Nurse Media

JOURNAL OF NURSING

Volume 12 Number 1, April 2022

Articles

NurseMedia
JOURNAL OF NURSING

REVIEW

Digital Health Interventions to Improve Cardiometabolic Risk Profile among Adults with Obesity and Chronic Diseases: A Systematic Review

Hoirun Nisa[1], Fadi Barsbay[2]

[1]Faculty of Health Sciences, Syarif Hidayatullah State Islamic University (UIN), Jakarta, Indonesia
[2]The University of New Orleans, New Orleans, USA

Article Info	Abstract
	Background: The prevalence of chronic diseases is rapidly increasing globally. Ubiquitous digital technologies give an opportunity for digital health intervention to improve cardiometabolic risk (CMR) profile that may consequently decrease the risk of chronic diseases. However, evidence on digital health associated with chronic disease interventions remains controversial. **Purpose:** This systematic review aimed to determine the association of digital health intervention with improving CMR profile of adults with obesity and chronic diseases. **Methods:** A comprehensive search of Medline, CINAHL, Embase, and PubMed was performed using the following criteria: publication between 2016-2021, using digital health tools as interventions, adults with obesity or chronic diseases, cardiometabolic profile as outcomes, and randomized controlled trial (RCT) as the design. The search yielded 548 articles of which 13 studies met the inclusion criteria. The Joanna Briggs checklist for RCT was used to assess the quality of the studies. Data analysis was conducted according to the guidance for synthesis without meta-analysis. **Results:** There were 8 (61.5%) out of 13 studies assessed the relationship between digital health interventions and weight, of which 7 studies (88%) found positive findings. The association between digital health intervention and blood pressure were assessed in 7 (53.8%) out 13 studies, of which only two studies had positive findings related with systolic blood pressure. The intervention modalities included m-Health (apps) in 2 studies, text-messaging in 4 studies, and combinations of modalities in 8 studies. The interventions used different strategies, including education, self-management, and social support. More than a half of the studies (54%) were about weight-loss interventions and 10 (76.9%) studies used education for intervention components. **Conclusions:** Digital health intervention may be associated with decreased weight and BMI; however, only a few studies assessed other CMR profile, and the findings were inconsistent. Additional studies are needed to assess digital health interventions targeting other CMR profile, including blood pressure, glucose, and cholesterol level.

How to cite: Nisa H., & Barsbay, F. (2022). Digital health interventions to improve cardiometabolic risk profile among adults with obesity and chronic diseases: A systematic review. *Nurse Media Journal of Nursing, 12*(1), 133-150. https://doi.org/10.14710/nmjn.v12i1.41139

1. Introduction

Chronic diseases are the largest cause of death globally (Bennett et al., 2018a). The leading chronic diseases such as cardiovascular diseases (CVDs), cancer, chronic lung disease, and diabetes collectively caused 32.8 million deaths worldwide, of which 77% occur in low- and middle-income countries (WHO, 2021). Adoption of modern lifestyles affects morbidity and mortality of the chronic diseases (Patterson et al., 2018). Many studies have shown that interventions targeting cardiometabolic risk (CMR) profile were associated with the reduce risk of chronic diseases (Pereira et al., 2020; Ralston et al., 2019; Sundfør et al., 2018).

CMR profile refers to conditions that increases the likelihood of developing of common chronic diseases, such as CVDs or type-2-diabetes mellitus (T2DM). CMR, mostly prevalent in patients with metabolic syndrome (Aghakhanian et al., 2019), is a group of metabolically interrelated risk factors indicating high level of blood pressure, fasting blood sugar, cholesterol,

obesity, and triglycerides (Ruilope, 2007). The strong associations of CMR with diabetes and cardiovascular health provide a convincing reason to reduce CMR events through early assessment and targeted interventions (Wilson et al., 2005). Thus, innovative method of cost-effective strategy targeting high-risk individuals, primarily adults with obesity or chronic diseases, is important to prevent further deterioration of health (Milani et al., 2017). Recently, many studies have integrated digital technology as one of the modalities in intervention program for people with obesity (Bennett et al., 2018b; Liyana et al., 2018; Lugones-Sanchez et al., 2020; Senecal et al., 2020a) or chronic diseases (Jahan et al., 2020; Toro-Ramos et al., 2020; Wang et al., 2020) .

Digital health is defined as technology used for improving the public's health and health services through mobile computing of clinical and genetic data (Fatehi et al., 2020). Digital health includes mobile health, mobile applications, health information technology, wearable devices, telehealth and telemedicine, social media, and website (Ronquillo et al., 2021). These technologies offer to educate patients by providing awareness into their behaviors and opportunities to practice new skills (Kuwabara et al., 2020). A systematic review demonstrated that women with diabetes receiving preconception care education through eHealth had significant improvements in knowledge and attitudes toward preconception care. In addition, intervention using eHealth showed a significant improvement in glycosylated hemoglobin levels with fewer preterm deliveries and adverse fetal outcomes (Nwolise et al., 2016). Multiple studies have suggested that mobile health (m-Health) interventions could be effective to promote healthy lifestyles and to support behavior change to smoking cessation, physically active, and less alcohol drink (Ek et al., 2020; Ludwig et al., 2018; Thomas et al., 2016; Whittaker et al., 2019). A meta-analysis of 13 studies among smokers of any age, primarily in high-income countries, showed that mobile text-based smoking cessation interventions resulted in a high likelihood of smoking cessation compared with less smoking cessation support; however, a smoking cessation smartphone apps with lower-intensity smoking cessation support was less likely to improve smoking cessation (Whittaker et al., 2019).

In recent decades, the transformation of digital health tools has enabled a rapidly increasing new field of digital public health (Conard, 2019). The WHO Global Observatory for eHealth assessed the evolution of digital health and its impact in 114 countries through a survey in 2009 (Ryu, 2012). The results showed that at least one type of m-Health service offered in majority of countries (83%). M-Health activity was found more in higher-income countries than in lower-income countries, whereas the greatest barrier to m-Health adoption by responding countries was the problem of competing health system priorities. Result-based evaluations of m-Health implementations were not routinely conducted, reporting an only 12% of countries had evaluating m-Health services. In addition, the survey underlined that the dominant form of m-Health was characterized by small-scale pilot projects that focused on single issues related to information sharing and access (Ryu, 2012).

The innovative approach of digital health may improve the individual's participation in promoting health and improving CMR profile (Burke et al., 2015). The increased use of digital health permits for modifying interventions suitable with each person, as the results from innovations in data analytics and health informatics. Digital health tools do not only help communication but also allow patients to better track and monitor their own health and wellness. A web-based self-management intervention for people with T2DM in the UK primary care has been shown to lower HbA1c over 12 months (Murray et al., 2017) and be cost-effective compared to usual care (Li et al., 2018). Several studies have shown the implementation strategy for a such digital health intervention in routine healthcare to improve glycemic control (Khunti et al., 2012; Ross et al., 2018). Furthermore, digital health interventions have been reported to change multiple-lifestyle health behavior including control obesity, encourage increased physical activity, healthy diet, smoking cessation, and control alcohol drinking. A randomized controlled trial including an intervention group (n=403) and a control group (n=387) among adults interested in reducing their cardiovascular risks showed that an 8-week web-based computer-tailored multiple-lifestyle interventions was associated with an increasing self-reported habit for physical activity and fruit and vegetable consumption (Storm et al., 2016). The effectiveness of health behavior change interventions using social networking cites was also reported in a meta-analysis of 21 studies, but the effects were moderated by health topic, methodological features, and participant features (Yang, 2017).

As the prevalence of chronic diseases continues to increase globally, digital tools as means for health intervention are necessary to reduce CMR profile. The results in a review that examined the effectiveness of m-Health interventions in patients with diabetes, hypertension, and dyslipidemia was inconsistent among different outcomes, suggesting an uncertainty regarding the effectiveness of different m-Health interventions (Cajita et al., 2021). However, the review was based on narrative syntheses with a lack of description of the methods used; unclear links between the included data, the synthesis, and the conclusions; as well as inadequate reporting of the limitations of the synthesis (Cajita et al., 2021). Digital health tools will continue to grow as they are becoming more ubiquitous with technological advances. According to the International Telecommunications Union (ITU), the mobile phone subscriptions worldwide increased in 2021 with a record 110 subscriptions per 100 inhabitants (ITU, 2021). This growth potentially benefits the use of digital tools for health intervention as cardiometabolic disorder continue to be the leading causes of morbidity and mortality worldwide (WHO, 2021). While digital health technology continues to change, we require a better understanding of digital health interventions with of chronic diseases. Therefore, it is important to review the evidence from studies on interventions using digital health tools to improve CMR risk profile. This systematic review aimed to determine whether digital health interventions was associated with improving CMR profile of adults with obesity and chronic diseases.

2. Methods

2.1 Research design
This systematic review was performed based on the Cochrane library guideline and PRISMA criteria (Rethlefsen et al., 2021).

2.2 Search methods
The articles' search was conducted by the second author (FB) to include articles published in English language within the years of 2016-June 2021, as digital health intervention studies were more available in this period. The final searches were conducted on June 5, 2021. Through the duration of the systematic review, the following databases and search engines were used: Embase, Medline, CINAHL, and PubMed. The search aimed to retrieve articles on digital health interventions to improve CMR profiles (Spaulding et al., 2021). The search keywords were informed by the search query of a recently published systematic review (Spaulding et al., 2021). In addition to the search query, the following terms were used to return articles of cardiometabolic lipid profile and smoking behavior: cholesterol OR lipid OR hyperlipid* AND smok*. The following keywords were used to identify candidate studies of other cardiometablic profiles and lifestyle factor: obesity OR overweight OR weight loss OR weight reduction OR weight loss maintenance OR weight control OR body weight maintenance OR weight regain OR body weight changes OR weight reduction programs OR weight reduction diets OR obes* OR Heart Diseases OR Vascular Diseases OR Cardiovascular Diseases OR Coronary Artery Diseases OR heart failure OR hypertens*, OR high blood pressure OR Diabetes Mellitus OR Exercise OR diabete* OR exercis* OR physical activity. In addition, the following terms were also used to return articles of digital health and design study: (Mobile Applications OR Computers, Handheld OR iphone* OR android OR smart phone OR smart phones OR smartphone OR mobile app OR mobile apps OR mHealth OR mobile health) AND (Randomized Controlled Trial OR mixed-methods).

2.3 Inclusion and exclusion criteria
Articles were eligible for inclusion if the use of digital health intervention was evaluated in those with obesity or chronic diseases. To be included, interventions should be published between January 2016 and June 2021, involved adult populations age of 19-64 years, used digital technology, focused on modifying lifestyle behaviors (smoking, alcohol intake, diet, weight, physical activity, and sedentariness), assessed cardiometabolic profile as outcomes, and having a randomized controlled trial (RCT) as study. Articles were excluded if interventions did not involve adults or were not required engagements. Studies with the sample size of less than 50 participants in intervention group were also excluded to minimize obtaining conclusions from underpower studies. Further, articles were excluded if not in English language.

2.4 Screening of articles

Each retrieved title and abstract were screened by the first author (HN) to determine articles' eligibility for full-text review after duplicate removal. The articles identified for full-text review were independently examined for inclusion by the two authors (HN and FB). Any discrepancies were discussed between the two authors. A consensus was reached on all the articles eligible for inclusion. The PRISMA flowchart was used for articles screening (Figure 1).

Identification

Articles identified through database searching
(n=548)

Articles after duplicates removed
(n=480)

Screening

Articles screened (title, abstract)
(n=109)

Articles excluded (n=66)
ie, protocol paper, systematic review, wrong study design, no digital interventions used, not required engagements, no CMR profile as outcomes

Eligibility

Full-text articles assessed for eligibility
(n=43)

Full-text articles excluded (n=30)
n=5, interventions did not relate to CVD behavior change
n=5, no digital-based intervention
n=15, less than 50 participants in mHealth intervention group(s)/with engagement data
n=5, no CMR profile as the outcomes

Included

Articles included in review
(n=13)

Figure 1. Diagram of search strategy

2.5 Data extraction

Data were extracted into a table to summarize the findings for the narrative results of this review (Table 1, Appendix 1). The first author (HN) extracted data on study population and setting, intervention and control description, and results regarding the relationship between using digital tools for health intervention and CMR profile.

2.6 Quality appraisal

Two authors (HN and FB) independently assessed the quality of each included study using the Joanna Briggs checklist for randomized controlled trials (JBI, 2017). The assessment consists of 13 predefined criteria with 4 options for the answer: yes, no, unclear, and not applicable. The rating of each criterion was 1 point if present or 0 point if absent or unclear or inadequately described. Potential scores ranged from 0 to 13, with scores of 0 to 4 indicating high risk, 5 to 8 indicating medium risk, and 9 to 13 indicating low risk. Appraisal results are presented in Table 2 (Appendix 2). Out of the 13 studies, there were none of the studies with high-risk bias, 10 studies with medium risk bias, and 3 studies with low-risk bias. The questions that the studies met all

criteria on the Joanna Briggs Checklist for RCT studies were question 1 ("Was true randomization used for assignment of participants to treatment groups?"), question 10 ("Were outcomes measured in the same way for treatment groups?"), question 11 ("Were outcomes measured in a reliable way?"), and question 12 ("Was appropriate statistical analysis used?"). A few studies poorly performed (absent or unclear or inadequately described) on question 13 ("Was the trial design appropriate, and any deviations from the standard RCT design--individual randomization, parallel groups-- accounted for in the conduct and analysis of the trial?") in which 7.7% (1/13) of the studies received a score of yes, question 7 ("Were treatment groups treated identically other than the intervention of interest ?") in which 15.4% (2/13) of the studies received a score of yes, question 9 ("Were participants analyzed in the groups to which they were randomized?") in which 15.4% (2/13) of the studies received a score of yes, and question 4 ("Were participants blind to treatment assignment?") in which 23.1% (3/13) of the studies received a score of yes.

2.7 Data analysis

Data analysis was performed according to the guidance for synthesis without meta-analysis (SWiM) which consists of 9 items of guideline (Campbell et al., 2020). The first step was evaluating each article retrieved at the title/ abstract to assess their eligibility by grouping the studies (SWiM item 1). The selected articles were grouped into author and year, country, study design, study population and setting, intervention, comparator, and outcomes. Replicated studies were then omitted. Review of full-text articles were then performed for all included studies to address the review questions (SWiM items 2-6). Further, extracted data were shown in tables to present the findings of the association between digital health and CMR profile, including limitations of the studies (SWiM items 7-9).

Finding was categorized as a positive finding if studies showed a statistically significant association between digital health intervention and CMR profile. On contrary, finding was categorized as a negative finding if a non-statistically significant association reported. Intervention components and modalities were also summarized from review articles. In this review, if the relationship between digital health intervention and CMR profile was reported at multiple time points, the end of the intervention time point was used to conclude digital tools for health intervention was or was not significantly associated with the CMR profile of interest.

3. Results

3.1 Characteristics of the selected studies

At the initial search results, a total of 548 articles emerged as can be seen from Figure 1. Then, 68 replicated articles were removed. The remaining 480 articles were screened according to the titles and abstracts, resulting in 109 articles for review. Further, a total of 66 articles were excluded after full-text review, and overall, 13 articles were considered eligible for inclusion in this systematic review (Bennett et al., 2018b; Godino et al., 2016; Jahan et al., 2020; Lin et al., 2015; Lugones-Sanchez et al., 2020; Muralidharan et al., 2019; Newton et al., 2018; Svetkey et al., 2015; Tobe et al., 2019; Toro-Ramos et al., 2020; Wang et al., 2020; Yu et al., 2020; Zheng et al., 2019). Of the 13 studies included in this review, 85% articles were published in medical or clinical journals (Bennett et al., 2018b; Godino et al., 2016; Jahan et al., 2020; Lin et al., 2015; Muralidharan et al., 2019; Newton et al., 2018; Svetkey et al., 2015; Tobe et al., 2019; Wang et al., 2020; Yu et al., 2020; Zheng et al., 2019), and the remaining articles (15%) were published in m-Health journals (Lugones-Sanchez et al., 2020; Toro-Ramos et al., 2020). These results are more likely showing journal preferences of medical and clinical journals. Studies with clinical outcomes were generally the focus in those journals, while technology used for interventions in the studies was published infrequently.

Most of the studies were performed in high-income countries, including the United States (n=7) (Bennett et al., 2018b; Godino et al., 2016; Lin et al., 2015; Lugones-Sanchez et al., 2020; Newton et al., 2018; Svetkey et al., 2015; Toro-Ramos et al., 2020), and Canada (n=1) (Tobe et al., 2019). Other studies were performed in Asian countries (n=5) (Jahan et al., 2020; Muralidharan et al., 2019; Wang et al., 2020; Yu et al., 2020; Zheng et al., 2019). All studies included both male and female participants, but one study was conducted only in female (Lugones-Sanchez et al., 2020). Figure 2 shows the participants were properly selected at high-risk individuals to evaluate the effect of interventions. A total of 7 studies involved obesity participants (Bennett et al., 2018b; Godino et al., 2016; Lin et al., 2015; Lugones-Sanchez et al., 2020; Newton et al., 2018; Svetkey

et al., 2015), and 3 studies involved participants with pre-diabetes or type-2 diabetes (Muralidharan et al., 2019; Toro-Ramos et al., 2020; Wang et al., 2020). The other two studies involved participants with hypertension (Jahan et al., 2020; Tobe et al., 2019) and coronary heart disease (Yu et al., 2020; Zheng et al., 2019). All studies involved participants aged 19-64 years. Duration of interventions in the included studies for this review was from 2 (Tobe et al., 2019) to 12 months (Bennett et al., 2018b; Godino et al., 2016; Toro-Ramos et al., 2020).
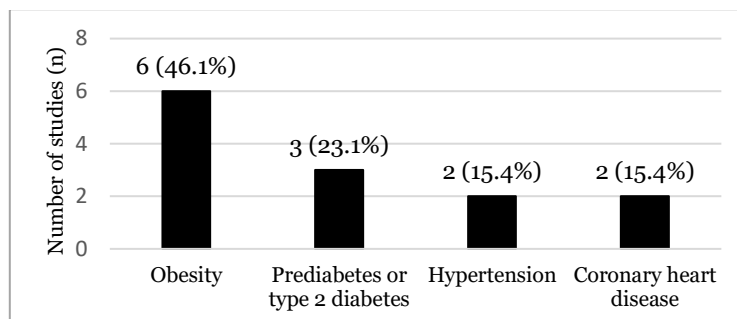

Figure 2. Frequency of studies based on participants

3.2 Digital health intervention modalities

Table 3 presents the frequency of studies according to intervention modalities. The use of m-Health (apps) as an intervention modality was reported in 1 (7.7%) study (Yu et al., 2020), and text-messaging (SMS) was used in 4 (30 .8%) studies (Lin et al., 2015; Newton et al., 2018; Tobe et al., 2019; Zheng et al., 2019). In addition, there were 4 combinations of digital health intervention modalities reported in the studies, including combinations of mHealth (apps), text messaging (SMS), telehealth, social media, and web-based computer. The use of mHealth (apps) and personal coach for intervention was found in 4 (30.8%) studies (Jahan et al., 2020; Svetkey et al., 2015; Toro-Ramos et al., 2020; Wang et al., 2020), and 2 (15.4%) studies used the combinations of mHealth (apps) and telehealth (Bennett et al., 2018b; Muralidharan et al., 2019). There was one study (7.7%) used the combination of mHealth (apps) and smart band (Lugones-Sanchez et al., 2020), and one study (7.7%) used an integrative intervention modality (Godino et al., 2016). Digital health intervention modalities and CMR profile were very heterogenous across the studies, confining to perform a quantitative review of the association between type of digital health intervention modalities and CMR profile.

Table 3. Frequency of studies based on intervention modalities

Participants	f	%
m-Health (apps)	1	7.7
Text messaging (SMS)	4	30.8
m-Health (apps) and telehealth	2	15.3
m-Health (apps) and smart band	1	7.7
m-Health (apps) and personal coach	4	30.8
m-Health (apps), SMS, social media, telehelath, and web-based computer	1	7.7

3.3 Components of digital health intervention

The interventions used a variety of strategies, including education, self-management, and social support. Half of the studies (54%) were about weight loss interventions (Bennett et al., 2018b; Godino et al., 2016; Lin et al., 2015; Lugones-Sanchez et al., 2020; Muralidharan et al., 2019; Newton et al., 2018; Svetkey et al., 2015), and 10 (76.9%) studies used education for intervention component (Godino et al., 2016; Jahan et al., 2020; Lin et al., 2015; Lugones-Sanchez et al., 2020; Muralidharan et al., 2019; Newton et al., 2018; Tobe et al., 2019; Toro-Ramos et al., 2020; Wang et al., 2020; Zheng et al., 2019). Table 4 shows frequency of studies according to intervention components.

Table 4. Frequency of studies based on intervention components

Participants	f	%
Education	10	76.9
Self-management progress	6	46.2
Structured telephone support	2	15.4

3.4 The associations of digital health interventions with CMR profile

Table 5 provides the number of studies reporting the relationship between the use of digital interventions and CMR profile. A positive finding was a statistically significant association between digital intervention and the CMR profile, whereas a negative finding was a non-statistically significant association between digital intervention and the CMR profile.

Of 13 studies in this review, a total of 8 (61.5%) studies measured weight as an outcome (Godino et al., 2016; Lin et al., 2015; Lugones-Sanchez et al., 2020; Muralidharan et al., 2019; Newton et al., 2018; Svetkey et al., 2015; Toro-Ramos et al., 2020; Wang et al., 2020), of which 7 studies (88%) found positive association between the digital health intervention use and weight change (Godino et al., 2016; Lin et al., 2015; Lugones-Sanchez et al., 2020; Muralidharan et al., 2019; Newton et al., 2018; Svetkey et al., 2015; Wang et al., 2020). In addition, there were 7 (53.8%) out of 13 studies assessed blood pressure (Bennett et al., 2018b; Godino et al., 2016; Jahan et al., 2020; Newton et al., 2018; Tobe et al., 2019; Yu et al., 2020; Zheng et al., 2019), of which only two studies had positive findings related with systolic blood pressure (Godino et al., 2016; Jahan et al., 2020). Most studies in this review rarely assessed others CMR profile.

Table 5. Findings for the relationship between using digital interventions and CMR profile in adults with obesity or chronic diseases

CMR Profile	Number of studies f	Positive findings f (%)	Negative findings f (%)
BMI_a	4	2 (50)	2 (50)
Weight (kg)	8	7 (88)	1 (12)
Systolic blood pressure	7	2 (29)	5 (71)
Diastolic blood pressure	7	1 (14)	6 (86)
Serum glucose	2	1 (50)	1 (50)
HbA1c	2	0 (0)	2 (100)
LDL cholesterol$_b$	2	0 (0)	2 (100)
HDL cholesterol$_c$	2	1 (50)	1 (50)
Triglyceride	1	0 (0)	1 (100)
Total cholesterol	2	0 (0)	1 (100)

[a]BMI: Body mass index; [b]LDL cholesterol: Low density lipoprotein cholesterol; [c]HDL: High density lipoprotein cholesterol.

4. Discussion

A total of 13 studies included in this systematic review to determine whether digital health intervention was associated with improving CMR profile of adults with obesity and chronic diseases. This systematic review found that digital health interventions may be associated with CMR profile among adults, particularly a reduction in weight and BMI. Almost all studies included in this systematic review showed that digital health intervention led to weight loss. The association was replicated across digital health intervention modalities. For instance, an RCT study on 741 adults who were at high risk for T2DM in three cities in India showed that a 12-week use of mHealth (apps) was significantly associated with a moderate weight loss, whereas those who viewed videos through apps had a greater weight loss (2.4 kg) than those who only attended coach calls (0.9 kg) (Muralidharan et al., 2019). The use of text messaging (SMS) as a digital health intervention modality was also significantly associated with weight loss in two studies (Lin et al., 2015; Newton et al., 2018). In addition, 4 studies found a significant weight loss using different combinations of digital intervention modalities (Godino et al., 2016; Lugones-Sanchez et al., 2020; Svetkey et al., 2015; Wang et al., 2020). However, there was one study reported no association between an integrative digital intervention modality with weight loss among those

who had pre-diabetes (Toro-Ramos et al., 2020). The observed associations could be explained by short duration of interventions, whereas intervention duration in the studies included in this review was limited only to a less than a year. This main finding supports the conclusions from previous reviews focused on both paper-based (Burke et al., 2011) and digital-based (Patel et al., 2021) self-monitoring in weight loss intervention among adults. Although a previous review suggested that engagement was a major issue in digital-based interventions (O'Connor et al., 2016), many studies reported digital health interventions implicated a short-term weight loss in overweight and obese adults (Beleigoli et al., 2019; Senecal et al., 2020a; Senecal et al., 2020b). For example, a systematic review of 11 RCT studies showed that web-based digital interventions led to greater short-term (<6 months follow-up) but not long-term weight loss than offline interventions in overweight and obese adults (Beleigoli et al., 2019). In addition, two retrospective observational analysis on 8,275 individual (Senecal et al., 2020a) and 251,718 individuals (Senecal et al., 2020b) with severe obesity suggested that the use of m-Health combining with weight-loss program resulted in the weight loss after 120 days follow-up.

