhood and family care. Structured programs focusing on spirituality, parenting, and social support may help strengthen sibling resilience.

Limitations

This cross-sectional study, limited to 1 urban site, restricts causal interpretation and generalizability. Additional limitations include reliance on self-reports and limited analysis of variables such as age, gender, disability type, and birth order. Broader, longitudinal studies are needed.

Conclusions

Spirituality, social support, and parenting style are key resilience predictors among siblings of children with disabilities. Interventions should integrate culturally embedded spiritual and family support systems.

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Conflicts of Interest

None declared.

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130 Queens Quay East.
Toronto, ON, M5A 3Y5
Phone: (+1) 416-583-2040
Email: support@jmir.org