Weight loss intervention among overweight and obese adults could improve others CMR profile (Liyana et al., 2018; Morris et al., 2021), suggesting that obesity management should be an integral part to modify the risk of cardiometabolic disorders (Iwamoto et al., 2021). However, this review found that digital-based intervention was not associated with decrease in others CMR profile, such as blood pressure, HbA1c, HDL cholesterol, triglyceride, and total cholesterol. The negative findings for associations of digital health intervention with many CMR profile in the studies included in this review could be explained by lack of power to detect a significance. In fact, an RCT study performed on 822 patients with coronary heart disease could not detect significant associations between mobile health intervention through text messaging with systolic blood pressure and BMI (Zheng et al., 2019), although adequate power was considered to identify statistically significant associations. Further, some studies (Godino et al., 2016; Newton et al., 2018; Yu et al., 2020) did not consider power calculations for blood pressure, serum glucose and cholesterol as they are secondary outcomes and viewed as exploratory findings.

Intervention components may also be important to persuade participant's adherence in medication. In fact, a recent qualitative study conducted on 20 patients with hypertensions in Belitung, Indonesia reported one of the barriers for managing hypertension was due to lack of a regular health monitoring and education from public health center (Aungsuroch et al., 2021). Interestingly, positive findings were found in studies that integrated telephone consultation with nurses, clinical dietitians, and other health specialists in their intervention (Muralidharan et al., 2019; Wang et al., 2020). However, the effect of frequency of telephone consultation was not discussed as a part of interventions. It is likely that the lifestyle interventions mainly focused on diet and physical activity, resulting insufficiency to significantly reduce blood pressure and cholesterol level (Godino et al., 2016; Newton et al., 2018). Further studies are needed to assess how digital health intervention may affect other CMR profile such as blood pressure, glucose, and cholesterol, as many digital health intervention studies have focused on weight management.

5. Implications and limitations

The result of this review implies the use of digital health intervention in clinical practices for managing and improving CMR profile of adults with obesity and chronic diseases. Components of digital health intervention, such as education, regular self-monitoring, or telephone support, may effectively provide patients with awareness into their health behaviors that can bring them closer to their health goals. Digital health is a proper measure to anticipate the trend of out-of-hospital care for patients with chronic diseases and disabilities. Using digital health intervention for chronic diseases potentially enhances the quality of health care services. Several reasons for digital health effectiveness include education and counseling related with disease control, face-to-face visits with health care professionals, and data collected on medical parameters. The engagement of patients in their own health care can also be improved using digital health tools. Moreover, the Coronavirus (COVID-19) pandemic has led to an inevitable surge in the use of digital health technologies due to the physical-distancing norms.

The strengths of this systematic review were each study conducted with a large sample size in the intervention group and performed based on guideline designed for this systematic review. Also, the study findings were reported on the associations of both general use and self-management progress with the CMR profile. The description of the number of studies with

positive or negative associations was presented. However, there were also limitations that should be considered in this systematic review. First, effectiveness of digital health intervention was not assessed because this systematic review was aimed to determine whether digital health intervention was associated with improvement in CMR profile outcomes. Second, digital health intervention modalities and CMR profile were very different across the studies. This precluded us to perform a quantitative review of the association between type of digital health intervention modalities and CMR profile. Third, hand searching to find eligible articles was not performed. In addition, evidence in this systematic review may not fully inclusive as digital health intervention in this review were limited. Finally, most of the studies were from the USA and high-income countries, limiting the evidence from other countries.

6. Conclusion

This systematic review found that digital health interventions may be associated with CMR profile among adults, particularly a reduction in weight and BMI. However, only a few studies assessed other CMR profile, and the findings were inconsistent. Digital health intervention modalities and CMR profile were very heterogenous across the studies, hindering us to examine the association of intervention modalities and CMR profile. Additional studies are needed to assess digital health interventions targeting other important CMR profile, including blood pressure, glucose, and cholesterol level. In addition, future studies should examine the effectiveness of specific digital modalities or intervention components in improving CMR profile. Finally, further studies are needed to explore the effectiveness of digital health interventions in improving CMR profile in other countries.

Acknowledgment

Author contribution

HN was responsible for the concept, design, data analysis, writing, and revision of the manuscript. HN and FB were responsible for data screening process, data extraction, and quality appraisal. All authors give final approval of the version submitted in this journal.

Conflict of interest

The authors declare no conflicts of interest.

References

Aghakhanian, F., Wong, C., Tan, J. S. Y., Yeo, L. F., Ramadas, A., Edo, J., Hoh, B. P., Khalid, B. A. K., & Phipps, M. E. (2019). Metabolic syndrome and cardiometabolic risk factors among indigenous Malaysians. *Public health*, *176*, 106-113. https://doi.org/10.1016/j.puhe.2018.10.001

Aungsuroch, Y., Gunawan, J., Polsook, R., Anuruang, S., Phongphibool, S., & Nazliansyah, N. (2021). Barriers and challenges in managing hypertension in Belitung, Indonesia: A qualitative study. *Nurse Media Journal of Nursing*, *11*(3), 305-317. https://doi.org/10.14710/nmjn.v11i3.42135

Beleigoli, A. M., Andrade, A. Q., Cançado, A. G., Paulo, M. N., Diniz, M. F. H., & Ribeiro, A. L. (2019). Web-based digital health interventions for weight loss and lifestyle habit changes in overweight and obese adults: Systematic review and meta-analysis. *Journal of Medical Internet Research*, *21*(1), e298. https://doi.org/10.2196/jmir.9609

Bennett, J. E., Stevens, G. A., Mathers, C. D., Bonita, R., Rehm, J., Kruk, M. E., Riley, L. M., Dain, K., Kengne, A. P., Chalkidou, K., Beagley, J., Kishore , S. P., Chen, W., Saxena, S., Bettcher, D. W., Grove, J. T., Beaglehole, R., & Ezzati, M. (2018a). NCD Countdown 2030: Worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. *Lancet*, *392*(10152), 1072-1088. https://doi.org/10.1016/s0140-6736(18)31992-5

Bennett, G. G., Steinberg, D., Askew, S., Levine, E., Foley, P., Batch, B. C., Svetkey, L. P., Bosworth, H. B., Puleo, E. M., Brewer, A., DeVries, A., & Miranda, H. (2018b). Effectiveness of an app and provider counseling for obesity treatment in primary care. *American Journal of Preventive Medicine, 55*(6), 777-786. https://doi.org/10.1016/j.amepre.2018.07.005

Burke, L. E., Ma, J., Azar, K. M., Bennett, G. G., Peterson, E. D., Zheng, Y., Riley, W., Stephens, J., Shah, S. H., Suffoletto, B., Turan, T. N., Spring, B., Steinberger, J., & Quinn, C. C. (2015). Current science on consumer use of mobile health for cardiovascular disease prevention: A scientific statement from the American Heart Association. *Circulation*, *132*(12), 1157-1213. https://doi.org/10.1161/cir.0000000000000232

Burke, L. E., Wang, J., & Sevick, M. A. (2011). Self-monitoring in weight loss: a systematic review of the literature. *Journal of the American Dietetic Association*, *111*(1), 92-102. https://doi.org/10.1016/j.jada.2010.10.008

Cajita, M. I., Zheng, Y., Kariuki, J. K., Vuckovic, K. M., & Burke, L. E. (2021). mHealth technology and CVD risk reduction. *Current Atherosclerosis Reports*, *23*(7), 36. https://doi.org/10.1007/s11883-021-00927-2

Campbell, M., McKenzie, J. E., Sowden, A., Katikireddi, S. V., Brennan, S. E., Ellis, S., Hartmann-Boyce, J., Ryan, R., Shepperd, S., Thomas, J., Welch, V., & Thomson, H. (2020). Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. *BMJ Clinical Research*, *368*, l6890. https://doi.org/10.1136/bmj.l6890

Conard, S. (2019). Best practices in digital health literacy. *International Journal of Cardiology*, *292*, 277-279. https://doi.org/10.1016/j.ijcard.2019.05.070

Ek, A., Alexandrou, C., Soderstrom, E., Bergman, P., Delisle Nystrom, C., Direito, A., Eriksson, U., Henriksson, P., Maddison, R., Trolle Lagerros, Y., Bendtsen, M., & Lof, M. (2020). Effectiveness of a 3-month mobile phone-based behavior change program on active transportation and physical activity in adults: Randomized controlled trial. *JMIR mHealth and uHealth*, *8*(6), e18531. https://doi.org/10.2196/18531

Fatehi, F., Samadbeik, M., & Kazemi, A. (2020). *What is digital health? Review of definitions*. Integrated Citizen Centered Digital Health and Social Care. https://doi.org/10.3233/SHTI200696

Godino, J. G., Merchant, G., Norman, G. J., Donohue, M. C., Marshall, S. J., Fowler, J. H., Calfas, K. J., Huang, J. S., Rock, C. L., Griswold, W. G., Gupta, A., Raab, F., Fogg, B. J., Robinson, T. N., & Patrick, K. (2016). Using social and mobile tools for weight loss in overweight and obese young adults (Project SMART): A 2 year, parallel-group, randomised, controlled trial. *The Lancet Diabetes & endocrinology*, *4*(9), 747-755. https://doi.org/10.1016/s2213-8587(16)30105-x

ITU. (2021). *Measuring digital development: Facts and figures 2021*. International Telecommunications Union. https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

Iwamoto, S. J., Abushamat, L. A., Zaman, A., Millard, A. J., & Cornier, M. A. (2021). Obesity management in cardiometabolic disease: State of the art. *Current Atherosclerosis Reports*, *23*(10), 59. https://doi.org/10.1007/s11883-021-00953-0

Jahan, Y., Rahman, M. M., Faruque, A. S. G., Chisti, M. J., Kazawa, K., Matsuyama, R., & Moriyama, M. (2020). Awareness development and usage of mobile health technology among individuals with hypertension in a rural community of Bangladesh: Randomized controlled trial. *Journal of Medical Internet Research*, *22*(12), e19137. https://doi.org/10.2196/19137

JBI. (2017). *The Joanna Briggs Institute critical appraisal tools for use in JBI systematic reviews checklist for randomized controlled trials*. Joanna Briggs Institute. https://jbi.global/sites/default/files/2019-05/JBI_RCTs_Appraisal_tool2017_0.pdf

Khunti, K., Gray, L. J., Skinner, T., Carey, M. E., Realf, K., Dallosso, H., Fisher, H., Campbell, M., Heller, S., & Davies, M. J. (2012). Effectiveness of a diabetes education and self management programme (DESMOND) for people with newly diagnosed type 2 diabetes mellitus: Three year follow-up of a cluster randomised controlled trial in primary care. *BMJ Clinical Research*, *344*, e2333. https://doi.org/10.1136/bmj.e2333

Kuwabara, A., Su, S., & Krauss, J. (2020). Utilizing digital health technologies for patient education in lifestyle medicine. *American Journal of Lifestyle Medicine*, *14*(2), 137-142. https://doi.org/10.1177/1559827619892547

Li, J., Parrott, S., Sweeting, M., Farmer, A., Ross, J., Dack, C., Pal, K., Yardley, L., Barnard, M., Hudda, M., Alkhaldi, G., & Murray, E. (2018). Cost-effectiveness of facilitated access to a self-management website, compared to usual care, for patients with type 2 diabetes (HeLP-diabetes): Randomized controlled trial. *Journal of Medical Internet Research*, *20*(6), e201. https://doi.org/10.2196/jmir.9256

Lin, M., Mahmooth, Z., Dedhia, N., Frutchey, R., Mercado, C. E., Epstein, D. H., Preston, K. L., Gibbons, M. C., Bowie, J. V., Labrique, A. B., & Cheskin, L. J. (2015). Tailored, interactive text messages for enhancing weight loss among African American adults: The TRIMM randomized controlled trial. *The American Journal of Medicine, 128*(8), 896-904. https://doi.org/10.1016/j.amjmed.2015.03.013

Liyana, A. Z., Appannah, G., Sham, S. Y. Z., Fazliana, M., Nor, N. S. M., Ambak, R., Samad, A. A., Dahlan, N. Y., & Aris, T. (2018). Effectiveness of a community-based intervention for weight loss on cardiometabolic risk factors among overweight and obese women in a low socio-economic urban community: Findings of the MyBFF@home. *BMC Women's Health, 18*(Suppl 1), 126. https://doi.org/10.1186/s12905-018-0593-1

Ludwig, K., Arthur, R., Sculthorpe, N., Fountain, H., & Buchan, D. S. (2018). Text messaging interventions for improvement in physical activity and sedentary behavior in youth: Systematic review. *JMIR mHealth and uHealth, 6*(9), e10799. https://doi.org/10.2196/10799

Lugones-Sanchez, C., Sanchez-Calavera, M. A., Repiso-Gento, I., Adalia, E. G., Ramirez-Manent, J. I., Agudo-Conde, C., Rodriguez-Sanchez, E., Gomez-Marcos, M. A., Recio-Rodriguez, J. I., & Garcia-Ortiz, L. (2020). Effectiveness of an mHealth intervention combining a smartphone app and smart band on body composition in an overweight and obese population: Randomized controlled trial (evident 3 study). *JMIR mHealth and uHealth, 8*(11), e21771. https://doi.org/10.2196/21771

Milani, R. V., & Franklin, N. C. (2017). The role of technology in healthy living medicine. *Progress in Cardiovascular Diseases, 59*(5), 487-491. https://doi.org/10.1016/j.pcad.2017.02.001

Morris, E., Jebb, S. A., Oke, J., Nickless, A., Ahern, A., Boyland, E., Caterson, I. D., Halford, J., Hauner, H., & Aveyard, P. (2021). Effect of weight loss on cardiometabolic risk: Observational analysis of two randomised controlled trials of community weight-loss programmes. *The British Journal of General Practice: The Journal of the Royal College of General Practitioners, 71*(705), e312-e319. https://doi.org/10.3399/bjgp20X714113

Muralidharan, S., Ranjani, H., Mohan Anjana, R., Jena, S., Tandon, N., Gupta, Y., Ambekar, S., Koppikar, V., Jagannathan, N., Allender, S., & Mohan, V. (2019). Engagement and weight loss: Results from the mobile health and diabetes trial. *Diabetes Technology & Therapeutics, 21*(9), 507-513. https://doi.org/10.1089/dia.2019.0134

Murray, E., Sweeting, M., Dack, C., Pal, K., Modrow, K., Hudda, M., Li, J., Ross, J., Alkhaldi, G., Barnard, M., Farmer, A., Michie, S., Yardley, L., May, C., Parrott, S., Stevenson, F., Knox, M., & Patterson, D. (2017). Web-based self-management support for people with type 2 diabetes (HeLP-Diabetes): Randomised controlled trial in English primary care. *BMJ Open, 7*(9), e016009. https://doi.org/10.1136/bmjopen-2017-016009

Newton, R. L., Jr., Carter, L. A., Johnson, W., Zhang, D., Larrivee, S., Kennedy, B. M., Harris, M., & Hsia, D. S. (2018). A church-based weight loss intervention in African American adults using text messages (LEAN study): Cluster randomized controlled trial. *Journal of Medical Internet Research, 20*(8), e256. https://doi.org/10.2196/jmir.9816

Nwolise, C. H., Carey, N., & Shawe, J. (2016). Preconception care education for women with diabetes: A systematic review of conventional and digital health interventions. *Journal of Medical Internet Research, 18*(11), e291. https://doi.org/10.2196/jmir.5615

O'Connor, S., Hanlon, P., O'Donnell, C. A., Garcia, S., Glanville, J., & Mair, F. S. (2016). Understanding factors affecting patient and public engagement and recruitment to digital health interventions: A systematic review of qualitative studies. *BMC Medical Informatics and Decision Making, 16*(1), 120. https://doi.org/10.1186/s12911-016-0359-3

Patel, M. L., Wakayama, L. N., & Bennett, G. G. (2021). Self-monitoring via digital health in weight loss interventions: A systematic review among adults with overweight or obesity. *Obesity, 29*(3), 478-499. https://doi.org/10.1002/oby.23088

Patterson, R., McNamara, E., Tainio, M., de Sá, T. H., Smith, A. D., Sharp, S. J., Edwards, P., Woodcock, J., Brage, S., & Wijndaele, K. (2018). Sedentary behaviour and risk of all-cause, cardiovascular and cancer mortality, and incident type 2 diabetes: A systematic review and dose response meta-analysis. *European Journal of Epidemiology, 33*(9), 811-829. https://doi.org/10.1007/s10654-018-0380-1

Pereira, M. A., Mullane, S. L., Toledo, M. J. L., Larouche, M. L., Rydell, S. A., Vuong, B., Feltes, L. H., Mitchell, N. R., de Brito, J. N., Hasanaj, K., Carlson, N. G., Gaesser, G. A., Crespo, N. C.,

Oakes, J. M., & Buman, M. P. (2020). Efficacy of the 'stand and move at work' multicomponent workplace intervention to reduce sedentary time and improve cardiometabolic risk: A group randomized clinical trial. *The International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 133. https://doi.org/10.1186/s12966-020-01033-3

Ralston, J., & Nugent, R. (2019). Toward a broader response to cardiometabolic disease. *Nature Medicine*, *25*(11), 1644-1646. https://doi.org/10.1038/s41591-019-0642-9

Rethlefsen, M. L., Kirtley, S., Waffenschmidt, S., Ayala, A. P., Moher, D., Page, M. J., Koffel, J. B., & Group, P.-S. (2021). PRISMA-S: An extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic Reviews*, *10*(1), 39. https://doi.org/10.1186/s13643-020-01542-z

Ronquillo, Y., Meyers, A., & Korvek, S. J. (2021). *Digital Health*. StatPearls Publishing. Copyright © 2021, StatPearls Publishing LLC.

Ross, J., Stevenson, F., Dack, C., Pal, K., May, C., Michie, S., Barnard, M., & Murray, E. (2018). Developing an implementation strategy for a digital health intervention: An example in routine healthcare. *BMC Health Services Research*, *18*(1), 794. https://doi.org/10.1186/s12913-018-3615-7

Ruilope, L. L. S., A.; Segura, J.; Garcia-Donaire, J.A. (2007). The meaning of cardiometabolic risk in hypertensive patients. *US Endocrinology*, *1*, 60-63.

Ryu, S. (2012). Book Review: mHealth: New horizons for health through mobile technologies: Based on the findings of the second global survey on eHealth (global observatory for eHealth series, volume 3). *Healthcare Informatics Research* *18*, 231-233. https://doi.org/10.4258/hir.2012.18.3.231

Senecal, C., Collazo-Clavell, M., Larrabee, B. R., de Andrade, M., Lin, W., Chen, B., Lerman, L. O., Lerman, A., & Lopez-Jimenez, F. (2020a). A digital health weight-loss intervention in severe obesity. *Digital Health*, *6*, 2055207620910279. https://doi.org/10.1177/2055207620910279

Senecal, C., Widmer, R. J., Larrabee, B. R., de Andrade, M., Lerman, L. O., Lerman, A., & Lopez-Jimenez, F. (2020b). A digital health weight loss program in 250,000 individuals. *Journal of Obesity*, *2020*, 9497164. https://doi.org/10.1155/2020/9497164

Spaulding, E. M., Marvel, F. A., Piasecki, R. J., Martin, S. S., & Allen, J. K. (2021). User engagement with smartphone apps and cardiovascular disease risk factor outcomes: Systematic review. *JMIR Cardio*, *5*(1), e18834. https://doi.org/10.2196/18834

Storm, V., Dörenkämper, J., Reinwand, D. A., Wienert, J., De Vries, H., & Lippke, S. (2016). Effectiveness of a web-based computer-tailored multiple-lifestyle intervention for people interested in reducing their cardiovascular risk: A randomized controlled trial. *Journal of Medical Internet Research*, *18*(4), e78. https://doi.org/10.2196/jmir.5147

Sundfør, T. M., Svendsen, M., & Tonstad, S. (2018). Effect of intermittent versus continuous energy restriction on weight loss, maintenance and cardiometabolic risk: A randomized 1-year trial. *Nutrition, Metabolism, and Cardiovascular Diseases*, *28*(7), 698-706. https://doi.org/10.1016/j.numecd.2018.03.009

Svetkey, L. P., Batch, B. C., Lin, P. H., Intille, S. S., Corsino, L., Tyson, C. C., Bosworth, H. B., Grambow, S. C., Voils, C., Loria, C., Gallis, J. A., Schwager, J., & Bennett, G. G. (2015). Cell phone intervention for you (CITY): A randomized, controlled trial of behavioral weight loss intervention for young adults using mobile technology. *Obesity (Silver Spring, Md.)*, *23*(11), 2133-2141. https://doi.org/10.1002/oby.21226

Thomas, K., Linderoth, C., Bendtsen, M., Bendtsen, P., & Müssener, U. (2016). Text message-based intervention targeting alcohol consumption among university students: Findings from a formative development study. *JMIR mHealth and uHealth*, *4*(4), e119. https://doi.org/10.2196/mhealth.5863

Tobe, S. W., Yeates, K., Campbell, N. R. C., Maar, M. A., Perkins, N., Liu, P. P., Sleeth, J., McAllister, C., Hua-Stewart, D., Wells, G., & Bernick, J. (2019). Diagnosing hypertension in indigenous Canadians (DREAM-GLOBAL): A randomized controlled trial to compare the effectiveness of short message service messaging for management of hypertension: Main results. *Journal of Clinical Hypertension (Greenwich, Conn.)*, *21*(1), 29-36. https://doi.org/10.1111/jch.13434

Toro-Ramos, T., Michaelides, A., Anton, M., Karim, Z., Kang-Oh, L., Argyrou, C., Loukaidou, E., Charitou, M. M., Sze, W., & Miller, J. D. (2020). Mobile delivery of the diabetes prevention

program in people with prediabetes: Randomized controlled trial. *JMIR mHealth and uHealth*, *8*(7), e17842. https://doi.org/10.2196/17842

Wang, X., Liu, D., Du, M., Hao, R., Zheng, H., & Yan, C. (2020). The role of text messaging intervention in inner Mongolia among patients with type 2 diabetes mellitus: A randomized controlled trial. *BMC Medical Informatics and Decision Making*, *20*(1), 90. https://doi.org/10.1186/s12911-020-01129-7

Whittaker, R., McRobbie, H., Bullen, C., Rodgers, A., Gu, Y., & Dobson, R. (2019). Mobile phone text messaging and app-based interventions for smoking cessation. *The Cochrane Database of Systematic Reviews*, *10*(10), Cd006611. https://doi.org/10.1002/14651858.CD006611.pub5

WHO. (2021, April 13, 2021). *Noncommunicable diseases*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

Wilson, P. W., D'Agostino, R. B., Parise, H., Sullivan, L., & Meigs, J. B. (2005). Metabolic syndrome as a precursor of cardiovascular disease and type 2 diabetes mellitus. *Circulation*, *112*(20), 3066-3072. https://doi.org/10.1161/CIRCULATIONAHA.105.539528

Yang, Q. (2017). Are social networking sites making health behavior change interventions more effective? A meta-analytic review. *Journal of Health Communication*, *22*(3), 223-233. https://doi.org/10.1080/10810730.2016.1271065

Yu, C., Liu, C., Du, J., Liu, H., Zhang, H., Zhao, Y., Yang, L., Li, X., Li, J., Wang, J., Wang, H., Liu, Z., Rao, C., & Zheng, Z. (2020). Smartphone-based application to improve medication adherence in patients after surgical coronary revascularization. *American Heart Journal*, *228*, 17-26. https://doi.org/10.1016/j.ahj.2020.06.019

Zheng, X., Spatz, E. S., Bai, X., Huo, X., Ding, Q., Horak, P., Wu, X., Guan, W., Chow, C. K., Yan, X., Sun, Y., Wang, X., Zhang, H., Liu, J., Li, J., Li, X., Spertus, J. A., Masoudi, F. A., & Krumholz, H. M. (2019). Effect of text messaging on risk factor management in patients with coronary heart disease: The CHAT randomized clinical trial. *Circulation: Cardiovascular Quality and Outcomes*, *12*(4), e005616. https://doi.org/10.1161/circoutcomes.119.005616

Appendix 1

Table 1. Data extraction for included studies

No	Author/ Year	Country	Study design	Study population & setting	Intervention (n)	Comparator (n)	Main results
1	Bennet et al. (2018b)	USA	Two-arm RCT with 12 months intervention duration; 6- and 12- months follow-ups	351 patients with obesity & diagnose of HTN, DM, or hyperlipidemia enrolled via primary care electronic health record. Age: 21-65 y Sex: 68% male Race: 52% Black	App for self-monitoring of behavior change goals with tailored feedback, smart scale, dietitian-delivered counseling calls, & clinician counseling at regular medical visits informed by app data. (n=176)	Usual care offered by clinician, self-help info., list of community resources for weight management, and newsletter. (n=175)	At both 6 and 12 months, a significantly larger proportion of intervention participants lost >5% of their initial weight, compared with usual care, at 6 (43% vs 6%, estimated RR = 6.8, 95% CI = 3.6, 12.7, *p*< 0.001) and 12 months (40.4% vs 16.7%, estimated RR = 2.4, 95% CI = 1.6, 3.5, *p*<0.001). There were no between-group differences in blood pressure, glucose, HbA1c, and blood lipids at 12 months, except for high-density lipoprotein cholesterol.
2	Godino et al. (2016)	USA	Parallel-group RCT 24 months intervention duration; 6, 12, 18, and 24- months follow-ups	404 college students with overweight/ obesity enrolled on college campuses Age: 18-35 y Sex: 70% female Race: 42% White	Social mobile approaches to reduce weight with PA/diet goals, tracking, & feedback via integrated Facebook, 3 apps, SMS, emails, blog posts, & health coach. (n=202)	Different website on weight loss and email newsletters. (n=202)	Weight was significantly less in the intervention group compared to the control group at 6 months (−1.33 kg, *p*=0.011) and 12 months (−1.33 kg, *p*=0.008). There was a significant difference between groups in systolic blood pressure at 24 months. There was no statistically significant difference between groups in diastolic blood pressure.
3	Jahan et al. (2020)	Bangladesh	Parallel-group RCT 5 months intervention duration;	420 individuals with HTN in rural community enrolled via a tertiary level health facility and through door-to-door visits by community health workers. Age: 35-71 y Sex: 86% female	Health education of behavior change via integrated in-person health education and SMS. (n=204)	Received only in-person health education (n=208)	SBP and DBP were significantly decreased in both groups (*p*<0.001). The mean SBP and DBP dropped between the groups over the study period, more in the intervention group, and the changes were statistically significant (*p*=0.04 and *p*=0.02, respectively).
4	Lugones et al. (2020)	USA	Multicenter RCT 3 months intervention duration.	440 individuals with overweight/obese enrolled via primary care centers. Age: 20-65 y Sex: 69% female	A mobile app and a smart band for self-monitoring of losing weight and changing body composition goals with tailored feedback, and counseling about healthy diet and PA. (n=231)	Counseling about healthy diet and PA. (n=209)	Weight was significantly less in the intervention group compared to the control group at 3 months (−0.84 kg, *p*<0.05)

Table 1. Continued

No	Author/ Year	Country	Study design	Study population & setting	Intervention (n)	Comparator (n)	Main results
5	Lin et al. (2015)	USA	Two-arm RCT 6 months intervention duration with a follow-up period of 12 months.	124 individuals with overweight/obese enrolled on 6 churches. Age: ≥21 y Sex: 85% female Race: 100% African American	Standard care and daily tailored text messages pertaining to targeted behaviors of participants' selection to lose weight, and customized to each participants' wake, lunch, and sleep times. (n=63)	Standard care included one-on-one counselling sessions with a dietitian and a physician. (n=61)	Mean weight loss at 3 months was 2.5 kg greater in the intervention group compared with standard care (95% CI, -4.3 to -0.6; *p*<0 .001), and 3.4 kg greater (95% CI, -5.2 to -1.7; *p*<0 .001) at 6 months.
6	Muralid haran et al. (2019)	India	RCT 12 weeks intervention duration.	561 individuals with prediabetes, overweight/obese enrolled via community-based screening and clinics. Age: >18 y Sex: 57% male	Mobile phone application for tracking weight, physical activity, and diet along with video lessons on T2D prevention and weekly coach calls. (n=271)	Usual care (n=290)	The intervention group experienced a significant 1 kg weight loss while the control group lost 0.3 kg (P < 0.05).
7	Newton et al.(2018)	USA	Cluster RCT 6 months intervention duration.	97 individuals with obesity or T2D enrolled participating churches. Age:18-7 y Sex: 91.8% female Race: African American.	Group sessions and received automated SMS text messages designed to reinforce behavioral strategies. (n=68)	Received SMS text messages related to health conditions including stroke prevention, lupus and CVD. (n=29)	There was a significant difference in weight loss (*P*=0.04) between participants in the intervention (−1.5 (SE 0.5) kg) and control (0.11 (SE 0.6) kg) groups. No significant between-group differences in the systolic or diastolic blood pressure, glucose, or cholesterol levels (*p*>0.356).
8	Svetkey et al. (2015)	USA	RCT 24 months intervention duration.	365 individuals with overweight/obesity enrolled by advertisings and mass mailings. Age: 18-35 y. Sex: 69.6% female Race: 56.2% White	Smartphone for self-monitoring and personal coaching of moderate calorie restriction, healthy dietary pattern, moderate PA, limited alcohol intake, and frequent self-monitoring of weight, diet, and PA. (n=122)	Received three hand-outs on healthy eating and PA and not asked to self-monitor. Use of these materials was not monitored. (n=123)	Intervention group lost the least weight at all measurement points (-0.87,-1.48, and -0.99 kg at 6, 12, and 24 months, respectively), and these values were not significantly different from Control (-1.14,-2.25, and -1.44 kg, respectively).
9	Toro-Ramos et al. (2020)	USA	RCT 20 weeks intervention duration; 6 and 12	202 individuals with prediabetes enrolled on clinics. Age:>18 y Sex: 71.2% female.	A mobile-delivered, coach-guided Diabetes Prevention Program (DPP, Noom), an interactive coach-to-participant	Received regular medical care including a paper based DPP curriculum (n=99)	Changes in the participants' weight and BMI were significantly different at 6 months between the intervention and control groups, but there was no difference in HbA levels (mean difference 0.004%, SE 0.05; *p*=0.94).

Table 1. Continued

No	Author/ Year	Country	Study design	Study population & setting	Intervention (n)	Comparator (n)	Main results
			months follow-ups.		interface and group messaging, daily challenges for behavior change, DPP-based education articles, food logging, and automated feedback. (n=101)		Weight and BMI were lower in the intervention group by -2.64 kg (SE 0.71; *p*<.001) and -0.99 kg/m2 (SE 0.29; *P*=.001), respectively.
10	Tobe et al. (2019)	Canada	Multicenter RCT 2 months intervention duration.	122 individuals with uncontrolled hypertension, and on or off medications enrolled from six communities. Age: >18 y Sex: 51% male	Received SMS pertaining information on the management of hypertension, advice to follow-up with the participants' health care provider if the measured BP was above target. (n=64)	Received SMS regarding healthy lifestyle and behavior changes. (n=58)	There was no statistically significant difference between groups in SBP and DBP.
11	Wang et al. (2020)	Mongolia	Two-arm RCT 12 months intervention duration.	171 patients with T2D enrolled on hospital. Age: 55.1 (10.8) Sex: 57% male	Received evaluated text messages twice a week, and telephone follow-up after each stage of the intervention. (n=74)	Received regular education. (n=72)	Compared with the control group, the decrease in the FPG (1.5 vs. 0.4, *p*=0.011), and the PPG (5.8 vs. 4.2, *p*=0.009) were better in the intervention group. Improvements in weight control (49.3% vs. 28.2%, *p*=0.031) was better in intervention group than in the control group.
12	Yu et al. (2020)	China	Multicenter RCT 6 months intervention duration.	1000 patients with coronary heart disease underwent isolated CABG enrolled on 4 teaching hospitals. Age: >18 y Sex: 85.5% male	Advanced smartphone application of self-management designed specifically to improve medication adherence after surgical coronary revascularization, the application automatically reminded the participants application, receive feedback, encouragement, and advice about their secondary prevention status and performance. (n=493)	Received standard post-CABG care, including cardiology education, instruction on CABG secondary prevention, and promotion of self-care management from research nurses and physicians during the inpatient stay after randomization. (n=494)	There was no statistically significant difference between groups in SBP, DBP, and BMI.

Table 1. Continued

No	Author/ Year	Country	Study design	Study population & setting	Intervention (n)	Comparator (n)	Main results
13	Zheng et al. (2019)	China	Multi-center RCT 6 months intervention duration.	822 patients with coronary heart disease and without diabetes mellitus enrolled from 37 hospitals. Age: 56.4 (SD 9.5) Sex: 14.1% female.	Text messaging by an automated computerized system provided educational and motivational information related to disease-specific knowledge, risk factor control, physical activity, and medication adherence. (n=402)	Usual care (n=404)	There were no significant differences in the change in SBP, LDL-C level, and BMI between the 2 groups.

Appendix 2

Table 2. Quality assessment of studies included in this systematic review using the Joanna Briggs Checklist for RCT studies

Quality assessment criteria	Bennet et al. (2018b)	Godino et al. (2016)	Jahan et al. (2020)	Lugones et al. (2020)	Lin et al. (2015)	Muralidharan et al. (2019)	Newton et al. (2018)	Svetkey et al. (2015)	Toro-Ramos et al. (2020)	Tobe et al. (2019)	Wang et al. (2020)	Yu et al. (2020)	Zheng et al. (2019)	Total studies meeting criterion
1. Was true randomization used for assignment of participants to treatment groups?	1	1	1	1	1	1	1	1	1	1	1	1	1	13
2. Was allocation to treatment groups concealed?	0	1	0	1	1	1	1	0	1	0	1	0	1	8
3. Were treatment groups similar at the baseline?	0	0	1	1	1	0	0	0	0	0	1	1	0	5
4. Were participants blind to treatment assignment?	0	1	0	0	0	0	0	0	1	0	1	0	0	3
5. Were those delivering treatment blind to treatment assignment?	0	0	0	1	1	0	0	0	1	0	1	0	1	5
6. Were outcomes assessors blind to treatment assignment?	0	1	0	1	1	0	0	0	1	0	1	0	1	6
7. Were treatment groups treated identically other than the intervention of interest?	0	0	0	0	0	0	0	0	0	0	0	1	1	2
8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	1	1	1	0	1	0	1	1	1	1	1	0	0	8
9. Were participants analyzed in the groups to which they were randomized?	0	0	0	0	0	1	0	0	1	0	0	0	0	2
10. Were outcomes measured in the same way for treatment groups?	1	1	1	1	1	1	1	1	1	1	1	1	1	13
11. Were outcomes measured in a reliable way?	1	1	1	1	1	1	1	1	1	1	1	1	1	13
12. Was appropriate statistical analysis used?	1	1	1	1	1	1	1	1	1	1	1	1	1	13
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	0	0	0	0	0	0	1	0	0	0	0	0	0	1
[a]Number of criteria met	5	8	6	8	9	6	7	5	10	5	10	6	8	

[a]Risk of Bias Total Score: 0-4 = high risk; 5-8 = medium risk; 9-13 = low risk.
Note. Rating of Each Criterion: 1 = present; 0 = absent or unclear or inadequately described.

NurseMedia
JOURNAL OF NURSING

ORIGINAL RESEARCH

The Role of Organizational Culture in Moderating Effect of Emotional Labor Strategies on Nursing Professionalism

Resekiani Mas Bakar[1], Yaumil Khaerah[1], Nurul Hidayati[1], Andi Nasrawaty Hamid[1]

[1]Faculty of Psychology, Universitas Negeri Makassar, Makassar, Indonesia

Article Info	Abstract
	Background: Emotional labor strategies are necessary for nurses to provide nursing care for society through friendliness, caring, and positive emotion. The results of a meta-analysis of emotional labor research have proven that previous studies focused more on the impact of deep and surface acting strategies only at the individual level of the nurses. This study emphasizes the impact of emotional labor strategies at the individual and organizational levels. **Purpose:** The study aimed to measure the effect of emotional labor strategy (surface and deep acting strategy) toward nursing professionalism mediated by organizational culture. **Methods:** This research design is a quantitative survey. The respondents were 124 hospital nurses recruited by accidental sampling technique. The instrument in this study used emotional labor, organizational culture, and nursing professionalism scale. The mediation model technique by Hayes's PROCESS was used to analyse the data. **Results:** The result showed an indirect effect of the role of organizational culture in mediating deep acting strategy toward nursing professionalism (b=0.03, 95% CI [-0.00–0.94]). Nurses who displayed deep acting strategies to their patients indirectly affected professionalism through the mediation of organizational culture. However, the surface acting strategies did not show a significant effect on nursing professionalism (b=-0.02, 95% CI [-0.05–0.00]) . **Conclusion:** Deep acting strategies indirectly affect nursing professionalism through organizational culture as a mediation variable compared to surface acting strategies. This study supports the control theory that emotional strategies implemented by nurses as organizational culture are a comparator to engage in nurse professionalism to provide healthcare. The deep acting strategies through organizational culture are essentially recommended for nurses in the hospital to improve their professionalism.

1. Introduction

Nurses in various public health centers and hospitals show significant numbers in quantity. The Ministry of Health Republic of Indonesia shows that nurses occupy the highest level compared to other medical personnel, namely 29.66% (Ministry of Health Republic Indonesia, 2017). Meanwhile, in order to achieve the third Sustainable Development Goals (SDG$_s$), health and welfare, WHO estimates the need for nurses around the world to reach nine million by 2030 (World Health Organization, 2022). One of the nurse's responsibilities is to enhance the service quality for patients. The health professionals need to rapidly adapt and respond in fulfilling the demand of society for the health-care system, either at the level of a person, family, or community (Akhtar-Danesh et al., 2013). The complexity that happens in the medical field and technology development results in several changes in nurses' working environments such as maintaining professionalism.

Professionalism for the nurse is the crucial aspect to show credibility and positive evaluation from surroundings. Professionalism performed by nurses during work time will directly affect people's judgment (Primm, 2010), so they required to perform their jobs and functions well (Jang et al., 2016). Professionalism has eight aspects namely continuous learning, accountability and initiative, self-care and professional growth, responsibility and a sense of duty, compassion and

respect for others, integrity and trustworthiness, teamwork and professional demeanour, and concern for the welfare of others. The service quality perceived by patients depends on nurse performance (Lombarts et al., 2014). Understanding professionalism will help nurses to provide a better service to patients (Bunkenborg et al., 2012).

Some previous studies showed that professionalism in nurse environment is also influenced by several factors, such as educational level, work experience, work environment, and position in the office (Solomon et al., 2015; Tanaka et al., 2014), organization type, rewarding system, nurse involvement in the hospital, and organizational culture (Ghadirian et al., 2014). Organizational culture refers to beliefs, ideology, principal, and values that are followed by society in a certain environment. Creating an organizational culture that can raise teamwork among the members is the current focus of hospital management instead of material profit (Kamel & Aref, 2017). The improvement of patient safety as the main hospital responsibility is started by creating and maintaining the culture (Stock et al., 2017). This improvement can accelerate standard achievement in applying norms and regulations in the workplace (Manley et al., 2011), enables the improvement of nurses' performance, job satisfaction, and problem-solving skill (Kamel & Aref, 2017; Kim, et al., 2016). Furthermore, it will encourage the nurses to apply initiative and show professionalism during work (Manojlovich & Ketefian, 2002). Therefore, hospital management needs to create a working environment that supports communication and coordination between nurses and other hospital staff. This atmosphere can lower negative behaviors during work (Yeun & Han, 2016).

Organizational culture is influenced by several aspects, such as internal communication, work balance, leadership style, employee satisfaction, reward system, and organization's performance (Kamel & Aref, 2017). If the hospital can maximize those factors, it will help to improve interpersonal relations among medical professionals and respect every single achievement. Organizational culture strongly relates to performance and communication processes in the workplace (Sass, 2000), decreases turnover intention (Lee & Jang, 2020), gives understanding to organization members regarding values and procedures (Scott-Findlay & Estabrooks, 2006), and affects strategies of emotion (Choi & Guy, 2020).

Most health practitioners, especially nurses, feel several emotions during their interaction with the patients (Bagdasarov & Connelly, 2015). Occupation as a nurse, which requires face-to-face interaction with patients, allows nurses to experience unpleasant feeling even when they are not able to display a proper strategy (Altuntaş & Altun, 2015; Ghalandari et al., 2012). The incompetence of nurses to regulate their emotions will affect to ability degrading in applying ethical code. This kind of strategy is called emotional labor. Emotional labor is a strategy used in regulating emotions or feelings to give the appearance of the body and face according to the demands of the job (Hochschild, 1983) and to preserve the external appearance and good impression to others (Gray, 2010). Emotional labor strategy is commonly applied into two types: deep acting and surface acting.

The strategies of emotional labor relate to internal emotion regulation and emotional expression display (Grandey & Melloy, 2017). Nurses who display deep acting strategies can regulate their internal emotions and the demand of patient's needs in order to enhance service quality to patients. Therefore, they can serve healthcare according to the hospital's standards. On the other hand, nurses who perform surface acting strategy will not feel positive emotion, yet they just try to show fake emotion as a work demand (Grandey & Sayre, 2019).

The meta-analysis of emotional labor research has focused more on the impact of deep and surface acting strategies only at the level of individual of nurses, such as burnout (Kim, 2020; Zaghini et al., 2020), self-efficacy, and type-A behavior patterns (Jeung et al., 2018), yet at organizational aspect. The mechanism of emotional labor strategy towards nursing professionalism mediated by organizational culture can be explained with control theory. Control theory consists of four components: input, standard, comparator, and output. When the nurse interacts with patients, there is an emotional exchange between them. The emotional exchange is affected by the self-perception of the nurse in terms of display rules in their working unit. This factor then influences the type of regulation strategy that will be displayed (surface or deep acting). Apart from self-perception, service delivery is also influenced by obligation as a nurse, including health rules and emotional aspects when serving the patients. Emotional display standard (display rule) will be different based on organizational culture in each hospital. Therefore, organizational culture becomes a mediate variable that affects emotional labor towards

nursing professionalism. Different emotional displays will indirectly influence professionalism which is mediated by perception about the organization's culture. Nurses who display deep acting strategy are presumed to indirectly show professionalism with mediation of organizational culture perception (Diefendorff & Gosserand, 2003).

Research that examines the impact of emotional labor strategies from the organizational level, such as organizational culture, is still limited. In fact, the emotional labor strategy occurs because of the display rules that nurses must obey, and this is rooted in the organizational culture (Diefendorff et al., 2011). The gap in this study provides an opportunity for researchers to examine organizational culture variables that mediate the indirect effect of emotional labor strategies on nurse professionalism. This study aims to measure the indirect effect between surface and deep acting strategy mediated by organizational culture perception towards nursing professionalism.

2. Methods

2.1 Research design
The research design was a quantitative survey. The respondents filled out self-reports in the form of emotional labor, organizational culture, and nursing professionalism scale.

2.2 Setting and samples
From 136 respondents who had completed the questionnaire, 12 respondents were eliminated because of incomplete responses in emotional labor form. Therefore, the number of respondents analysed in this study was 124. Determination of the number of participants was done by a prior analysis of G*Power. Recruitment of respondents was carried out through manual announcements by distributing an informed consent sheet to participate as respondents. The sampling technique used was accidental sampling. The respondents of this study were regular full-time nurses in three public hospitals in Makassar. The characteristics of the respondents were: (1) regular full-time nurse, (2) having a minimum of one year of service as a nurse, and (3) willing to participate in the study. The selection of the hospital under study was based on the minimum criteria for type-B general hospital.

2.3 Measurement and data collection
The data were collected in May 2019. The respondents received surveys manually. The participation of respondents was conducted voluntarily. Each participating nurse received a survey package containing three types of questionnaires. The Indonesian version of the questionnaires was given to the respondents. The original questionnaire was adapted from the English to Indonesian version. The process of adapting the measuring instrument was done by translation-back translation method. From the translation result, expert judgments, involving three experts in the field of Psychology were used to assess the translated questionnaires based on the theoretical content of instrument. The expert panel indicated the suitability and relevance above 80 percent of each questionnaire.

2.3.1 Emotional labor strategy scale
Emotional labor strategies were measured using nine items. This instrument adopted the scale of Gosserand and Diefendorff (2005). The emotional labor strategy scale consists of surface acting (5 items) and deep acting (4 items), with Cronbach alpha of English version ranging from 0.89 to 0.85. Each respondent was measured with deep and surface acting because, in its application, the nurse can display deep or surface acting consecutively when interacting with patients. One of the examples of surface acting items is "*I fake the emotional expression which must be displayed during interaction with patients*" and the example of deep acting items is "*I try to feel the emotion that I should display when encountering the patients*". Item content validity was carried out using the expert judgment. The reliability of Indonesian version of this instrument showed good internal consistency ($\alpha=0.84$). The respondents of the reliability test were nurses in the city of Makassar. The measurement of emotional labor ranged from 1 (strongly inappropriate) to 5 (strongly appropriate). Scoring was done by calculating the total score of surface and deep acting items separately.

2.3.2 Organizational culture scale

The organizational culture variable was measured using the scale from Jafree et al. (2016). The original scale has a Cronbach alpha ranging from 0.74 to 0.88. The reliability of Indonesian version of this instrument showed a Cronbach alpha of 0.88 for 27 items. The respondents of the reliability test were nurses in the Makassar city. Content validity of the instrument was done through expert judgment. Organizational culture consisted of six aspects: 1) Nursing participation in governance, 2) Nurse manager ability leadership and support, 3) Nurse participation in Hospital Affairs, 4) Nurse foundations for quality of care, 5) Nurse co-worker relations, and 6) Nursing Staffing and Resource. One of the item examples is *"Nurse applies written planning in delivering service to patients."* The organizational culture score was measured from 1 (strongly inappropriate) to 5 (strongly appropriate).

2.3.3 Nursing professionalism scale

Nursing professionalism attribute was measured by a-12-scale from Lombarts et al. (2014). The original scale has a Cronbach alpha 0.81. Cronbach alpha analysis of the Indonesian version of the scale was 0.87. Expert judgments were used to test the validity of the instrument. Nursing professionalism consists of four aspects: 1) improving the quality of care, 2) maintaining professional competence, 3) fulfilling professional competence, 4) shared education and collaboration. One of the item examples is: *"I am responsible for supervising the result of medical treatment for patients."* Nursing professionalism score was measured from 1 (strongly inappropriate) to 5 (strongly appropriate).

2.4 Data analysis

To answer the study hypothesis, analysis of mediation by Hayes's PROCESS was applied to analyze the data (Hayes, 2018). Hayes process is a method for analyzing data in order to measure the mediation model, which is a part of regression analysis and measures both direct and indirect effects between one variable to another (Field, 2013). There were two hypotheses in this study. There was a significant effect between surface acting strategy to professionalism with organizational culture as mediation (H_1), and there was a significant effect between deep acting strategy to professionalism with organizational culture as mediation (H_2).

2.5 Ethical considerations

In considering the ethics of the study, the researchers used a peer review of two lecturers of psychology to provide an assessment of whether there is any risk arising from the planned research procedure. The authors also applied for permits to three public hospitals in Makassar. Another effort made to ensure that this research did not violate ethics was to provide an informed consent form. The nurses who participated in this study obtained informed consent forms, including an explanation of the research objectives, procedures, and their rights in this study. This includes maintaining the confidentiality of respondent data. Permissions from the authorities of the hospital were obtained first before collecting the data. The nurses were assured that their participation would not affect their performance appraisal.

3. Results

3.1 Characteristics of respondents

Table 1 depicts the result of this study. The majority of respondents were female (98.4%), aged around 22-30 years old (46.7%), having tenure from 5 to 10 years (68.4%), and having diploma in nursing as the educational background (30.1%). Out of 124 respondents, 53 respondents (42.7%) tend to perform surface acting strategies, while 71 nurses (57.3%) tend to perform deep acting strategies. This result indicated that the sample group of nurses in this study generally displayed deep acting than surface acting strategies when working. The levels of nursing professionalism and organizational culture were categorized in the high level; for each category was 98 respondents (79%).

3.2 Organizational culture in mediating the effect of surface acting strategies on nursing professionalism

The results in Table 2 show the Hayes PROCESS analysis that the independent variable, namely surface acting strategy, did not have a significant effect on the mediating variable of

organizational culture (b=-0.07, p=0.09) and nursing professionalism (b=-0.02, p=0.66). However, organizational culture variables had an effect on nursing professionalism (b=0.24, p=0.02).

Table 1. Characteristics of respondents

Variables	f	%
Gender		
Female	122	98.4
Male	2	1.6
Tenure		
1-5 year	34	27.4
5-10 year	60	48.4
10-15 year	19	15.6
> 15 year	9	7.4
Age		
22 - 30 years old	57	46.7
31 – 39 years old	53	43.5
40 – 50 years old	14	9.8
Education		
D3	46	30.1
S1	29	20.4
S2	3	3.2
Ners	14	11.8
Emotional labor strategies		
Surface acting	53	42.7
Deep acting	71	57.3
Nursing professionalism		
Low	1	0.8
Moderate	25	20.2
High	98	79.0
Organizational culture		
Moderate	26	21.0
High	98	79.0

Table 2. The effect of surface acting strategies toward nursing professionalism mediated by organizational culture

		Consequence						
		M (OC)				Y (NP)		
Antecedent		Coeff.	SE	p		Coeff.	SE	p
X (SA)	a	-0.07	0.04	0.09	c'	-0.02	0.05	0.66
M (OC)					b	0.24	0.10	0.02
Constant	i_1	4.31	0.13	0.00	i_2	3.11	0.49	0.00
		R^2=0.02				R^2=0.04		
		$F(1,122)$=2.91, p=0.09				$F(2,121)$=2.87, p=0.06		

SA = surface acting, NP = nursing professional, OC = organizational culture, SE =sum of error

Figure 1 shows that organizational culture as mediation variable on surface acting had no significant relationship to nursing professionalism (b=-0.02, 95% CI [-0.05–0.00]). Therefore, H_1 was declined. There was no significant effect between surface acting strategy to professionalism with organizational culture as mediation.

3.3 Organizational culture in moderating the effect of deep acting strategy on nursing professionalism

The results of Table 3 show that the independent variable, namely deep acting strategy, had a significant effect on the mediating variable of organizational culture (b=0.16, p=0.001) and nursing professionalism (b=0.12, p=0.09) The mediating variable of organizational culture also had an effect on nursing professionalism (b=0.21, p=0.05). Thus, the deep acting variable had an indirect effect on nursing professionalism.
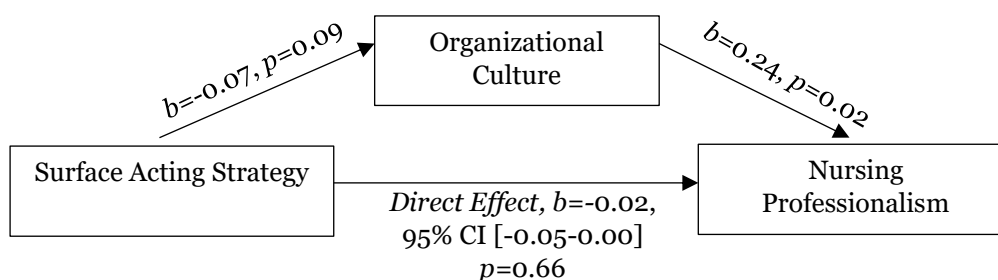
Figure 1. The hypothesis test of surface acting strategies

Data on the effect of deep acting strategies on nursing professionalism with the mediation of organizational culture is shown in Table 3 below.

Table 3. The effect of deep acting strategies towards nursing professionalism with the mediation of organizational culture

		M (OC)				Y (NP)		
Antecedent		Coeff.	SE	p		Coeff.	SE	p
X (DA)	a	0.16	0.06	0.00	c'	0.12	0.07	0.09
M (OC)					b	0.21	0.11	0.05
Constant	i_1	3.53	0.21	0.00	i_2	2.76	0.45	0.00
		R^2=0.06				R^2=0.07		
		$F(1,122)$=7.32, p=0.00				$F(2,121)$=4.25, p=0.01		

DA = deep acting, NP = nursing professional, OC = organizational culture, SE =sum of error

The PROCESS analysis in Figure 2 shows that there was a significant effect of deep acting on nursing professionalism through an organizational culture which was indirect (b=0.03, 95% CI [-0.00–0.94]). Therefore, H2 was accepted. Deep acting strategies indirectly affected nursing professionalism through organizational culture as a mediation variable.
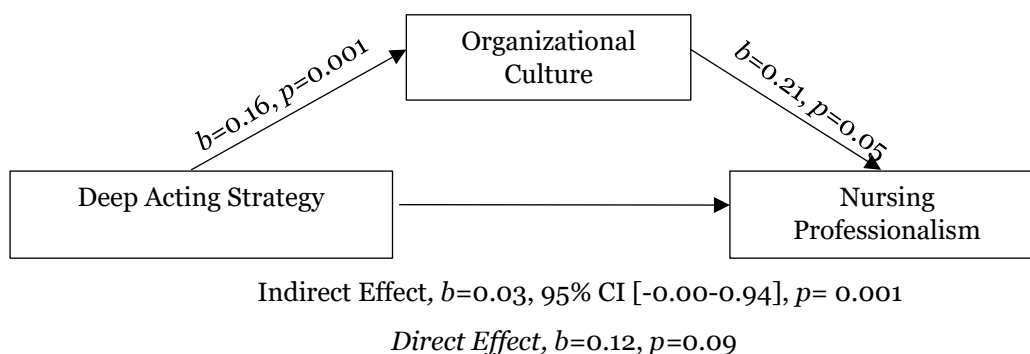

Indirect Effect, b=0.03, 95% CI [-0.00-0.94], p= 0.001

Direct Effect, b=0.12, p=0.09

Figure 2. The hypothesis test of deep acting strategies

4. Discussion

The aim of this study was to measure the effect of emotional labor strategy toward nursing professionalism mediated by organizational culture. The result of research found that surface acting did not affect nursing professionalism through organizational culture as a mediation variable. In contrast, the result of this study showed that there were positive effects of deep acting strategy on the increase of organizational culture and nursing professionalism which occurred significantly. The results of this study are different from previous study which have shown that surface acting has positive effect on the desire to leave work. Nurses who display surface acting strategies can modify their emotional expression when interacting with patients, although it does not fit with current feelings. When dealing with patients, the nurse tries to suppress the negative

emotion and pretend to show positive emotion (Diefendorff et al., 2011). Generally, modifying emotional expression for a nurse is no violation at all. The nurses who display surface acting is a part of obedience to display rule. Display rule is a root of an organization or hospital norm. However, nurse obedience when displaying surface acting is based on job condition, not hospital or organization culture. Therefore, surface acting strategy performed by nurses did not significantly affect organizational culture. In addition, modifying surface acting expression when providing healthcare service does not influence nursing professionalism. This is because nurses who display surface acting can still provide service based on professionalism context in their operational procedure (Wanninayake et al., 2021)

This study revealed that deep acting strategy indirectly influenced nursing professionalism through organizational culture. The deep acting strategy does not only obey the display rule, but it can provide health service more than the existing standard operational procedure. The display rule, which becomes the basic rule in showing emotion, is the reflection of the company's organizational culture. An individual who can perform their job in deep acting strategy will have stronger value to organizational culture. Previous research had shown that deep acting had a positive impact on the performance of nurses, because it was able to harmonize internal emotions with emotions that were the organizational culture in treating patients (Koh et al., 2018). These findings also support the previous study, which states that deep acting strategy relates to the display rule (Allen et al., 2010). Nurses' responses that display surface acting strategies during work tend to improve service quality by 88.7%, while display deep acting strategies improve service quality by 99%. Moreover, an initiative to enhance service showed the difference between surface acting and deep acting strategies, with 86.8% and 94.3% respectively.

This study showed that nurses with a high perception of organizational culture correlate with nursing professionalism. Nurses can assess whether the hospital provides a chance to participate in hospital service improvement so they can improve themselves and enhance the service quality through self-evaluation during work (Sarıköse & Göktepe, 2022). Nursing professionalism is performed by responsibility and dedication to fulfil the health service standard, attention to self-competence, self-responsibility, and willingness to collaborate with other parties in an organization. Nursing professionalism is also performed through a commitment to show warmness, caring, ethical code, and sustainability self-improvement in order to reach patients' well-being (Lombarts et al., 2014). The previous study found that organizational culture is the fundamental factor in determining professionalism among nurses (Manojlovich & Ketefian, 2002; Ghadirian et al., 2014). Nurses in a supportive environment are likely to participate in service delivery and monitoring for patients and work together with other medical staff in a collaboration. This result supported a study of Lee and Jang (2020) that an organizational culture has effect on turnover intention. Nurses who obtain a positive work environment, correlated with their interprofessional collaboration (Ghasemi et al., 2021).

Every nurse has a self-perception about display rules of emotional labor (surface or deep acting) when interacting with patients. Self-perception regarding display rules must be understood and applied in every work unit. A company or hospital always has a standard for their employee to perform a job, which has to be applied by nurses, especially the emotional aspect when delivering a service. Nurses' self-perception will be adapted with a standard from the comparator. If the gap happens between personal emotion and display rule standards, nurses will apply emotional regulation to decrease that gap. Emotional display which nurses perform, can be surface or deep acting (Lee & Madera, 2019).

Based on control theory (Carver, 2018), organizational culture variable has a role as the comparator for nurses in order to strengthen its positive effect to work behaviors by maintaining professionalism (Pedrosa et al., 2021). The comparator aspect in this theory will continuously happen and become guidance for nurses (Diefendorff & Gosserand, 2003). Nurses who perform deep acting strategy as the emotional display will have higher perception input to improve professionalism. This condition happens because service is delivered sincerely and appropriately with organizational culture. In addition, an individual who delivers deep acting will have a stronger input self-perception to organizational culture (Han et al., 2018). This enables a person to apply the work value properly, especially when offering health services. Deep acting strategy with self-willingness to apply professionalism during work allows strengthening self-perception to hospital management in order to collaborate with nurses in providing healthcare system (Liu et al., 2020)

5. Implications and limitations

This study contributes in providing a description and explaining the effect of surface and deep acting on the organizational culture, which is still limited in previous studies, especially in the context of health service between nurses and patients. A deep acting strategy could be implemented in sincere service and beyond the organization's expectations. Therefore, this condition could represent high organizational culture and professionalism value in every task. Deep acting strategy has an effect on the nursing professionalism indirectly. The organizational culture which has been internalized enabled the achievement of professionalism standards through the same understanding among all members in an organization. Therefore, the hospitals should maintain their service quality by training and development as well as monitoring nurses to display deep acting strategy.

Some of the limitations of this study that might affect the results of the study were limitations in the process of instrument validity and the absence of ethical approval at the beginning of the research process. However, reliability test had been carried out; and research study permits from the hospitals and informed consent from the respondents were obtained before the data collection in order to improve the rigor of the study. In addition, other individual aspects which might affect the perception of organizational culture such as personality types, emotional intelligence or job autonomy, self-efficacy, burnout, and behavior types were not controlled in this study.

6. Conclusion

This study provided new significant finding which positively affects deep acting strategies to organizational culture and nursing professionalism, while surface acting strategies did not significantly provide negative effect in lowering organizational culture and professionalism. Deep acting strategy indirectly affects nursing professionalism through organizational culture as a mediation variable. The findings of this study recommend the hospitals to nurture supportive organizational culture and to encourage as well as to monitor nurses to display deep acting strategies. The future study can be developed by using a larger sample size and more thorough instrument's validity process. Moreover, the level classification or work unit of respondents should be examined. Those factors were necessary to consider because the researcher could acquire a more detailed description. The future study also could measure other individual aspects which might affect the perception of organizational culture.

Acknowledgment

Author contribution

RMB: conceptualization, methodology, writing-original draft, project administration, validation, resources, writing-review & editing. YK: conceptualization, investigation, validation, and data curation. NH: data collection and translating. ANH: methodology and statistics.

Conflict of interest

No potential conflicts of interest have been reported by the authors.

References

Akhtar-Danesh, N., Baumann, A., Kolotylo, C., Lawlor, Y., & Lee, R. (2013). Perceptions of professionalism among nursing faculty and nursing students. *Western Journal of Nursing Research, 35*(2), 248–271. https://doi.org/10.1177/0193945911408623

Allen, J. A., Pugh, S. D., Grandey, A. A., & Groth, M. (2010). Following display rules in good or bad faith?: Customer orientation as a moderator of the display rule-emotional labor relationship. *Human Performance 23*(2), 101–115. https://doi.org/10.1080/08959281003621695

Altuntaş, S., & Altun, Ö. Ş. (2015). The relationship between emotional labor behaviors and burnout levels of nurses. *Journal of Health and Nursing Management, 2*(1), 37–43. https://doi.org/10.5222/SHYD.2015.037

Bagdasarov, Z., & Connelly, S. (2015). Emotional labor among healthcare professionals: The effects are undeniable. *Narative Inquiry in Bioethics*, *3*(2), 125–129. https://doi.org/10.1353/nib.2013.0040

Bunkenborg, G., Samuelson, K., Jonas, A., & Poulsen, I. (2012). Impact of professionalism in nursing on in-hospital bedside monitoring practice. *Journal of Advanced Nursing*, *69*(7), 1–12. https://doi.org/10.1111/jan.12003

Carver, C. S. (2018). Control theory, goal attainment, and psychopathology. *Psychological Inquiry, 29*(3), 139–144. https://doi.org/10.1080/1047840X.2018.1513681

Choi, S. W., & Guy, M. E. (2020). The link between emotional labor and organizational culture in Korean bureaucracy: how taxing is tax work? How enforcing is law enforcement? *International Review of Public Administration*, *25*(2), 129–144. https://doi.org/10.1080/12294659.2020.1776810

Diefendorff, J. M., Erickson, R. J., Grandey, A. A., & Dahling, J. J. (2011). Emotional display rules as work unit norms: A multilevel analysis of emotional labor among nurses. *Journal of Occupational Health Psychology*, *16*(2), 170–186. https://doi.org/10.1037/a0021725

Diefendorff, J. M., & Gosserand, R. H. (2003). Understanding the emotional labor process: A control theory perspective. *Journal of Organizational Behavior*, *24*(8), 945–959. https://doi.org/10.1002/job.230

Field, A. P. (2014). *Skills in Mathematics and statistics in psychology and tackling transition.* The Higher Educatiom Academy.

Ghadirian, F., Salsali, M., & Cheraghi, M. A. (2014). Nursing: An evolutionary concept analysis. *Iranian Journal of Nursing and Midwifery Research*, *19*(1), 1–10.

Ghalandari, K., Mortazavi, S., Abbasi, S., Ghorbani, M., & Jogh, G. (2012). *The effect of emotional labor on emotional exhaustion in banking services: The role of Iranian emotional intelligence. Research Journal of Applied Sciences, Engineering and Technology, 4*(12), 1794–1800.

Gosserand, R. H., & Diefendorff, J. M. (2005). Emotional display rules and emotional labor: The moderating role of commitment. *Journal of Applied Psychology*, *90*(6), 1256–1264. https://doi.org/10.1037/0021-9010.90.6.1256

Grandey, A. A., & Melloy, R. C. (2017). The state of the heart: Emotional labor as emotion regulation reviewed and revised. *Journal of Occupational Health Psychology*, *22*(3), 407–422. https://doi.org/10.1037/ocp0000067

Grandey, A. A., & Sayre, G. M. (2019). Emotional labor: Regulating emotions for a wage. *Current Directions in Psychological Science*, *28*(2), 131–137. https://doi.org/10.1177/0963721418812771

Gray, B. (2010). Emotional labour, gender and professional stereotypes of emotional and physical contact, and personal perspectives on the emotional labour of nursing. *Journal of Gender Studies*, *19*(4), 349–360. https://doi.org/10.1080/09589236.2010.514207

Han, S. S., Han, J. W., & Kim, Y. H. (2018). Effect of nurses' emotional labor on customer orientation and service delivery: The mediating effects of work engagement and burnout. *Safety and Health at Work*, *9*(4), 441–446. https://doi.org/10.1016/j.shaw.2017.12.001

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis, second edition: A regression-based approach.* The Guildford Press.

Hochschild, A. R. (1983). *The managed heart: Commercialization of human feeling.* University of California Press.

Jafree, S. R., Zakar, R., Zakar, M. Z., & Fischer, F. (2016). Nurse perceptions of organizational culture and its association with the culture of error reporting: A case of public sector hospitals in Pakistan. *BMC Health Services Research, 16,* 3. https://doi.org/10.1186/s12913-015-1252-y

Jang, I., Kim, Y., & Kim, K. (2016). Professionalism and professional quality of life for oncology nurses. *Journal of Clinical Nursing, 25*(19), 1–11. https://doi.org/10.1111/jocn.13330

Jeung, D. Y., Kim, C., & Chang, S. J. (2018). Emotional labor and burnout: A review of the literature. *Yonsei Medical Journal 59*(2), 187–193). https://doi.org/10.3349/ymj.2018.59.2.187

Kamel, F. F., & Aref, M. A. E. (2017). Staff nurses perception toward organizational culture and its relation to innovative work behavior at critical care units. *American Journal of Nursing Science, 6*(3). https://doi.org/10.11648/j.ajns.20170603.23

Kim, J. S. (2020). Emotional labor strategies, stress, and burnout among hospital nurses: A path analysis. *Journal of Nursing Scholarship*, *52*(1), 105–112. https://doi.org/10.1111/jnu.12532

Kim, Y. I., Geun, H. G., Choi, S., & Lee, Y. S. (2016). The impact of organizational commitment and nursing organizational culture on job satisfaction in Korean American registered nurses. *Journal of Transcultural Nursing*, *28*(6), 1–8. https://doi.org/10.1177/1043659616666326

Koh, M. S., Lee, H. Z., & Kim, M. J. (2018). Convergence research on emotional labor, professionalism, social support, and performance of nurses in clinical field. *Journal of the Korea Convergence Society*, *9*(8), 343–353. https://doi.org/10.15207/JKCS.2018.9.8.343

Lee, E., & Jang, I. (2020). Nurses' fatigue, job stress, organizational culture, and turnover intention: A culture–work–health model. *Western Journal of Nursing Research*, *42*(2), 108–116. https://doi.org/10.1177/0193945919839189

Lee, L., & Madera, J. M. (2019). A systematic literature review of emotional labor research from the hospitality and tourism literature. *International Journal of Contemporary Hospitality Management*, *31*(7), 2808–2826. https://doi.org/10.1108/IJCHM-05-2018-0395

Liu, H., Zou, H. Y., Wang, H. J., Xu, X., & Liao, J. Q. (2020). Do emotional labour strategies influence emotional exhaustion and professional identity or vice versa? Evidence from new nurses. *Journal of Advanced Nursing*, *76*(2), 577–587. https://doi.org/10.1111/jan.14266

Lombarts, K. M. J. M. H., Plochg, T., Thompson, C. A., & Arah, O. A. (2014). *Measuring professionalism in medicine and nursing: Results of a European survey*. *PLoS ONE, 9*(5),e97069. https://doi.org/10.1371/journal.pone.0097069

Manley, K., Sanders, K., Cardiff, S., & Webster, J. (2011). Effective workplace culture: The attributes, enabling factors and consequences of a new concept. *International Practice Development Journal*, *1*(2), 1–29.

Manojlovich, M., & Ketefian, S. (2002). The effects of organizational culture on nursing professionalism: Implications for health resource planning. *Canadian Journal of Nursing Research*, *33*(4), 15–34.

Ministry of Health Republic of Indonesia. (2017). *Situasi tenaga keperawatan Indonesia [The situation of nursing personnel]*. Misnistry of Health Republic of Indonesia. https://www.kemkes.go.id/article/view/17072400004/situasi-tenaga-keperawatan-indonesia.html.

Pedrosa, J., Sousa, L., Valentim, O., & Antunes, V. (2021). Organizational culture and nurse's turnover: A systematic literature review. *International Journal of Healthcare Management* 14(4), 1542–1550. https://doi.org/10.1080/20479700.2020.1801160

Primm, R. D. (2010). Professionalism among occupational health nurses. *Professional Practice*, *58*(7), 281–283. https://doi.org/10.3928/08910162-20100625-02

Sarıköse, S., & Göktepe, N. (2022). Effects of nurses' individual, professional and work environment characteristics on job performance. *Journal of Clinical Nursing*, *31*(5–6), 633–641. https://doi.org/10.1111/jocn.15921

Sass, J. S. (2000). Emotional labor as cultural performance: The communication of caregiving in a nonprofit nursing home. *Western Journal of Communication*, *64*(3), 330–358. https://doi.org/10.1080/10570310009374679

Scott-Findlay, S., & Estabrooks, C. A. (2006). Mapping the organizational culture research in nursing: A literature review. *Integrative Literature Reviews and Meta-Analysis*, *56*(5), 498–513. https://doi.org/10.1111/j.1365-2648.2006.04044.x

Solomon, Y., Beker, J., & Belachew, T. (2015). Nursing and care professionalism and its predictors among nurses working in Jimma zone public. *Journal of Nursing Care*, *4*(5), 1–9. https://doi.org/10.4172/2167-1168.1000292

Stock, G. N., Mcfadden, K. L., & Iii, C. R. G. (2017). Organizational culture, knowledge management, and patient safety in U.S Hospitals. *Quality Management Journal*, *17*(2), 7–27. https://doi.org/10.1080/10686967.2010.11918267

Tanaka, M., Taketomi, K., Yonemitsu, Y., & Kawamoto, R. (2014). Professional behaviours and factors contributing to nursing professionalism among nurse managers. *Journal of Nursing Management*, *24*(1), 12–20. https://doi.org/10.1111/jonm.12264

Wanninayake, S. D. K., O'Donnell, M. E., & Williamson, S. (2021). Caring with a forced smile: Emotional labour among private hospital nurses in Sri Lanka. *South Asian Journal of Human Resources Management*, *8*(2), 219–239. https://doi.org/10.1177/23220937211037221

World Health Organization. (2022). *Nursing and midwifery*. World Health Organization International. https://www.who.int/news-room/fact-sheets/detail/nursing-and-midwifery#:~:text=For all countries to reach,delivering primary and community care

Yeun, Y., & Han, J. (2016). Effect of nurses' organizational culture, workplace bullying, and work burnout on turnover intention. *International Journal of Bio-Science and Bio-Technology*, *8*(1), 372–380. https://doi.org/10.14257/ijbsbt.2016.8.1.33

Zaghini, F., Biagioli, V., Proietti, M., Badolamenti, S., Fiorini, J., & Sili, A. (2020). The role of occupational stress in the association between emotional labor and burnout in nurses: A cross-sectional study. *Applied Nursing Research*, *54*, 151277. https://doi.org/10.1016/j.apnr.2020.151277

ORIGINAL RESEARCH

The Relationship between Self-Efficacy, Self-Care Behavior, and Generalized Anxiety Disorder in COVID-19: A Path Analysis Model

Mohammad Hossein Delshad[1,2], Fahimeh Pourhaji[3], Fatemeh Pourhaji[1,2], Hassan Azhdari Zarmehri[4,5]

[1]Department of Public Health, School of Health, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran
[2]Health Sciences Research Center, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran
[3]PhD candidate, Department of Health Education and Health Promotion, School of Health, Mashhad University of Medical Sciences, Mashhad, Iran
[4]Neuroscience Research Center, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran
[5]Department of Physiology, School of Paramedical Sciences, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran

Article Info	Abstract
  Corresponding Author: Fatemeh Pourhaji Department of Public Health, School of Health, Torbat Heydariyeh University of Medical Sciences, Iran Email: pourhajif1@thums.ac.ir	**Background:** The outbreak of the COVID-19 pandemic has a strong impact on individuals and becomes a very stressful period. Long-term exposure to stress due to lockdown scenario may also increase psychological distress by reducing support resources, and in these circumstances, personal resources such as self-efficacy and its relationships appear important. It is essential to explore people's beliefs about their capabilities to produce designated levels of behavior in the face of COVID-19, which is not known in the target population, and also to show its effect on anxiety. **Purpose:** This study aimed to investigate the relationship between self-efficacy, self-care behavior, and generalized anxiety disorder in COVID-19. **Methods:** A cross-sectional online survey was performed after COVID-19 was confirmed in Iran. The samples of the study were 500 residents in the Razavi Khorasan province, Iran, that were randomly selected. Demographic data, general self-efficacy, self-care behavior, and the Generalized Anxiety Disorder (GAD-7) questionnaires were used for data collection. The data were analyzed using bivariate correlation and hierarchical linear regression models. **Results:** The mean(SD) age of the participants was 31.9(11.9). Their GAD-7 scores had severe anxiety (score ≥17). There was a negative and significant relationship between generalized anxiety disorder and self-efficacy (r=-0.238, $p \leq 0.01$). Also, there was a positive and significant relationship between self-efficacy and self-care behavior. No significant relationship between generalized anxiety disorder and self-care behavior was found. The path analysis model estimated anxiety and self-efficacy as about 4% of the variance self-care behavior in COVID-19. **Conclusion:** This study revealed that enhancing self-efficacy levels might reduce anxiety. Self-efficacy-enhancing programs should be used as part of the routine readiness effort drives and health care system change.

How to cite: Delshad, M. H., Pourhaji, F., Pourhaji, F., & Zarmehri, H. A. (2022). The relationship between self-efficacy, self-care behavior, and generalized anxiety disorder in COVID-19: A path analysis model. *Nurse Media Journal of Nursing, 12*(1), 111-121. https://doi.org/10.14710/nmjn.v12i1.32938

1. Introduction

COVID-19 pandemic has become a severe health threat to people in Iran and around the world (Mailani et al., 2021; Pourhaji et al., 2022; Tuppal et al., 2021). The COVID-19 is now a virus disease with the fatality rates ranges from 2.5% to 3% (Wu & McGoogan, 2020). The outbreak of the COVID-19 pandemic has a strong impact among individuals and becomes a very stressful period. Zhang et al. (2020) showed that 33% of the study participants had not left their home at all during the previous month due to the restrictive measures to contain COVID-19 and 25% had to stop working due to the outbreak. Those who stopped working reported worse health conditions by Short Form-12 (SF12) as well as distress (Mahmoud et al., 2016; Zhang et al., 2020). Anxiety is one of the issues that people face in an epidemic era. Meanwhile, Generalized Anxiety Disorder (GAD) is specifically characterized by extreme and persistent anxiety that is uncontrollable and pervasive, and the resulting anxiety focuses on all daily life events (Mahmoud et al., 2016). It seems that due to inhibition of the sympathetic system in

these people, their physical symptoms have increased restlessness, fatigue, muscle tension, irritability and difficulty concentrating and sleeping (Abdi et al., 2013).

The study by Martin (2009) showed that stress can have adverse effects on the immune system. Therefore, in epidemic conditions, COVID-19 can affect on people's responsiveness and it seems to have destructive effects the rate of infection and body resistance to this disease. In addition, with the growth of information technology to obtain information from various sources, especially the Internet and social networks, people are aware of the various sources, and this may affect the perception of risk (Kwok et al., 2020).

Qian et al. (2020) in a cross-sectional study among 510 residents of Wuhan, China, and 501 residents of Shanghai, reported that the studies subjects had moderate to severe anxiety. The results of this study showed the efforts to disseminate accurate and reliable information in a timely manner to affect high levels of anxiety (Qian et al., 2020). Long-term exposure to stress due to the lockdown may also increase psychological distress by reducing support resources (e.g., family), increasing the importance of personal resources such as self-efficacy, and relationship variables (Mousavi et al., 2021; Losada-Baltar et al., 2020). This issue may have a profound effect on perceived loneliness, a factor that is broadly related to psychological distress as well as the outcome itself (Cacioppo & Cacioppo, 2018).

Self-efficacy is constructing preventive behaviors by reinforcing positive steps and the belief that one has ability to overcome a given situation. Self-efficacy is defined as perceived capability to perform a target behavior (Bandura, 1977). It refers to the confidence in one's ability to acquire a new behavior (Sharma, 2016). Self-efficacy is central to health behavior theories due to its robust predictive capabilities. One of the purported strengths of self-efficacy is that it explains why people are (or are not) motivated to perform health-related behaviors, rather than merely predicting who is (or is not) motivated to perform health-related behaviors (Bandura, 1977). Research shows a significant relationship between self-efficacy and behavior and anxiety. Simonetti et al. (2021) found a negative correlation between self-efficacy and anxiety. Xue et al. (2021) showed that the COVID-19 is a global issue which affects the entire population's mental health and there was a positive correlation between the quality of life and self-efficacy. In such a way, it can be said that self-efficacy is a necessary and important factor for self-care behavior during the COVID-19 pandemic.

Repeating mental health concerns that require the establishment of unauthorized views and encouraging lifestyle modification and motivating behavior change will help assess stress and coping strategies (Mukhtar, 2020). Similar studies have indicated this finding. Yildrim and Güler (2020) showed that COVID-19 severity, self-efficacy, and preventive behaviors uniquely predicted mental health and indicated findings may underscore development of interventions to improve mental health of individuals during pandemic. Pragholapati (2020) suggested people who are high in so-called Bandura overcoming self-efficacy, are more able and pleasant to take on threatening tasks, where they might experience many failures because they are not overcome by anxiety. They are confident in their ability to overcome difficult situations. Furthermore, long-term exposure to stress due to the lockdown scenario may also increase psychological distress by reducing support resources, and in these circumstances, personal resources such as self-efficacy, and its relationships appear important. It is not known regarding people's beliefs about their capabilities to produce designated levels of behavior in the face of COVID-19 in the population of Iran, and this study helps us to explore these beliefs in different cultural contexts as well as the effect on anxiety.

Obviously, by unbalancing mental health factors in case of low self-efficacy and causing negative outcomes such as anxiety, most part of self-care behaviors will be affected. However, data regarding the relationship between self-efficacy and self-care behaviors in COVID-19 pandemic are limited, and questions remain about how to interpret the relationship of self-efficacy to anxiety disorder or avoidance behavior in general (Tahmassian et al., 2011). Thus, it is interesting to find out whether the correlations between self-efficacy, self-care behavior and generalized anxiety disorder in COVID-19 hold up. Accordingly, this study aimed to investigate the relationship between self-efficacy, self-care behavior, and generalized anxiety disorder in COVID-19.

2. Methods

2.1 Research design

This study was a cross-sectional online survey that was performed after the confirmed spread of SARS-CoV-2 in Iran from February 19, 2020 to March 13, 2020.

2.2 Setting and samples

The participants in this study were 500 residents in the Razavi Khorasan province, Iran, that were randomly surveyed about their anxiety, self-efficacy, and self-care behavior status. Eligible participants in this study were the general population who: (i) were aged 17 years old or above, (ii) could understand Persian language, (iii) have lived in Razavi Khorasan for at least 6 months before the survey, (iv) not suffering from mental illness, and (v) have literacy and capability of working with computers and an Android phone. The respondents with incomplete responses were excluded from the study.

2.3 Measurement and data collection

The data were collected from February 19, 2020 to March 13, 2020. The instruments used in this study included demographic data (gender, age, education and occupational status, travel history in the past month), general self-efficacy scale, self-care behavior scale, and generalized anxiety disorder questionnaire with the 7-item GAD scale.

Self-efficacy was assessed using the General Self-Efficacy Scale which is a 10-item scale. Participants responded to questions concerning "to what extent did you feel capable of coping effectively with the current situation?" Answers were based on a five-point Likert scale from 0 "not at all true" to 5 "exactly true". Face and content validity were evaluated by an expert panel consisting of 10 specialists in health education and psychologists and attempted to obtain equivalents of semantic, empirical, and conceptual words and sentences. The experts answered to comment independently on the necessity and relevance of the items in order to calculate Content Validity Ratio (CVR) and the Content Validity Index (CVI). The CVR and CVI of the questionnaire were ≥0.80 and >0.78, respectively. According to Polit et al. (2007), these indicators were appropriate. The consistency of the scale was assessed among 70 participants. In this study's samples, good internal consistency was also found (Cronbach's α=0.89).

Generalized anxiety disorder was assessed using the 7-item GAD scale (Spitzeret al., 2006). The generalized anxiety disorder questionnaire measures the severity of its symptoms over the past two weeks on a 4-point Likert scale ranging from 0 (never) to 3 (nearly every day). The total score ranges from 0 to 21, with increasing scores indicate 17 more severe functional impairments as a result of anxiety (Spitzer et al., 2006). The scores of GAD 0-10 was categorized as low anxiety and the score of 10-16 was indicated as moderate level anxiety. A previous study (Naeinian et al., 2011) has shown that GAD is valid in the Iranian community population. A cut of the point was identified that optimized sensitivity (89%) and specificity (82%) (Spitzer et al., 2006). In this study, GAD-total score of 10 points or greater was defined as the presence of anxiety symptoms (Naeinian et al., 2011). Face and content validity was evaluated by an expert panel consisting of 10 psychologists. They reviewed the final version of the GAD scale and were answered to comment independently on the necessity and relevance of the items to calculate the CVR and CVI. The CVR and CVI of the questionnaire were ≥0.79 and >0.7, respectively. According to Polit et al. (2007), these indicators were appropriate. The consistency of the GAD Scale was also assessed in a pilot study of 70 similar participants. In this study's sample, good internal consistency was also found (Cronbach's α=0.81).

Self-care behavior was measured by six items as follows: (1) "I am trying to avoid public transportation to prevent a COVID-19 disease", (2) "I am trying to eat in restaurants to prevent a COVID-19 disease", (3) "I am trying to avoid visiting public places to prevent a COVID-19 disease", (4) "I am trying to wear masks to prevent a COVID-19 disease", (5) "I am trying to use gloves to prevent a COVID-19 disease", and (6) "I am trying to wash my hands for 40 seconds to prevent COVID-19 disease. Answers were based on a five-point Likert scale from 0 "Never" to 5 "Always". The total score for self-care behavior is calculated in these sub-scales. The scores were between 0-25. The higher scores indicated higher levels of self-care behavior. Face and content validity of the self-care behavior scale were evaluated by an expert panel consisting of 10 specialists in health education. The CVR and CVI of the questionnaire were ≥0.80 and >0.79, respectively. According to Polit et al. (2007), these indicators were appropriate. The consistency

of self-care behavior scale was assessed in a pilot study of 70 similar participants. Good internal consistency was found (Cronbach's α=0.78).

The instrument expanded online questionnaire in Persian language and adopted it from previous studies by social media such as Telegram and WhatsApp. To avoid duplicate responses from the same responder, the survey could only be taken once from the same electronic device. Data collection lasted about two months. Due to the specific prevention endorsed throughout the outbreak, including prevention in close contacts and touch precautions.

2.4 Data analysis

Analyses were carried out in SPSS statistical version (v.20). Descriptive analysis of the responses was performed to report the counts and frequencies. Furthermore, independent sample t-test, One-Way ANOVA, and bivariate correlation path analysis model were performed.

The hierarchical linear regression model was used to analyze the effects of self-efficacy and generalized anxiety disorder and self-care behavior. First, we tested the statistical assumption of the normal distribution of a research variable by the one-sample Kolmorov Smirnov (K-S) test. We followed the steps for evaluating a mediating effect as proposed by Baron and Kenny (1986). Step 1, we examined whether self-efficacy and generalized anxiety disorder was correlated. Step 2, we examined the association of self-efficacy and self-care behavior. Step 3, we examined the effect of generalized anxiety disorder on self-care behavior while controlling for self-efficacy.

2.5 Ethical considerations

This study was approved by the Ethics Committee of Torbat Heydariyeh University of Medical Sciences with the ethical clearance certificate number of IR.THUMS.REC.1398.055. Informed consent was completed by the participants prior to their participation.

3. Results

3.1 Characteristics of the respondents

As many as 500 participants responded to the survey in this study with a response rate of 98%. Ten questionnaires were omitted as they were incompletely augmented or filled out. The mean(SD) age of participants was 31.9(11.9). The majority were female (74.2%) and aged 18-27 years old (42.6%) (Table 1). The results also indicated that 167 (33.4%) of the participants were single, 327 (65.4%) were married, and 6 (1.2%) were divorced. Related to anxiety, the results showed that 7.6% (n=38) participants had low-level anxiety (0-10), 14.4% (n=72) had moderate level-level anxiety (10-16), and 78% (n=390) had severe level anxiety (GAD-7 score ≥17).

Table 1. Characteristics and travel history of the participants (n=500)

Variable	f	%
Gender		
Male	129	25.8
Female	371	74.2
Age (years)		
18-27	213	42.6
28-37	144	28.8
38-47	84	16.8
48-57	42	8.4
58 or above	17	3.4
Educational level		
Elementary and lower	35	7
Guidance school	18	3.6
High school and diploma	104	20.8
Graduate and above	343	68.6
Employment status		
Employee	188	43.6
Employer	14	2.8
Housewife	218	43.6
Retired	12	2.4
Unemployed	68	13.6

Table 1. Continued

Variable	f	%
Medical visit in the last 14 days		
Yes	60	12
No	440	88
Having had respiratory symptoms in the last 14 days		
Yes	132	26.4
No	368	73.6
Last month's travel history		
Yes	100	20
No	400	80

3.2 The relationship between participants' characteristics and self-efficacy, generalized anxiety disorder and self-care behavior

The results of the independent sample t-test showed no relationship between gender and self-efficacy ($p=0.7$). However, there was a relationship between gender and generalized anxiety disorder ($p\leq0.001$), and between gender and self-care behavior ($p\leq0.001$). The findings also indicated a relationship between age and self-care behavior; individuals aged 18-27 years old had the most self-care behavior ($p\leq0.001$). Furthermore, results of One-Way ANOVA showed a relationship between educational level and self-care behavior, indicating that participants with high school and diploma had the most self-care behavior ($p=0.01$). Also, a relationship between employment status and self-care behavior was found, indicating that housewife participants had the most of the self-care behaviors against COVID-19 (Table 2).

Table 2. The relationship between participant characteristics and self-efficacy, generalized anxiety disorder and self-care behavior in COVID-19

Variable	N(%)	SE Mean(SD)	GAD Mean(SD)	SCB Mean(SD)
Gender				
Male	129 (25.8)	38.55(5.72)	4.85(4.27)	19.46(5.07)
Female	371 (74.2)	38.37(6.92)	7.07(5.4)	21.03(3.71)
Independent sample t-test		*p=0.7*	**p≤0.001*	**p≤0.001*
Age (years)				
18-27	213 (42.6)	38.15(6.57)	6.69(5.38)	21.28(3.21)
28-37	144 (28.8)	37.44(6.84)	7.07(5.06)	20.57(3.93)
38-47	84 (16.8)	40.73(6.94)	5.11(4.95)	20.32(4.69)
48-57	42 (8.4)	38.61(4.98)	6.61(4.91)	18.80(6.02)
58 or above	17 (3.4)	38.11(5.21)	5.64(6.26)	18.29(5.53)
One-way ANOVA		*p=0.10*	*p=0.07*	**p≤0.001*
Educational level				
Elementary and lower	35 (7)	38.37(5.80)	7.65(6.11)	19.17(5.48)
Guidance school	18 (3.6)	38.88(7.76)	6.16(5.69)	21.27(4.29)
High School and Diploma	104 (20.8)	39.03(7.62)	6.78(5.30)	21.63(3.48)
Graduate and above	343 (68.6)	38.21(6.33)	6.30(5.10)	20.48(4.08)
One-way ANOVA		*p=0.7*	*p=0.4*	*p=0.01*
Employment status				
Employee	188 (43.6)	39.15(6.26)	5.89(5.08)	20.03(4.51)
Employer	14 (2.8)	36.42(6.33)	7.57(5.7)	19.30(5.97)
Housewife	218 (43.6)	37.86(7.17)	6.94(5.28)	21.50(3.27)
Retired	12 (2.4)	40(5.52)	5.33(3.84)	19.16(5.67)
Unemployed	68 (13.6)	38.32(5.88)	6.72(5.53)	20.12(4.19)
One-way ANOVA		*p=0.21*	*p=0.25*	**p=0.002*

Note: *p<0.001. self-efficacy (SE), generalized anxiety disorder (GAD), and self-care behavior (SCB)

As seen in Table 3, the mean and standard deviation of self-efficacy, anxiety, and self-care behavior was 33.28(7.4), 6.4(5.23), and 20.66(4.12), respectively. There was a negative and significant relationship between generalized anxiety disorder and self-efficacy (r=-0.238,

$p \leq 0.001$). Furthermore, there was a positive and significant relationship between self-efficacy and self-care behavior (r=0.102, p=0.02). On the other hand, the results also indicated no significant relationship between generalized anxiety disorder and self-care behavior.

Table 3. The correlation between self-efficacy, generalized anxiety disorder and self-care behavior

Variables	Mean(SD)	N	SE	GAD	SCB
1. Self-efficacy	33.28(7.4)	500	1		
2. Generalized anxiety disorder	6.4(5.23)	500	r =-0.238** p<0.001	1	
3. Self-care behavior	20.66(4.12)	500	r =0.102* p=0.02	r =-0.01 p=0.83	1

Note: **Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)
Abbreviations: GAD-7 (Generalized anxiety disorder 7-item scale); SE (Self-efficacy); SCB (Self-care behavior)

Before examining the research questions, correlations among the three variables were calculated. Generalized anxiety disorder (M=6.4, SD=5.23) and self-efficacy (M=33.28, SD=7.4) were significantly and negatively related (r=-0.238, p<0.01). Self-care behavior was significantly and positively related to self-efficacy (r=0.10, p=0.02). In other words, self-care behavior scores increased with an increase in self-efficacy. However, generalized anxiety disorder was not related to self-care behavior (r=-0.01, p=0.83). We used the hierarchical linear regression model to analyze the effects of self-efficacy and generalized anxiety disorder, and self-care behavior. First, we tested the statistical assumption of the normal distribution of the research variable. Then the one sample Kolmorov Smirnov test showed that normal distribution was obtained. We followed the steps for evaluating a mediating effect as proposed by Baron and Kenny (1986), including: Step 1, we examined whether self-efficacy was a significant predictor of generalized anxiety disorder; Step 2, we examined self-efficacy as a significant predictor related to self-care behavior; Step 3, we examined whether the generalized anxiety disorder was a significant predictor of self-care behavior while controlling for self-efficacy. If the generalized anxiety disorder was a complete mediator of the relationship between self-efficacy and self-care behavior, then the effect of self-efficacy should be zero. The findings indicated that self-efficacy (ß=-0.24, p<0.001) and generalized anxiety disorder (ß=0.10, p<0.001) were significant predictors of self-care behavior (Table 4). They explained 4% of the variance in self-care behavior. As shown in Table 4, the effect of self-efficacy on generalized anxiety disorder was not zero (Step 3). Thus, generalized anxiety disorder was a partial mediator rather than a complete mediator.

Table 4. Effects on self-efficacy and generalized anxiety disorder self-care behavior in COVID-19

	Beta (ß)		
	Step 1	Step 2	Step 3
Age	-0.07	-0.18***	-0.18***
Gender (1=male)	0.01***	0.153***	0.152***
Marital status (1=married)	-0.01	0.062	0.055
Education	-0.08	-0.02	-0.02
Self-efficacy	-0.24***	0.11***	-0.023
Generalized anxiety disorder	-	-	0.10***
Adjusted r^2	0.05	0.06	0.04
F	7.17	6.91	5.57
p	0.000***	0.000***	0.000***

Note: ***p<0.001

The indirect effect of self-efficacy on self-care behavior through generalized anxiety disorder was 0.011, calculated by multiplying the direct effects of 0.11 and 0.10. Thus, the total effect was -0.012 (-0.023 and 0.011) (Figure 1).
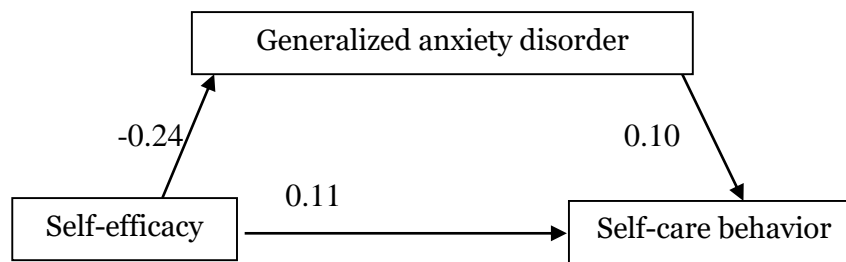
Figure 1. Path diagram of the self-efficacy, generalized anxiety disorder and
self-care behavior

4. Discussion

The purpose of this study was to investigate the relationship between self-efficacy, self-care behavior, and general anxiety disorder in COVID-19 in Razavi Khorasan Province's population. The average score of anxiety in this study was high, 78% of the participants had scores of anxiety upper 17, which indicated high anxiety.

The results of this study indicated that after controlling for demographic data, self-efficacy had a direct negative effect on anxiety. Some scientific research and efforts identified that low levels of self-efficacy occur with high levels of anxiety. Self-efficacy can be a cognitive factor that plays a mediating role in the anxiety and when people become anxious, a low sense of self-efficacy will be activated (Muris, 2002). This finding was confirmed in the study by Xiao et al. (2020) and other studies (Tahmassian & Moghadam, 2011; Wang et al., 2019; Wu et al., 2013). In general, people with high self-efficacy can control their emotions even when they are under anxiety (Bihlmaier & Schlarb, 2016) and have increased self-focus and self-control (Przepiórkaet al., 2019), and therefore seems to has a positive impact on self-care behaviors of the individuals. An individual who has high self-efficacy indicates that she/he will have a positive evaluation of herself/himself (Bowsher & Keep, 1995), which also shows the individual's positive self-evaluation and ability. High self-efficacy means individuals believe in their own ability for being successful in certain behaviors. Having a positive belief in one's ability also engenders a sense of control and decreases negative emotional symptoms. People who have high self-efficacy also can use more different strategies to achieve their goals thereby decreasing anxiety (Muris, 2002). Self-care behaviors and activities related to disease and treatment are essential for the patient's physical and psychological health (Wenget al., 2008).

This study also showed that self-efficacy had a positive correlation with self-care behavior. This result is supported by previous research (Tharek et al., 2018). Another study also showed that COVID-19 self-efficacy and preventive behaviors uniquely predicted mental health over and above gender and age (Yıldırım & Güler, 2020). The results of a previous study indicated one of the effective factors in self-care behavior is awareness (Heo et al., 2008). In the present study, self-care behavior was higher in women than men. It seems that female participants' knowledge was higher than male participants. Another reason may be that in our study, there were more housewives who followed the news and the media more and paid more attention to self-care behaviors, when compared to males.

In current study, there was a relationship between gender and means of generalized anxiety disorder; women had a higher score than men. These findings are consistent with other studies (Du et al., 2020; Lau et al., 2010). This may be because women were more likely than men to follow illness and deaths due to illness, which made them more anxious. In contrast to our study, the results in the study of Lee (2020) and Huang and Zhao (2020) showed no relationship between gender and anxiety. In our study, there was a relationship between educational level and self-care behavior so that people with high school and diploma tend to have higher self-care behavior score. This finding is consisted with a study by Mohammadpour et al. (2020) which indicated a relationship between educational level and self-care behavior, such as hand washing.

The results in this study, despite the negative effect of anxiety on behavior, indicated that there was no significant relationship between generalized anxiety disorder and self-care behavior. Consistent with the present study, a study by Mohammadpour et al. (2020) also found that there was an association between anxiety and handwashing behavior. Similarly, Asadi et al. (2021) also reported a negative and significant correlation between generalized anxiety disorder and self-care behavior. Perhaps one of the reasons for this finding was the low perception of risk in the research samples.

5. Implications and limitations

The research findings indicate that self-efficacy has a positive and significant correlation with self-care behaviors and a negative and significant correlation with anxiety disorder. Considering the important roles that nurses have in caring for patients with COVID-19, it is necessary to provide appropriate interventions, including increasing self-efficacy to increase self-care behaviors and reduce anxiety disorder and ultimately improve the quality of life. This study also shows that self-efficacy can be best regarded as a cognitive factor that plays a mediating role in anxiety. The present results show that different domains of self-efficacy and symptoms of affective disorder are significantly correlated. However, more prospective studies are needed.

Our study has many limitations. First, in order to assess the public response to the major public health crisis, we shortened our survey questionnaire and obtain representative population samples using random sampling. Second, we asked participants to remember some of their behaviors; as a result, their answers might have recalled bias. This study did not inquire about the occupation of respondents who were employed. If this study recruited health care workers, they are at the highest risk of psychological distress during the COVID-19 outbreak and confound the results. We suggest that other studies focus on health and anxiety and the role of self-efficacy in their self-care behaviors in health workers. This study mainly focused on anxiety and did not explore other common psychiatric symptoms such as depression that is beyond anxiety and panic disorder. We suggest that other studies focus on common psychiatric symptoms because these disorders may affect self-efficacy and self-care behaviors.

6. Conclusion

On the basis of the results, this study showed that the scores of GAD for most patients were within the high range (upper than 17). However, 92.4% of the participants had mild-to-severe anxiety. Experiencing anxiety is still a problem that needs to be solved among participants. In the current study, self-efficacy had a moderate negative correlation with GAD and a positive correlation with self-care behavior. This study revealed that enhancing self-efficacy levels might reduce anxiety. Self-efficacy enhancing programs should be used as a part of the routine readiness effort drives and health care system change.

Author contribution

FP, FP, MHD: Performed the all study and had complete access to all the data for analysis. They confirmed the eligibility of the participations for the study. They were involved in drafting the article. MHD and FP: supervised the whole study and approved a final version of the manuscript. HAZ: Project consulting.

Conflict of interest

There is no conflict of interests.

References

Abdi, R., Bakhshi, A., & Mahmoud, A. M. (2013). Efficacy of unified transdiagnostic treatment on reduction of transdiagnostic factors and symptoms severity in emotional disorders. *Journal of Psychological Models and Methods, 3*(13),1-27.

Asadi, M., Kiani, A., Azimi, L., & Gharibi, Z. (2021). COVID-19 related anxiety and self-care behaviors in students based on demographic characteristics: A cross-sectional study. *Journal of Clinical Psychology, 13*(2), 169-80.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173. https://doi.org/10.1037//0022-3514.51.6.1173

Bihlmaier, I., & Schlarb, A. A. (2016). Self-efficacy and sleep problems. *Somnologie, 20*(4), 275-280. https://doi.org/10.1007/s11818-016-0085-1

Bowsher, J. E., & Keep, D. (1995). Toward an understanding of three control constructs: Personal control, self-efficacy, and hardiness. *Issues in Mental Health Nursing, 16*(1), 33-50. https://doi.org/10.3109/01612849509042961

Cacioppo, J. T., & Cacioppo, S. (2018). The growing problem of loneliness. *The Lancet, 391*(10119), 426. https://doi.org/10.1016/S0140-6736(18)30142-9

Du, J., Dong, L., Wang, T., Yuan, C., Fu, R., Zhang, L., Qin, J. (2020). Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. *General Hospital Psychiatry, 67*(1), 144-145. https://doi.org/10.1016/j.genhosppsych.2020.03.011

Heo, S., Moser, D. K., Lennie, T. A., Riegel, B., & Chung, M. L. (2008). Gender differences in and factors related to self-care behaviors: A cross-sectional, correlational study of patients with heart failure. *International Journal of Nursing Studies, 45*(12), 1807-1815. https://doi.org/10.1016/j.ijnurstu.2008.05.008

Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 epidemic in China: A web-based cross-sectional survey. *Psychiatry Research, 288*(1),112954. https://doi.org/10.1016/j.psychres.2020.112954

Kwok, K. O., Li, K. K., Chan, H. H., Yi, Y. Y., Tang, A., Wei, W. I., & Wong, Y. S. (2020). Community responses during the early phase of the COVID-19 epidemic in Hong Kong: Risk perception, information exposure and preventive measures. *Emerging Infectious Diseases, 26*(7), 1575-1579. https://doi.org/10.3201/eid2607.200500

Lau, J. T. F., Griffiths, S., Choi, K. C., & Tsui, H. Y. (2010). Avoidance behaviors and negative psychological responses in the general population in the initial stage of the H1N1 pandemic in Hong Kong. *BMC Infectious Diseases, 10*(1), 139. https://doi.org/10.1186/1471-2334-10-139

Lee, S. A. (2020). Coronavirus anxiety scale: A brief mental health screener for COVID-19 related anxiety. *Death Studies, 44*(7), 393-401. https://doi.org/10.1080/07481187.2020.1748481

Losada-Baltar, A., Jiménez-Gonzalo, L., Gallego-Alberto, L., Pedroso-Chaparro, M. D. S., Fernandes-Pires, J., & Márquez-González, M. (2020). "We're staying at home". Association of self-perceptions of aging, personal and family resources and loneliness with psychological distress during the lock-down period of COVID-19. *The Journals of Gerontology: Series B, 76*(2), e10-e16. https://doi.org/10.1093/geronb/gbaa048

Mahmoud, A. M., Hashemi, N. T., & Sohrabi, F. (2016). Effectiveness of combined intervention based acceptance and commitment therapy (ACT) with exposure techniques on patient's anxiety symptoms intensity and sensitivity dimensions in general anxiety disorder (GAD). *Journal of Clinical Psychology, 8*(3), 61-76.

Mailani, F., Huriani, E., Muthia, R., & Sarfika, R. (2021). Nurses' intention to work during the COVID-19 outbreak in West Sumatra, Indonesia. *Nurse Media Journal of Nursing, 11*(1), 50-60. https://doi.org/10.14710/nmjn.v11i1.34093

Martin, L. B. (2009). Stress and immunity in wild vertebrates: Timing is everything. *General and Comparative Endocrinology, 163*(1), 70-76. https://doi.org/10.1016/j.ygcen.2009.03.008

Mohammadpour, M., Ghorbani, V., Khoramnia, S., Ahmadi, S. M., Ghvami, M., & Maleki, M. (2020). Anxiety, self-compassion, gender differences and COVID-19: Predicting self-care behaviors and fear of COVID-19 based on anxiety and self-compassion with an emphasis on

gender differences. *Iranian Journal of Psychiatry, 15*(3), 213-219. https://doi.org/10.18502/ijps.v15i3.3813

Mousavi, S. H., Delshad, M. H., Acuti Martellucci, C., Bhandari, D., Ozaki, A., & Pourhaji, F., Pourhaji, F., Hosseini, S. M. R., Roien, R., Ramozi, A. A., Wafaee, M., Qaderi, S., Delsoz, M., Sigdel, S., Kotera, Y., Sawano, T., Dhama, K., Rodríguez-Morales, A. J., Wang, J., ... Sah, R. et al. (2021). Community behavioral and perceived responses in the COVID-19 outbreak in Afghanistan: A cross-sectional study. *Disaster Medicine and Public Health Preparedness, 5*(1), 1-7.

Mukhtar, S. (2020). Mental health and emotional impact of COVID-19: Applying health belief model for medical staff to general public of Pakistan. *Brain, Behavior, and Immunity, 87,* 28–29. https://doi.org/10.1016/j.bbi.2020.04.012

Muris, P. (2002). Relationships between self-efficacy and symptoms of anxiety disorders and depression in a normal adolescent sample. *Personality and Individual Differences, 32*(2), 337-348.

Naeinian, M. R., Shaeiri, M. R., Sharif, M., & Hadian, M. (2011). To study reliability and validity for a brief measure for assessing Generalized Anxiety Disorder (GAD-7). *Clinical Psychology & Personality, 9*(1), 41-50.

Pourhaji F., Pourhaji F., Tehrani H., Talebi M., & Peyman N.(2022). Perceived threat and stress responses in the face of Covid-19 based on health belief model. *Journal of Health Literacy, 7*(1), 17-25.

Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in Nursing & Health, 30*(4), 459-467. https://doi.org/10.1002/nur.20199

Pragholapati, A. (2020). Self-efficacy of nurses during the pandemic Covid-19. https://www.academia.edu/43045687/Self_Efficacy_Of_Nurses_During_The_Pandemic_Covid_19

Przepiórka, A., Błachnio, A., & Siu, N. Y. F. (2019). The relationships between self-efficacy, self-control, chronotype, procrastination and sleep problems in young adults. *Chronobiology International, 36*(8), 1025-1035. https://doi.org/10.1080/07420528.2019.1607370

Qian, M., Wu, Q., Wu, P., Hou, Z., Liang, Y., Cowling, B. J., & Yu, H. (2020). Psychological responses, behavioral changes and public perceptions during the early phase of the COVID-19 outbreak in China: A population based cross-sectional survey. *BMJ Open, 10*(10), e040910. https://doi.org/10.1136/bmjopen-2020-040910

Sharma, M. (2016). *Theoretical foundations of health education and health promotion.* Jones & Bartlett Publishers.

Simonetti, V., Durante, A., Ambrosca, R., Arcadi, P., Graziano, G., Pucciarelli, G., & Cicolini, G. (2021). Anxiety, sleep disorders and self-efficacy among nurses during COVID-19 pandemic: A cross-sectional study. *Journal of Clinical Nursing,* 30(9-10), 1360-1371. https://doi.org/10.1111/jocn.15685

Spitzer, R., Kroenke , K., Williams, J., & Bernd , L. (2006). A Brief Measure for Assessing Generalized Anxiety Disorder: The GAD-7. *Archives of Internal Medicine, 166(*10), 1092-1097. https://doi.org/10.1001/archinte.166.10.1092

Tahmassian, K., & Jalali Moghadam, N. (2011). Relationship between self-efficacy and symptoms of anxiety, depression, worry and social avoidance in a normal sample of students. *Iranian Journal of Psychiatry and Behavioral Sciences, 5*(2), 91-98.

Tharek, Z., Ramli, A. S., Whitford, D. L., Ismail, Z., Zulkifli, M. M., Sharoni, S. K. A., Jayaraman, T. (2018). Relationship between self-efficacy, self-care behaviour and glycaemic control among patients with type 2 diabetes mellitus in the Malaysian primary care setting. *BMC Family Practice, 19*(1), 1-10. https://doi.org/10.1186/s12875-018-0725-6

Tuppal, C. P., Ninobla, M. M. G., Ruiz, M. G. D., Loresco, R. D., Tuppal, S. M. P., Panes, I. I., Oducado, R. M. F., Prudencio, D. A. M., Vega, P. D., Eribal, M. J. E., Real, D. V. P., & Roa, M. N. T. (2021). Knowledge, attitude, and practice toward COVID-19 among healthy population in the Philippines. *Nurse Media Journal of Nursing, 11*(1), 61-70. https://doi.org/10.14710/nmjn.v11i1.36067

Wang, N., Wang, S., Qian, H.-Z., Ruan, Y., Amico, K. R., Vermund, S. H., Zheng, S. (2019). Negative associations between general self-efficacy and anxiety/depression among newly

HIV-diagnosed men who have sex with men in Beijing, China. *AIDS Care, 31*(5), 629-635. https://doi.org/10.1080/09540121.2018.1549721

Weng, L. C., Dai, Y. T., Wang, Y. W., Huang, H. L., & Chiang, Y. J. (2008). Effects of self-efficacy, self-care behaviours on depressive symptom of Taiwanese kidney transplant recipients. *Journal of Clinical Nursing, 17*(13), 1786-1794. https://doi.org/10.1111/j.1365-2702.2007.02035.x

Wu, S.-F. V., Huang, Y.-C., Lee, M.-C., Wang, T.-J., Tung, H.-H., & Wu, M.-P. (2013). Self-efficacy, self-care behavior, anxiety, and depression in Taiwanese with type 2 diabetes: A cross-sectional survey. *Nursing & Health Sciences, 15*(2), 213-219. https://doi.org/10.1111/nhs.12022.

Wu, Z., & McGoogan, J. M. (2020). Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. *Jama, 323*(13), 1239-1242. https://doi.org/10.1001/jama.2020.2648

Xiao, H., Zhang, Y., Kong, D., Li, S., & Yang, N. (2020). The effects of social support on sleep quality of medical staff treating patients with coronavirus disease 2019 (COVID-19) in January and February 2020 in China. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research, 26*, e923549-923541. https://doi.org/10.12659/MSM.923549.

Xue, A., Oros, V., La Marca-Ghaemmaghami, P., Scholkmann, F., Righini-Grunder, F., Natalucci, G., Restin, T. (2021). New parents experienced lower parenting self-efficacy during the COVID-19 pandemic lockdown. *Children, 8*(2),79. https://doi.org/10.3390/children8020079

Yıldırım, M., & Güler, A. (2020). COVID-19 severity, self-efficacy, knowledge, preventive behaviors, and mental health in Turkey. *Death Studies, 46(4),* 1-8. https://doi.org/10.1080/07481187.2020.1793434

Zhang, S. X., Wang, Y., Rauch, A., & Wei, F. (2020). Health, distress, and life satisfaction of people one-month into COVID-19 outbreak in China. *Psychiatric Research, 288*(1), 112958. https://doi.org/10.1016/j.psychres.2020.112958

ORIGINAL RESEARCH

Comparison of the Effectiveness of Breast Cancer Education through Two Virtual Methods for Increasing Knowledge in Nurses

Forouzandeh Jannat[1], Sadaf Alipour[2,3], Fariba Noori[1], Somayeh Ansari[1], Tahereh Ashtab[4], Amirhossein Eskandari[5], Sepehr Boroumand Sani[6], Marzieh Orouji[1], Donya Goodarzi[1], Fatemeh Dousti Amshaki[4]

[1]Department of Nursing, Arash Women's Hospital, Tehran University of medical Sciences, Tehran, Iran
[2]Breast Disease Research Center (BDRC), Cancer Institute, Tehran, Iran
[3]Department of Surgery, Arash Women's Hospital, Tehran University of medical Sciences, Tehran, Iran
[4]Department of Nursing, Razi Hospital, Tehran University of medical Sciences, Tehran, Iran
[5]Ministry of health and Medical Education, Tehran, Iran
[6]Faculty of Medicine, Tehran University of Medicine, Tehran, Iran

Article Info	Abstract
  Corresponding Author: Fatemeh Dousti Amshaki Department of Nursing, Razi Hospital, Tehran University of medical Sciences, Tehran, Iran Email: fnda2006@yahoo.com	**Background**: Virtual education today is about to become one of the most important educational methods in nursing. However, there have been few studies that examine the effectiveness of virtual education to increase knowledge towards breast cancer among nurses in Iran. **Purpose:** The aim of this study was to compare the knowledge towards breast cancer among nurses who were provided with two different methods of virtual training. **Methods:** This quasi-experimental study was conducted among 182 nurses in two hospitals in Tehran, Iran, who were randomly selected and divided into two groups of 91 nurses. Participants of the first group got virtual training about breast cancer in two sessions within two weeks by Skyroom. In the second group, the content was sent as educational messages by WhatsApp within two weeks. Participants' knowledge in both groups was measured using valid and reliable questionnaires developed by the researchers as a pretest and three posttests, and the satisfaction of the participants was also measured. To analyze the data, analysis of variance, standard deviation, t-test and Tukey test were performed. **Results:** According to the average score observed in the post-test period, the score of the WhatsApp group was 7.62, significantly higher than the Skyroom group of 6.25. The scores of the three post-test were higher than the pre-test in the two groups (with no significant difference between the two groups, p-value = 0.825 in the first post-test), but the scores declined from the first to third tests, showing a decline in the learning effect with time. However, the slope was gentler in the WhatsApp group, indicating a more persistent learning effect. **Conclusion:** This study showed that teaching with educational messages through WhatsApp had a greater impact on the sustainability of learning than teaching via lecturing through Skyroom.

How to cite: Jannat, F., Alipour, S., Noori, F., Ansari, S., Ashtab, T., Eskandari, A., Sani, S. B., Orouji, M., Goodarzi, D., & Amshaki, F. D. (2022). Comparison of the effectiveness of breast cancer education through two virtual methods for increasing knowledge in nurses. *Nurse Media Journal of Nursing, 12*(1), 100-110. https://doi.org/10.14710/nmjn.v12i1.41780

1. Introduction

Breast cancer is a common disease, accounting for 10% of all cancers in both men and women, and is the second most common cancer after lung cancer. Breast cancer is the most common cancer among women, as it accounts for 22% of all cancers in women (Atoum & Alzoughool, 2017). In 2018, approximately 330,000 women were diagnosed with breast cancer all over the world (Nastasi et al., 2018). In Iran, breast cancer is the most common among cancers diagnosed in women (Blasiak et al., 2020). This type of cancer with 16% of all cancers in women is the fifth leading cause of cancer death among Iranian women (Faramarzi et al., 2021). With respect to the inclusive nature of modern technologies, researchers endeavor to exploit various technologies, such as smartphone applications and social networks, to enhance the degree of breast cancer awareness among people. At present, social media are among the most favorite technologies used for assisting individuals to pursue a more active and healthier

lifestyle. Hence, social media are considered as tools for raising awareness and more effectively confronting breast cancer (Döbrössy et al., 2020) .

Liu et al. (2017) have shown that education has a significant effect on early detection and prevention of breast cancer. One of the most important measures at this level is supportive and educational care (Andreoli & Cecil, 2007); unfortunately, not enough attention is paid to this issue. The results of a study in Iran showed that the majority (6.63%) of breast cancer patients received moderate supportive care from nurses (Eghtedar et al., 2012). Moursy and Ead (2014), in their study of self-care in breast cancer patients, concluded that the self-care practices performed by the subjects were inadequate. According to them, nurses have an important and effective role in improving the quality of life of cancer patients due to their longer and more direct contact with the patient (Moursy & Ead, 2014). Since women are the center and guarantee of family health, and considering the wide role of women in the socio-economic cycle of the country, the need for early detection and prevention of breast cancer, as one of the best approaches to control this disease, is important (Tahergorabi et al., 2014)).

The ever-increasing development of the internet and enhancement of its accessibility in Iran are noticeable (Akbari & Gabdulhakov, 2019). Thus, smartphones and the internet are highly available in Iran and provide a platform that enables participants to communicate with people and transfer information. On the other hand, this ever-increasing growth and the effects of these media on different domains, such as knowledge and technology, and the role and status of modern media such as cellphones and internet-based systems, can tremendously impact social health promotion (Seyyedi et al., 2020). The movement to make more use of virtual learning has begun around the world, and it is becoming more and more widespread. E-learning increases the power of information retention in learners, in which different elements such as audio, video, short-term exams, and interaction with the learner and others are used to re-emphasize the purposeful learning. If they do not learn a subject, they can refer to it at the right time and learn it, and learning each section is a license to enter the next section (Kadoić & Redep, 2015). Also, the Internet is one of the challenges and disadvantages of e-learning. Lack of a suitable platform has made it impossible to use many programs or has reduced the quality of their use. Theft of personal information, lack of familiarity with e-learning programs and software, and malware are the disadvantages of virtual education (Shahbeigi & Nazari, 2012). As a very popular communication application, WhatsApp is a free messenger application that is extensively used in various societies to transfer simple text as well as multimedia messages including pictures, audio files, or videos (Mefolere, 2016). Skyroom is an Iranian platform that allows participants to easily host webinars, online tutorials and web conferencing sessions (Khodabandelou et al., 2021; Reimers & Schleicher, 2020). Social media, like Facebook, Twitter, or internet forums, which are designated to health-related topics, have been converted to accessible participatory tools by a set of structured textual documents for the exchange of knowledge, experience, and perspectives. Health-related online meetings are used by patients for exchanging information (Nzali et al., 2017).

Application of learning and instruction tools, such as internet and information technology, is increasing rapidly. Virtual learning is one of the most important learning environments today, so efforts and experiences in this area are considered worldwide. Virtual education today is about to become one of the most important educational method (Fini, 2008). Virtual education is an active and intelligent learning that has revolutionized the process of teaching, learning and knowledge management (Delavar & Ghorbani, 2011). A previous study examined the factors affecting the use of information resources by e-learning students and stated that the use of e-learning was easy and fast information retrieval (Liu et al., 2017). Other previous studies have also highlighted the positive impacts of using new educational technologies in health promotion programs (Papzan & Soleimani, 2010; Wang, 2009). However, there have been few studies that have investigated the community with this diversity in the workplace and the level and field of study to examine the knowledge, attitude and practice of women working in hospitals towards breast cancer, especially using latest educational technologies. Since nurses are the most central member of healthcare team, their performance and responsibility play an important role in implementing patient education and self-care program; this training is related to early detection and screening for breast cancer. Nurses should be equipped with knowledge and work according to applicable standard procedures (Tage et al., 2021). Accordingly, this study was conducted to compare the effect of two virtual education methods, including WhatsApp group and Skyroom

platform, on female nurses' awareness of breast cancer and their learning rate in two specialized hospitals in Tehran.

2. Methods

2.1 Research design

This was a quasi-experimental study that recruited 180 nurses in two hospitals in Tehran, Iran as participants. They were randomly selected among all nurses of the two hospitals and were divided into two groups.

2.2 Setting and samples

This research was conducted in the first six months of 2021. The population of this study consisted of nurses working in two small specialized hospitals in Tehran, Iran (n=344). Among this population, a sample of 182 people was selected using the Cochran's formula (Kotrlik & Higgins, 2001). The inclusion criteria included all nurses of the hospitals who were willing to participate in the study. Meanwhile, the exclusion criteria were all nurses who did not have the opportunity or desire to use social networks, nurses who have completed breast care education, nurses working in the hospital breast clinic, and nurses who themselves or their first-degree relatives have had breast cancer. The reason for excluding these nurses was that they had already been trained in breast cancer, and they would thus answer the pre-test and post-test questions correctly. Therefore, they could not be evaluated regarding the effect of the education. Two of the researchers were education supervisors of the nursing staff in the two hospitals, and the nurses were approached according to the defined regulations of the hospitals.

2.3 Intervention

For the first group, breast cancer education was delivered in the form of a lecture; which was held in two sessions in Skyroom throughout two weeks. As to the second group, educational messages containing practical information about breast cancer with the same outline as the former group were sent in a dedicated WhatsApp group within two weeks. Prior to the start of classes, in addition to informed consent to participate in the training, all nurses declared their devotion to be committed to the research design process and not to use another source. This process is shown in Figure 1.

2.4 Measurement and data collection

First, a pre-test was taken from all participants. The pre-test consisted of 20 items, the first 10 of which included scientific topics related to the subject of education. These items had been prepared in advance through three steps. In the first step, 50 questions were written by a breast surgeon, and ranked by experts. Then, the first higher-ranked 20 questions were presented to 20 women whose education and profession were not related to medical sciences and who had never suffered from breast cancer. The first 10 questions that had been answered by less than 40% of the examinees correctly were selected as pre-test and post-test awareness questions. To estimate the participants' level of knowledge, we gave a positive score to each correct answer, and zero score to incorrect answers. Therefore, individuals' knowledge scores ranged from 0 to 10 in both the pre-test and post-test. Moreover, the learning effect in each group was roughly calculated by the formula: "post-test score minus pre-test score divided by the pre-test score. To measure the participants' satisfaction, a 9-item questionnaire was given simultaneously with the third post-test. All the questionnaire items were based on a 5-point Likert scale. The satisfaction score of each participant was in the range of 9-45 in that the values ranged from 9 to 27 (low satisfaction), 27 to 36 (medium satisfaction) and 36 to 45 (high satisfaction), respectively, to ensure sufficient variation among the item scores.

In order to determine the validity of the questionnaire, after preparing the initial version, the questionnaire was distributed among ten university professors who practice and teach breast diseases; they reviewed and rated the questions. Then, the questionnaire was modified based on the received comments. To calculate the Cronbach's alpha coefficient of the questionnaire, the validated version of the questionnaire was distributed among 20 participants; and the Cronbach's alpha coefficient was calculated. The coefficient was higher than 0.9 in all dimensions of the questionnaire, and the alpha coefficient of the whole questionnaire was equal to 0.93, which indicated the high reliability of this tool.

In this study, as soon as the teaching process ended, the first post-test was given (post-test 1). After one month, both groups were retested (post-test 2). In the last step, after three months, the post-test was taken again by both groups (post-test 3), and the results of the four experiments were compared. To measure the participants' satisfaction, the 9-item questionnaire was given simultaneously with the third post-test.
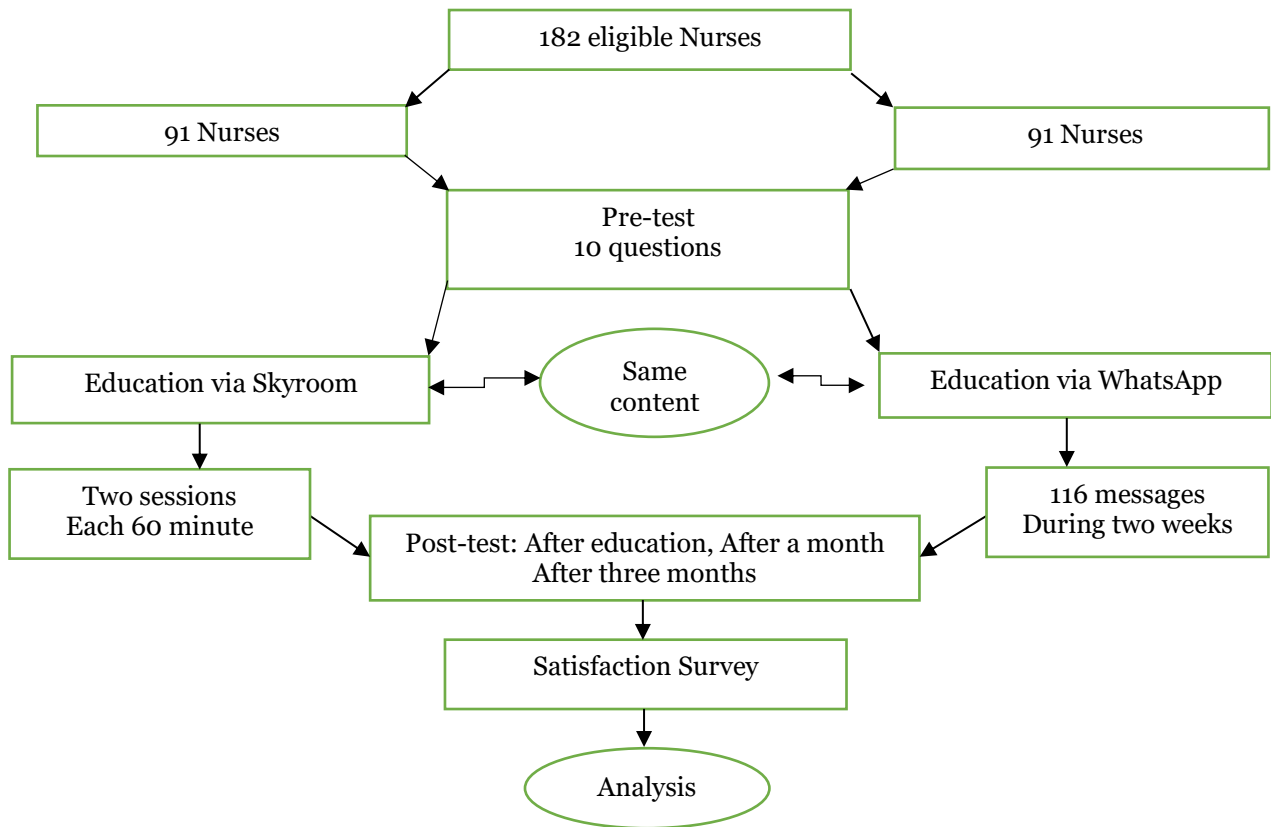

Figure 1. Diagram of the research procedure

2.5 Data analysis
The obtained data were analyzed using SPSS software and statistical tests. Analysis of variance was used to significantly analyze the differences between the scores obtained in each hospital. Test scores were classified and compared into four categories (pre-test, post-test1, post-test2, post-test3). Therefore, the difference in scores varied in different groups. Post-experimental tests were used to show significant differences between the groups. In this study, the method of true significant difference called Tukey test was used. Independent t-test was used to compare the scores of the Skyroom and WhatsApp groups in the pre-test stage. Moreover, the learning effect in each group was roughly calculated by the formula: "post-test score minus pre-test score divided by the pre-test score".

2.6 Ethical considerations
This study was approved by the Research Ethics Committee of Tehran University of Medical Sciences with the ethical code of IR.TUMS.IKHC.REC.1399.317. This study was informed to all participants, and an informed consent was signed by all of them prior to their participation.

3. Results
3.1 Characteristics of the samples and pre-test scores
A total of 182 nurses (91 in each group) working in two hospitals in Tehran participated in this study. However, two participants were excluded during the study, so the groups consisted of 90 nurses each. This exclusion occurred since the participants were unable to be involved in the measurement over time. In total, the participants ranged in age from 25 to 55. Table 1 shows the demographic characteristics and the rate of studying, use of social networks, and participation

in educational conferences in the two groups. There was a significant difference between the two groups in the pre-test stage. The average pre-test scores were 4.467 and 7.678 in the Skyroom and the WhatsApp group, respectively.

Table 1. Demographic characteristics of the samples and pre-test scores

Demographic characteristics	Categories	Skyroom group		WhatsApp group	
		f	%	f	%
Education	**B. S.	87	97	77	85
	***M.S.	3	3	13	15
Using social networks*	Never	3	3	2	2
	<1 hour	63	70	54	59
	>1 hour	24	27	34	38
Watching educational programs*	≤Once	27	30	10	11
	Twice to three times	55	61	55	62
	>Three times	8	9	25	27
Reading scientific subjects*	≤1 hour	19	21	12	13
	2-10 hours	65	72	68	75
	>10 hours	6	7	10	11
Participating in educational conferences*	Never	34	38	23	26
	1 to 3 times	46	51	50	54
	>3 times	10	11	17	19
Pretest score		4.467		7.678	

Notes: *times in a month, **Bachelor of Science, ***Master of Science

3.2 Differences in nurses' knowledge between the WhatsApp and Skyroom groups

The measurement of nurses' knowledge about breast cancer in the two groups (WhatsApp and Skyroom) was carried out several times. These measurements were conducted before the intervention (pretest), two weeks after the intervention (posttest 1), one month after the intervention (posttest 2), and three months after the intervention (posttest 3). The differences in the results of these measurements in the two groups are shown in Table 2.

Table 2. Differences in the level of nurses' knowledge about breast cancer between the pretest and serial posttests in the WhatsApp and Skyroom groups

Group	N	Mean (SD) WA	Mean (SD) SR	Std. Error WA	Std. Error SR	Lower Bound WA	Upper Bound WA	p	Lower Bound SR	Upper Bound SR	p
								95% CI			
Pretest	90	6.72 (1.60)	4.53 (1.52)	0.16	0.16	6.38	6.38	0.182	4.21	4.85	0.049
Postest 1	90	7.68 (1.44)	7.67 (1.17)	0.15	0.12	7.38	7.38		7.43	7.92	
Postest 2	90	7.50 (1.50)	6.72 (1.70)	0.15	0.18	7.18	7.18		6.36	7.08	
Postest 3	90	7.62 (1.24)	6.25 (1.71)	0.13	0.18	7.36	7.36		5.89	6.61	

N: number; WA: WhatsApp; SR: Skyroom; CI: Confidence Interval

The results in Table 2 indicate that nurses' knowledge in the Skyroom group increased in the first month; yet was followed by a decline afterward. The results revealed that the scores increased in post-test 1 and declined in post-test 2 and 3. However, all the obtained scores were higher than those of the pre-test. The scores in the WhatsApp group also increased in all the post-tests compared to the pre-test, but there was also a decrease at the end of the third month compared to the first month. Therefore, the scores varied in different groups.

The ANOVA test was conducted to examine differences in nurses' knowledge about breast cancer between the WhatsApp and Skyroom groups (Table 3). A further analysis was conducted to see the significance of differences in the level of nurses' knowledge about breast cancer between the WhatsApp and Skyroom groups (Table 4).

Table 3. Differences in nurses' knowledge about breast cancer between WhatsApp and Skyroom

	Training WhatsApp				
	Sum of Squares	df	Mean Square	F	*p*
Between Groups	54.10	3	18.03	8.52	0.000
Within Groups	753.00	356	2.11		
Total	807.10	359			
	Training Skyroom				
Between Groups	467.96	3	155.98	65.08	0.000
Within Groups	853.23	356	2.39		
Total	1321.19	359			

Table 4: Significance of the differences in scores between in WhatsApp and Skyroom groups

	Research variables	Average	Mean difference	Equality of variance	T	*p*
Training method (Pre-test)	WhatsApp	6.72	2.25	0.000	9.61	0.000
	Skyroom	4.53				
Training method (Post-test)	WhatsApp	7.62	0.044	0.000	0.22	0.000
	Skyroom	6.25				

Table 3 and Table 4 show a significant difference (*p*=0.000) in the nurses' knowledge levels before and after the intervention, as well as between WhatsApp and Skyroom groups.

3.3 Differences in the effect of the intervention on nurses' knowledge about breast cancer between WhatsApp and Skyroom

The results of the Tukey test showed that the scores in the first post-test had increased significantly, yet decreased significantly in the second and third post-tests. However, the scores increased compared to the pre-test, and there was no significant difference between post-test scores 2 and 3. The independent t-test was used to compare the scores of the Skyroom and WhatsApp groups in the pre-test stage. However, the difference in the mean scores of the first and second groups was not statistically significant immediately after the educational program (i.e., in post-test 1) (*p*=0.825). The results of Tukey's HSD test and Learning effect of teaching breast cancer through Skyroom and WhatsApp are presented in Table 5.

Table 5. The differences of learning effect between WhatsApp and Skyroom groups

Group	N	Subset for alpha = 0.05 SR			Learning effect SR	Subset for alpha = 0.05 WA			Learning effect WA
		1	2	3		1	2	3	
Pretest	90	4.53				6.72			
Posttest 1	90			7.67	0.729			7.68	0.142
Posttest 2	90		6.72		0.510		7.50		0.117
Posttest 3	90		6.25		0.398		7.62		0.098
Sig.		1.000	0.182	1.000		1.000	0.820	1.000	

Notes: N: Number; SR: Skyroom; WA: WhatsApp.

The results of the Tukey test showed that the scores in the post-test 1 have increased significantly, and in the second and third post-tests, have decreased significantly. However, the scores obtained have increased compared to the pre-test. This shows that the effectiveness of training in the first post-test in the Skyroom group is very high with an increase in the average score (from 4.53 to 6.25), while in the WhatsApp group, it has increased (from 6.72 to 7.62). Moreover, the learning effect in each group was roughly calculated by the formula: "post-test score minus pre-test score divided by the pre-test score".

The subjects' scores in the WhatsApp group increased relative to the pre-test one month after the test. This score did not change in the second post-test, but decreased at the end of the third post-test. A relatively similar trend was observed in the Skyroom group; however, the intensity of the decrease in scores was greater at the end of the third post-test. Based on the results, the learning effect in both groups had decreased over time. However, in the WhatsApp

group, it had decreased with a gentler slope; showing that the learning effect was more persistent in teaching via WhatsApp. Independent t-test was used to compare nurses' scores in the pre-test stage. The difference between the average scores of nurses in the two methods of Skyroom and WhatsApp was 2.25. It could be claimed that, with 95% confidence, the scores of nurses with WhatsApp method are significantly higher than nurses with Skyroom method.

3.4 Differences in nurses' satisfaction between WhatsApp and Skyroom groups

The independent t-test was used to compare the satisfaction of the Skyroom and WhatsApp training methods. The difference between the average satisfaction of nurses' education with Skyroom and WhatsApp methods was 0.456. The significant value of the observed difference was 0.546, which was greater than the error level of 5%. The t-statistic was 0.606, which was smaller than the critical value of 1.96. Hence, the difference between the observed means was not significant and no difference was observed in satisfaction of the two educational methods.

Table 6. Satisfaction rate and significance of satisfaction difference between two training methods in nurses

Satisfaction Rate	Skyroom group		WhatsApp group		T	Equality of variance	Mean difference	*p*
	n	%	n	%				
Low	20	22	15	17	0.606	0.03	0.456	0.546
Moderate	32	36	39	43				
High	38	42	36	40				
Total	90	100	90	100				
Average	31.10		30.64					

4. Discussion

The aim of this study was to compare the learning effect about breast cancer among nurses who were provided with two different methods of virtual training. There was a significant difference between the two groups in the pre-test stage. The average pre-test scores were 4.53 and 6.25 in the Skyroom and the WhatsApp group, respectively. This difference can be due to the difference in demographic characteristics between the two groups in terms of age and level of education, since the WhatsApp group nurses were younger with a higher level of education. This difference could also be due to the fact that the rate of monthly reading (75%), using social networks (38%) and participation in educational conferences (54%) were also higher among nurses in the WhatsApp group. Previous studies are consistent with the present finding. Kim et al. (2016) examined a sample of Korean women and concluded that greater use of social media increases access to educational content, thus increasing women's awareness of breast cancer. Freedman et al. (2016) pointed out the importance of using social media to increase awareness of breast cancer treatment methods. Nazeri et al. (2017) found that the learners' ability to use technological tools and their level of education were the most important statements from the perspective of all respondent groups. This result is most consistent with the characteristics of computer skills and content interaction that Selim (2007) has listed in his study. The usefulness of virtual modes and apps in educational programs, particularly WhatsApp, has already been illustrated (Cetinkaya, 2017; Gon & Rawekar, 2017; Sayan, 2016; Zulkanain et al., 2020). This role has also been compared with face-to-face classrooms for non-medical science.

In medical education, WhatsApp is gaining substantial interest and approval. Coleman and O'Connor (2019) have reviewed this matter and shown that this app is being used frequently, and is proving useful in this regard. WhatsApp has also been used in instructing health subjects at the community level. Kamel Boulos et al. (2016) reviewed the use of WhatsApp and Instagram in healthcare and quoted that these were useful in that setting, even in low-resource areas. Furthermore, Simons et al. (2018) evaluated the use of WhatsApp as a tool for offering social support in an eHealth program. They found out that groups formed in WhatsApp created a higher rate of participation than most other apps (Simons et al., 2018). Iftikhar and Abaalkhail (2017) also explored the attitude of people in response to medical data received via various media. They detected that WhatsApp was used more frequently than other media and that the information that had been shared on it affected the choices of users regarding the health of their families (Iftikhar & Abaalkhail, 2017). In addition, Maitra (2021) investigated if data shared in

WhatsApp could expand eye health awareness in a deprived area in India. The results showed that not only healthcare workers approved that method for delivering scientific data, but also general people had acquired a higher level of awareness (Maitra, 2021). Likewise, Alanzi et al. (2018) demonstrated that the knowledge of people about diabetes increased more significantly when educational messages were sent to them through WhatsApp. In this study, respondents' scores increased in the WhatsApp group in post-test 1; however, this increase was larger among nurses in the Skyroom group. In the last test, the obtained scores revealed that the learning effect in the WhatsApp group subjects had declined in reference to the first test; however, such decrease was larger in the Skyroom group. These findings depict that education offered through WhatsApp had a higher impact on learning stability. There are few studies comparing the effect of social networks on training. Yaros (2012) found that the training mode in social networks influenced the learning rate and its continuity.

The main findings of this study have demonstrated the positive effect of virtual education on learning about breast cancer and the higher durability of education offered via WhatsApp. Mobile education is a subset of e-learning and virtual education, and due to its special feature, has a significant role in education (Papzan & Soleimani, 2010). Numerous studies in the past have disclosed that training and discussions presented in virtual education effectively contribute to enhancing awareness and preventing breast cancer. For example, Attai et al. (2015) reported that the use of Twitter had a significant effect on increasing women's knowledge and awareness of breast cancer symptoms. Xiaosheng et al. (2018) also showed that virtual education was efficient tools to transfer breast cancer-related information among cancer survivors and healthy individuals. Also, the superiority of virtual education over speech has been shown in results of previous studies (Jabbari Byramy & Bakhshian, 2008; Khakbazan et al., 2008; Khandan, 2008).

This study also measured participants' satisfaction through the questionnaire that was given simultaneously with the third post-test. The results showed that nurses' satisfaction was higher in the WhatsApp group. Previous studies also showed positive attitude of the students towards virtual education (Khandaghi et al., 2009; Mirzaei et al., 2012; Mohammadi et al., 2008). Furthermore, Zolfaghari et al. (2011) also showed that the majority of students and educators had a positive attitude towards new educational technologies, including combined e-learning. The finding from previous studies is consistent with the results of the present study, showing the respondents' satisfaction with the use of virtual education.

5. Implications and limitations

With respect to the wideness of virtual method and numerous debates on their merits and drawbacks, the findings of the present study portrait one of the health-related applications of virtual methods. Since breast cancer is a highly prevalent, costly, and, at the same time, fatal disease among females in the country, the findings of this research can be applied to provide educational programs based on virtual method and social networks in order to enhance awareness and prevent the disease. Also, since there is no difference between respondents' satisfaction of the two methods for training nurses, both teaching methods provide can be used.

The statistical population to nurses in two hospitals is one of the most important limitations of the present study. It is suggested that future researchers review other educational programs, make messengers a priority in teaching and learning, and examining this training in other treatment categories. Considering the importance of these programs in higher education, it is recommended that programmers could design and produce a messaging program suitable for educational environments by examining important educational factors.

6. Conclusion

This study showed that teaching breast cancer to nurses via virtual modes has a positive learning effect, and that the durability of this effect is higher when the teaching material is delivered via WhatsApp, such as short videos, in comparison with virtual classes held through Skyroom. Primary prevention in the form of lifestyle changes, avoidance of risk factors and extensive education and information, especially through mass media such as radio, television and virtual media in order to raise awareness about breast cancer screening methods, is needed.

Author contribution

The authors confirm contribution to the paper as follows. FJ: Data collection, data analysis, manuscript preparation; SA: study conception and design, data analysis, manuscript preparation; FN: data analysis, manuscript preparation; SA: manuscript revision; TA: manuscript revision; AE: manuscript revision; SBS: data analysis and interpretation, MO: manuscript revision; DG: manuscript revision; FDA: manuscript revision. All authors approved the final version of the manuscript.

Conflict of interest

The authors declare that they have no conflict of interest (financial and non-financial).

References

Akbari, A., & Gabdulhakov, R. (2019). Platform surveillance and resistance in Iran and Russia: The case of telegram. *Surveillance & Society, 17*(1/2), 223-231.

Andreoli, T., & Cecil, R. (2007). *Blood diseases and cancer* (M. Jafari M, Trans; A. Firoz-Abadi, Eds). Tehran: Andisheh Rafi.

Alanzi, T., Bah, S., Alzahrani, S., Alshammari, S., & Almunsef, F. (2018). Evaluation of a mobile social networking application for improving diabetes type 2 knowledge: An intervention study using WhatsApp. *Journal of Comparative Effectiveness Research, 7*(09), 891-899. https://doi.org/10.2217/cer-2018-0028.

Atoum, M., & Alzoughool, F. (2017). Vitamin D and breast cancer: Latest evidence and future steps. *Breast Cancer: Basic and Clinical Research, 11*, 1178223417749816. https://doi.org/10.1177/1178223417749816

Attai, D. J., Cowher, M. S., Al-Hamadani, M., Schoger, J. M., Staley, A. C., & Landercasper, J. (2015). Twitter social media is an effective tool for breast cancer patient education and support: patient-reported outcomes by survey. *Journal of Medical Internet Research, 17*(7), e4721. https://doi.org/10.2196/jmir.4721

Blasiak, J., Pawlowska, E., Chojnacki, J., Szczepanska, J., Fila, M., & Chojnacki, C. (2020). Vitamin D in triple-negative and BRCA1-deficient breast cancer—implications for pathogenesis and therapy. *International Journal of Molecular Sciences, 21*(10), 3670. https://doi.org/10.3390/ijms21103670

Cetinkaya, L. (2017). The impact of WhatsApp use on success in education process. *International Review of Research in Open and Distributed Learning, 18*(7). https://doi.org/10.19173/irrodl.v18i7.3279

Coleman, E., & O'Connor, E. (2019). The role of WhatsApp® in medical education; A scoping review and instructional design model. *BMC Medical Education, 19*(1), 1-13. https://doi.org/10.1186/s12909-019-1706-8

Delavar, S., & Ghorbani, M. (2011). The role of virtual training on the students creative learning in universities of Bojnourd, northeast Iran. *Interdisciplinary Journal of Virtual Learning in Medical Sciences, 2*(3), 17-27.

Döbrössy, B., Girasek, E., Susánszky, A., Koncz, Z., Győrffy, Z., & Bognár, V. K. (2020). "Clicks, likes, shares and comments" A systematic review of breast cancer screening discourse in social media. *PloS One, 15*(4), e0231422. https://doi.org/10.1371/journal.pone.0231422

Eghtedar, S., Moghadasyan, S., Ebrahimi, H., & Haydari, S. (2012). Assessment of quality of life and supportive care in women with. *Advances in Nursing & Midwifery, 21*(75), 33-40.

Faramarzi, A., Jahromi, M. G., Ashourzadeh, S., & Jalilian, N. (2021). Metastatic and pathophysiological characteristics of breast cancer with emphasis on hereditary factors. *Central Asian Journal of Medical and Pharmaceutical Sciences Innovation, 1*(3), 104-113. https://doi.org/10.22034/CAJMPSI.2021.03.01

Freedman, R. A., Viswanath, K., Vaz-Luis, I., & Keating, N. L. (2016). Learning from social media: utilizing advanced data extraction techniques to understand barriers to breast cancer treatment. *Breast cancer research and treatment, 158*(2), 395-405. https://doi.org/10.1007/s10549-016-3872-2

Fini, A. (2008). Survey on professors and student's attitude about virtual learning in Iran universities. *International Journal of Education and Information Technologies, 2*(1), 31-35.

Gon, S., & Rawekar, A. (2017). Effectivity of e-learning through WhatsApp as a teaching learning tool. *MVP Journal of Medical Sciences, 4*(1), 19-25. https://doi.org/10.22034/CAJMPSI.2021.03.01

Hooman, H. A. (2007). Understanding the scientific method in the behavioral sciences. *Tehran: Samt*, 259-260.

Iftikhar, R., & Abaalkhail, B. (2017). Health-seeking influence reflected by online health-related messages received on social media: Cross-sectional survey. *Journal of Medical Internet Research, 19*(11), e382. https://doi.org/10.2196/jmir.5989

Jabbari Byramy, H., & Bakhshian, F. (2008). Comparison of two-person non-person training methods to prevent transmission of obstetrics and gynecology outpatient units. *Journal of Medical Research, 18*(4), 259-264.

Kadoić, N., & Redep, N. B. (2015). *Methodology for online study program development-case study ePITUP.* 2015 38th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO). https://doi.org/10.1109/MIPRO.2015.7160411

Kamel Boulos, M. N., Giustini, D. M., & Wheeler, S. (2016). Instagram and WhatsApp in health and healthcare: An overview. *Future Internet, 8*(3), 37. https://doi.org/10.3390/fi8030037

Khakbazan, Z., Jamshidi, F., Abbass, M., & Damghanian, M. (2008). Comparison of the effects of two teaching methods (lectures-training packages) on their knowledge about puberty health. *Journal of Nursing Midwifery and Science-Life Research, 14*(1), 41-48.

Khandaghi, A., Hosseinzadeh, M., & Pour Smaeil, F. (2009). Evaluation of students attitudes of Mashhad University of Medical Sciences about virtual education of organization that conducted the study in it: Educational Development Center Mashhad University of Medical Sciences. *Green Journal: Special Journal of Education in Medical Science, 6*, 283.

Khandan, M. (2008). *E-learning impact on type 2 diabetic patients self care centers of Kerman University of diabetes* [Master's Thesis, Kerman University of Medical Sciences]. Available from: www. irct. ir.[Persian]

Khodabandelou, R., Amoozegar, A., & Pourjafarian, Z. (2021). COVID-19 and online behaviors in higher education: A comparative study of an Iranian, Omani and Malaysian Universities. *International Journal of Research in Educational Sciences, 4*(1), 271-284.

Kim, E., Hou, J., Han, J. Y., & Himelboim, I. (2016). Predicting retweeting behavior on breast cancer social networks: Network and content characteristics. *Journal of Health Communication, 21*(4), 479-486. https://doi.org/10.1080/10810730.2015.1103326

Kotrlik, J., & Higgins, C. (2001). Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal, 19*(1), 43.

Liu, Y., Zhang, J., Huang, R., Feng, W.-L., Kong, Y.-N., Xu, F., Zhao, L., Song, Q.-K., Li, J., & Zhang, B.-N. (2017). Influence of occupation and education level on breast cancer stage at diagnosis, and treatment options in China: A nationwide, multicenter 10-year epidemiological study. *Medicine, 96*(15). https://doi.org/10.1097/MD.0000000000006641

Mirzaei, M., Ahmadipour, F., & Azizian, F. (2012). Viewpoints of students of Shahid Sadoughi University of Medical Sciences towards e-Learning in teaching clinical biochemistry. *The Journal of Medical Education and Development, 7*(2), 67-74.

Moursy, A. M. E.-S., & Ead, A. Y. S. (2014). Self care practices of chemotherapy patients. *Life Science Journal, 11*(4), 212-222.

Maitra, C. (2021). *WhatsApp in health communication: The case of eye health in deprived settings in India Manchester metropolitan university* [Doctoral Dissertation, Manchester Metropolitan University].

Mefolere, K. F. (2016). WhatsApp and information sharing: Prospect and challenges. *International Journal of Social Science and Humanities Research, 4*(1), 615-625.

Mohammadi, D., Hosseini, M., Shabanali Fami, H., Rajab beigi, M., & Isaee, M. T. (2008). An analysis of the attitude of instructors towards E-learning in agricultural applied science education in Iran. *Iranian Journal of Agricultural Economics and Development, 39*(1), 99-109.

Nzali, M. D. T., Bringay, S., Lavergne, C., Mollevi, C., & Opitz, T. (2017). What patients can tell us: topic analysis for social media on breast cancer. *JMIR medical informatics, 5*(3), e7779 . https://doi.org/10.2196/medinform.7779

Nastasi, A., Bryant, T., Canner, J. K., Dredze, M., Camp, M. S., & Nagarajan, N. (2018). Breast cancer screening and social media: A content analysis of evidence use and guideline opinions on Twitter. *Journal of Cancer Education, 33*(3), 695-702.

Nazeri, N., Dorri, S., & Atashi, A. (2017). The effective factors on success of e-learning in medical sciences fields. *Journal of Health and Biomedical Informatics, 4*(2), 98-107.

Papzan, A., & Soleimani, A. (2010). Comparison of the effect of two training methods from teaching by mobile phone and lecturing on students learning rate. *Journal of Information and Communication Technologies in Educational Science, 1,* 55-65.

Reimers, F. M., & Schleicher, A. (2020). *A framework to guide an education response to the COVID-19 Pandemic of 2020*. OECD. Retrieved April 14, 2020.

Sayan, H. (2016). Affecting higher students learning activity by using WhatsApp. *European Journal of Research and Reflection in Educational Sciences, 4*(3).

Selim, H. M. (2007). Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education, 49*(2), 396-413. https://doi.org/10.1016/j.compedu.2005.09.004

Seyyedi, N., Rahimi, B., Eslamlou, H. R. F., Afshar, H. L., Spreco, A., & Timpka, T. (2020). Smartphone-based maternal education for the complementary feeding of undernourished children under 3 years of age in food-secure communities: Randomised controlled trial in Urmia, Iran. *Nutrients, 12*(2), 587. https://doi.org/10.3390/nu12020587

Shahbeigi, F., & Nazari, S. (2012). Virtual education: Benefits and limitations. *The Journal of Medical Education and Development, 6*(1), 47-54.

Simons, L. P., van den Heuvel, W. A., & Jonker, C. M. (2018). *eHealth WhatsApp Group for Social Support: Preliminary Results*. Bled eConference. https://doi.org/10.18690/978-961-286-170-4.14

Tahergorabi, Z., Moodi, M., & Mesbahzadeh, B. (2014). Breast Cancer: A preventable disease [Review]. *Journal of Birjand University of Medical Sciences, 21*(2), 126-141.

Tage, P. K. S., Berkanis, A. T., Betan, Y., & Pinis, E. B. (2021). A qualitative study on nurses' experiences of reporting patient safety incidents in East Nusa Tenggara, Indonesia. *Nurse Media Journal of Nursing, 11*(3), 359-369. https://doi.org/10.14710/nmjn.v11i3.38400

Wang, L. (2009). *Effectiveness of text-based mobile learning applications: Case studies in tertiary education* [Master's Thesis, Massey University].

Xiaosheng, D., Xiangren, Y., Shuyuan, H., Dezong, G., Mengyao, C., & Meng, D. (2018). The effects of combined exercise intervention based on Internet and social media software for postoperative patients with breast cancer: Study protocol for a randomized controlled trial. *Trials, 19*(1), 1-8.

Yaros, R. A. (2012). Social media in education: Effects of personalization and interactivity on engagement and collaboration. *Social Media: Usage and Impact,* 57-74.

Zolfaghari, M., Negarandeh, R., & Ahmadi, F. (2011). The evaluation of a blended e-learning program for nursing and midwifery students in Tehran University of Medical Sciences. *Iranian Journal of Medical Education, 10*(4), 398-409.

Zulkanain, N. A., Miskon, S., & Abdullah, N. S. (2020). An adapted pedagogical framework in utilizing WhatsApp for learning purpose. *Education and Information Technologies, 25*(4), 2811-2822. https://doi.org/10.1007/s10639-019-10096-0

NurseMedia
JOURNAL OF NURSING

ORIGINAL RESEARCH

Nursing Students' Perception of the Educational Environment in a Public University in Ahvaz, Iran: A Study Based on DREEM Questionnaire

Dariush Rokhafrooz[1], Zhila Alborzi[2], Sima Sadat Ghaemi Zade Shustari[3], Meysam Heydari[4]

[1]Assistant-Professor, Department of Nursing, School of Nursing and Midwifery, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[2]Student Research Committee, School of Nursing and Midwifery, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[3]PhD Student in Nursing, School of Nursing and Midwifery, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[4]PhD Student of Medical Education, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran

Article Info	Abstract
  Corresponding Author: Dariush Rokhafrooz Assistant Professor Department of Nursing, School of Nursing and Midwifery, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran Email: Darushrokhafroz@gmail.com	**Background:** Students' perception of educational environment is an important factor in evaluating the quality of education as it provides invaluable resources to identify the strengths and weaknesses of educational environment. However, there is a paucity of information regarding the educational environment from the perceptions of nursing students in Iran. **Purpose:** This study aimed to investigate nursing students' perception of the educational environment and compare the male and female students' perceptions of the educational environment in a public university in Ahvaz, Iran. **Methods:** A cross-sectional study was conducted among 130 nursing students in a public university in Ahvaz, Iran, using the Dundee Ready Educational Environment Measure (DREEM) questionnaire. Convenient sampling was used to recruit the samples. For the data analysis, the independent t-test was utilized. **Results:** The overall mean (SD) DREEM score in this study was 105.01(22.00), indicating a more positive educational environment than negative. The highest mean (SD) DREEM score was related to *Students' Perceptions of Learning* domain 24.03(6.01), while the lowest one was related to *Students' Social Self-Perceptions* domain 14.01(4.00). The female students showed significantly better mean score in the domains of *Students' Academic Self-Perception* and *Students' Social Self-Perception* than males ($p<0.05$). **Conclusion:** The students' perception of their educational environment is a positive and optimistic one. Therefore, it is suggested that students' perceptions of the educational environment be measured regularly, for instance, at the end of each academic year, to create a healthy and effective environment for learning in the educational environment.

1. Introduction

In recent years, in order to improve the quality of nursing education, attention to the views and perceptions of nursing students as one of the main stakeholders of the nursing education program has grown significantly (Shrestha et al., 2019). The educational environment is one of the most effective factors in the quality of education and consequently in the quality of learning of nursing students (Akdeniz et al., 2019). In this regard, several learning theories have pointed to the relationship between learning and the educational environment; one of the most famous of which is the theory of experiential learning (Rawas & Yasmeen, 2019). According to the experiential learning theory, the educational environment is an important factor in the teaching-learning process that can have a tremendous impact on students' learning outcomes (Kolb, 1984).

The educational environment refers to various physical sets, contexts, and values in which students receive an education. Significant effects of educational environment on knowledge, attitude, and skills of medical students were mentioned in several studies (Patil & Chaudhari, 2016; Akdeniz et al., 2019). Approximately 50% of nursing school's time is devoted to clinical

activities. In the clinical environment, focusing on the student's learning needs and creating an appropriate learning environment should be allowed to progress and ensure their competence in clinical skills (Victor et al., 2017). Nowadays, in the clinical education environment, variables such as the content of the delivered curriculum, teaching methods, and the students who graduate as manpower from the university affect clinical education. At the same time, the impact of the educational programs can be provided through the learning environment (Frothagh & Gourchian, 2019). Emanuel and Pryce-Miller (2013) introduced the appropriate clinical environment as an essential part of nursing education. Furthermore, Kaphagawani and Useh (2013) also suggested that students have opportunities to practice what they have learned in theoretical classes in a clinical setting. In their study, they refer to the guided clinical environment as a supportive environment with good communication. Therefore, more attention and importance to clinical education in nursing and awareness of its concepts, obstacles, and problems has a significant impact on students' learning and acceptance of the professional role of nursing (Bjerkvik & Hilli, 2019).

According to the World Federation of Medical Education (1998), one of the main tools for evaluating the success or failure of a medical education program is to evaluate the educational environment. Therefore, in order to identify the strengths and weaknesses of the educational environment of an educational institution, regular evaluation of the educational environment is very important (Kaur et al., 2021). In addition, students' perceptions regarding their educational environment play important role in developing and reforming the nursing curriculum (Bakhshialiabad et al., 2019). Nursing students' perception of their educational environment has been reported in many studies. For instance, the results of a study in Sri Lanka showed that nursing students' perceptions of their educational environment were more positive than negative (Jayaweera et al., 2021). The results of a study conducted in Eastern Nepal also showed that nursing students' perceptions of their educational environment were positive (Shrestha et al., 2019). While in a study in Saudi Arabia, nursing students revealed the positive and negative aspects of their learning environment (Rawas & Yasmeen, 2019). A previous study also revealed that there was a positive correlation between students' perception of the educational environment and their gender discrepancies (Kaur et al., 2021).

Several methods have been used by medical educators to assess and analyze students' perceptions about the specific educational environment in medical institutes, such as Learning Environment Questionnaire (LEQ), Learning Environment Assessment (LEA), Medical School Environment Inventory (MSEI), Learning Environment Survey (LES), and Dundee Ready Educational Environment Measure (DREEM). DREEM inventory is one of the most practical and widely used tools for evaluating educational environments, including theoretical and clinical environments (Jeyashree et al., 2018). The DREEM is specifically designed to measure the undergraduate medical and nursing educational environment (Salih et al., 2018).

Nursing is one of the most important branches of medical sciences that require scientific and professional skills at high levels. One of the scientific methods to evaluate the quality of clinical education in this field is to examine the opinions and views of students in this field as the main stakeholders of such education (Yoo & Kim, 2019). As medical teachers, the educators are continuously thinking about improving medical education or curriculum by adding or modifying teaching and learning methods. However, students' views on these aspects can provide significant and beneficial information concerning the strengths and weaknesses of the educational environments. This is especially useful for nursing students who spend much of their activities in the clinical education environment.

Although in many studies, students' perceptions of the educational environment have been reported (Shrestha et al., 2019), in Iran, only two nursing schools in Tehran (Imanipour et al., 2015) and Rafsanjan (Hamid et al., 2013) studied the perception of nursing students toward the educational environment. Therefore, there was a paucity of information regarding this issue in many nursing schools in Iran, including Ahvaz. Also, based on the knowledge of the authors of this study, no study was found that focused on the perception of third and fourth-year nursing students regarding the educational environment. For this reason, the researchers in this study decided to evaluate the perceptions of third and fourth-year nursing students, instead of the first and second ones, about their educational environment. It was with a consideration that these students have spent more time in the clinical educational environment than first and second-year students and, therefore, have a more comprehensive view of their clinical and theoretical

educational environment. Accordingly, this study was conducted to seek the perceptions of nursing students toward their educational environment in a public university in Ahvaz, Iran.

2. Methods

2.1 Research design
The present study used a cross-sectional, questionnaire-based study design.

2.2 Setting and samples
This study was conducted in a public university in Ahvaz, Iran in the academic year of 2017-2018. For this study, the online Raosoft sample size calculator was used to estimate the sample size (Al-Balas et al., 2020). In the university where the study took place, with a total of third and fourth-year nursing students of 198, and based on a 50% response distribution, a confidence interval of 95%, and a margin of error of 5%, the most extensive required sample size is 130. Therefore, 130 undergraduate nursing students from the 5th, 6th, 7th, and 8th semesters were selected by convenience sampling. The inclusion criteria were the enrolled nursing students in their third and fourth-years in the academic year of 2017-2018. Students who had filled the questionnaire incompletely and those who were guest students were excluded from the study.

2.3 Measurement and data collection
This study utilized the DREEM questionnaire as one of the tools developed specifically to assess the educational environment of medical institutions as perceived by the students (Bakhshialiabad et al., 2019). DREEM consists of 50 items, where each answer was given a point based on a five-point Likert scale (strongly disagree = 0, disagree = 1, unsure = 2, agree = 3, strongly agree = 4). Out of a total of 50 questions, nine negative items were scored in a reverse manner before analysis and interpretation (items 4, 8, 9, 17, 25, 35, 39, 48, and 50) (Bakhshialiabad et al., 2019). Demographic information, including age and gender, was added to the questionnaire.

The maximum score for the overall DREEM is 200, and the following five domains:
(1) the maximum score for the Students' Perceptions of Learning (SPL) is 48;
(2) the maximum score for the Students' Perceptions of Teachers (SPT) is 44;
(3) the maximum score for the Students' Academic Self-Perceptions (SASP) is 32;
(4) the maximum score for the Students' Perceptions of the Atmosphere (SPA) is 48;
(5) the Students' Social Self-Perceptions (SSSP): 7 items; maximum score is 28.
The interpretation of the DREEM questionnaire is detailed in Table 1.

Previous studies have assessed the face and content validity of the DREEM questionnaire (Roff et al., 1997; Soltani Arabshahi et al., 2008). Cronbach's alpha coefficient was used to determine its reliability (determination of internal consistency), and the total reliability of the questionnaire was reported to be 0.89. In this study, the Farsi version of the DREEM questionnaire from Koohpayehzadeh et al. (2014) was used. The validity and reliability of the Persian version of the DREEM questionnaire were assessed. The content validity index (CVI) was 0.39, and the mean of test-retest reliability of was 0.71; the consistency reliability was in an acceptable range (Koohpayehzadeh et al., 2014).

2.4 Data analysis
Data were analyzed using the statistical package SPSS version 21.00 (IBM Corp., Armonk, USA). To define the sample, variables were expressed as mean and standard deviation, median (minimum-maximum), and categorical variables such as number and percentage. The independent sample t-test was used for comparative analysis of the differences between the males and the females. $P<0.05$ was considered to be significant. The numerical differences between the males and the females were analyzed with the independent t-test.

2.5 Ethical considerations
The ethical approval of the study was obtained from the research committee of Ahvaz Jondishapur School of Nursing and Midwifery (IR.AJUMS.REC.1396.61). The study materials included a personal characteristics information sheet, a consent form, and questionnaires were distributed to each nursing student during break time. The researcher explained the aim of the present study to the nursing students. Students were asked to read and sign an informed

consent form before completing the questionnaire. The participation of all students was voluntary basis.

Table 1. Score interpretation of mean subscales and total DREEM scores

Area	Score	Interpretation
Total DREEM score	0-50	Very poor
	51-100	Significant problems
	101-150	More positive than a negative
	151-200	Excellent
Perception of learning	0-12	Very poor
	13-25	Negative view of teaching
	25-37	More positive than negative view
	37-40	Teaching highly regarded
Perception of teaching	0-11	Very poor
	12-22	Re-education required
	23-33	Moving in the right direction
	34-44	Model Instructors
Academic self-perception	0-8	Feelings of total failure
	9-16	Many negative aspects
	17-24	More positive than negative perception
	25-32	Confident
Perception of atmosphere	0-12	Very poor environment
	13-24	Many issues need changing
	25-36	More positive than negative attitude
	37-48	Good feeling overall
Social self-perception	0-7	Miserable
	8-14	Negative perception
	15-21	More positive than negative
	22-28	Very good perception
Individual items (non-negative)	<2	Problem area
	2-3	Could be enhanced
	3-3.5	Positive aspect
	>3.5	Excellent

3. Results

3.1 *Socio-demographic and DREEM questionnaire profile of nursing students*

As many as 130 nursing students participated in the study. The mean age of the participants was 21.84(1.31) years. Furthermore, 84 (64%) of students were females, and 46 (35%) of them were males.

As presented in Table 2, the mean overall DREEM score was 105.01(22.00). The perception of the male nursing students toward their educational environment was more positive than female nursing students, but the differences were not statistically significant (p=0.097). The result of these scores reveals that students' perceptions about their educational environment are more positive than negative. According to the results in Table 2, students did not give any item a score ≥3. In the SPL subscale, students scored 6 out of 12 items (items 1, 7,13, 24, 25, 48), in the SASP subscale, 2 out of 8 items (items 21, 26), in the SPA subscale, 4 out of 12 items (items 11, 12, 17, 42), and in the SSSP subscale 3 out of 7 items (items 3, 4, 14) less than 2.

3.2 *Students' perception of educational environment based on the gender*

Regarding the educational environment, the male students' perceptions were more positive than the female students' perceptions, but this was not statistically significant (p=0.097). Regarding the students' perception of atmosphere, the female students' perceptions were statistically more than the male students' perceptions (p=0.025). However, student's social self-perception of male students was comparatively better than female students (p=0.046). Table 3 presented the comparison of score between male (n=46) and female (n=84) nursing students.

Table 2. Analysis of all items of the DREEM questionnaire and their interception

According to subscales	Male Mean(SD)	Female Mean(SD)	Total Mean(SD)	Interception
Subscales 1: Students' Perceptions of Learning Total score: 24.03(6.0)				
1. I am encouraged to participate in Class	2.04(1.00)	1.01(1.07)	1.01(1.09)	Problem area
7. The teaching is often stimulating	1.00(1.03)	1.01(1.08)	1.09(1.02)	Problem area
13. The teaching is student-centered	1.02(1.01)	1.00(0.00)	1.03(1.07)	Problem area
16. The teaching helps to develop my competence	2.06(1.02)	2.03(1.07)	2.00(1.09)	Could be enhanced
20. The teaching is well focused	2.00(0.00)	2.01(0.00)	2.05(0.00)	Could be enhanced
22. The teaching helps to develop my confidence	2.01(1.07)	1.00(1.02)	2.03(1.05)	Could be enhanced
24. The teaching time is put to good use	2.02(1.01)	1.00(1.09)	1.01(1.01)	Problem area
25. The teaching over-emphasizes factual learning	1.03(1.02)	2.08(0.00)	1.03(1.05)	Problem area
38. I'm clear about the learning objectives of the course	2.00(1.09)	2.01(0.00)	2.06(0.00)	Could be enhanced
44. The teaching encourages me to be an active learner	2.07(1.05)	2.07(0.00)	2.04(0.00)	Could be enhanced
47. Long term learning is emphasized over short term learning	2.01(1.06)	2.04(0.00)	2.02(0.00)	Could be enhanced
48 The teaching is too teacher-centered	1.00(0.00)	1.08(0.00)	1.01(0.00)	Problem area
Subscales 2. Students' Perceptions of Teachers Total score: 24.0(5.0)				
2. The teachers are knowledgeable	2.02(1.01)	2.00(1.02)	2.04(1.07)	Could be enhanced
6. The teachers adopt a patient-centered approach to consulting	2.05(1.00)	2.08(0.00)	2.05(1.03)	Could be enhanced
8. The teachers ridicule the students	2.01(1.06)	2.02(1.07)	2.00(1.01)	Could be enhanced
9. The teachers are authoritarian	2.06(1.06)	2.09(0.00)	2.02(0.00)	Could be enhanced
18. The teachers have good communication skills with patients	2.01(1.00)	2.05(1.02)	2.03(1.09)	Could be enhanced
29. The teachers are good at providing feedback to students	2.08(1.01)	1.04(0.00)	2.01(1.07)	Could be enhanced
32. The teachers provide constructive criticism here	2.07(1.05)	2.05(0.00)	2.09(1.03)	Could be enhanced
37. The teachers give clear examples	2.03(1.09)	2.06(0.00)	2.01(0.00)	Could be enhanced
39. The teachers get angry at teaching	2.03(1.01)	2.05(0.00)	2.06(1.01)	Could be enhanced
40. The teachers are well-prepared for their teaching sessions	2.02(1.02)	2.07(0.00)	2.03(1.05)	Could be enhanced
50. The students irritate the teachers	2.02(1.00)	2.05(1.08)	2.01(1.00)	Could be enhanced
Subscales 3. Students' Academic Self-Perceptions Total score: 17.0(4.0)				
5. Learning strategies that worked for me before continue to work now	1.00(1.09)	2.01(1.04)	2.04(1.01)	Could be enhanced
10. I am confident about my passing this year	2.06(1.05)	2.02(1.06)	2.05(1.00)	Could be enhanced
21. I feel I am being well prepared for my profession	2.02(1.04)	1.01(1.09)	1.02(1.03)	Problem area
26. Last year's work has been a good preparation for this year's work	1.03(1.00)	1.02(0.00)	1.01(1.04)	Problem area
27. I am able to memorize all I need	2.03(1.02)	2.01(1.01)	2.05(1.01)	Could be enhanced
31. I have learnt a lot about empathy in my profession	2.01(1.01)	2.05(0.00)	2.06(0.00)	Could be enhanced
41. My problem-solving skills are being well developed here	2.08(1.01)	2.07(2.02)	2.09(0.00)	Could be enhanced

Table 2. Continued

According to subscales	Male Mean(SD)	Female Mean(SD)	Total Mean(SD)	Interception
45. Much of what I have to learn seems relevant to a career in health	2.05(1.03)	2.05(0.00)	2.01(1.01)	Could be enhanced
Subscales 4. Students' Perceptions of Atmosphere Total score:24.0(5.0)				
11. The atmosphere is relaxed during ward teaching	1.00(1.00)	1.02(0.00)	1.01(1.04)	Problem area
12. This school is well time-tabled	1.04(1.05)	1.01(1.01)	1.04(1.01)	Problem area
17. Cheating is a problem in this school	1.02(1.01)	1.05(1.03)	1.06(1.03)	Problem area
23. The atmosphere is relaxed during lectures	2.05(0.00)	2.03(0.00)	2.02(0.00)	Could be enhanced
30. There are opportunities for me to develop my interpersonal skills	2.03(1.01)	2.04(0.00)	2.03(1.00)	Could be enhanced
33. I feel comfortable in class socially	2.03(1.00)	2.06(0.00)	2.07(1.05)	Could be enhanced
34. The atmosphere is relaxed during class/seminars/tutorials	2.06(1.01)	2.07(0.00)	2.09(0.00)	Could be enhanced
35. I find the experience disappointing	2.09(1.08)	2.03(0.00)	2.04(0.00)	Could be enhanced
36. I am able to concentrate well	2.07(1.03)	1.01(1.04)	2.03(1.09)	Could be enhanced
42. The enjoyment outweighs the stress of the course	1.01(1.02)	1.09(0.00)	1.05(1.02)	Problem area
43. The atmosphere motivates me as a learner	1.00(1.06)	2.02(0.00)	2.00(1.01)	Could be enhanced
49. I feel able to ask the questions I want	2.01(1.01)	2.02(0.00)	2.06(1.04)	Could be enhanced
Subscales 5. Students' Social Self-Perceptions Total score: 14.0(4.0)				
3. There is a good support system for students who get stressed	1.02(1.00)	1.00(0.00)	1.01(1.01)	Problem area
4. I am too tired to enjoy the course	1.00(1.07)	1.05(1.01)	1.03(1.01)	Problem area
14. I am rarely bored in this course	1.05(1.02)	1.01(1.02)	1.04(1.03)	Problem area
15 I have good friends in this course	2.03(1.01)	2.09(1.05)	2.01(1.05)	Could be enhanced
19. My social life is good	2.01(1.08)	2.03(0.00)	2.01(1.02)	Could be enhanced
28. I seldom feel lonely	2.01(1.05)	1.02(1.06)	2.02(1.03)	Could be enhanced
46. My accommodation is pleasant	1.03(1.08)	2.02(1.07)	2.09(1.02)	Could be enhanced
Total mean score: 105.01(22.0)				

Note: M=Mean; SD=Standard Deviation

Table 3. Comparison of percentage scores of the DREEM scale and subscale

DREEM domain (Ideal mean score)	Gender	Mean(SD)	Median	Min	Max	*p*-value[a]
Students' perception of learning (48)	Male	24.03(7.01)	25	8	40	
	Female	23.01(6.05)	24	3	38	0.094
Students' perception of teachers (44)	Male	25.04(6.00)	26	8	39	
	Female	24.06(4.02)	25	11	31	0.087
Students' academic self-perception (32)	Male	17.01(4.04)	18	0	28	
	Female	18.04(4.01)	18	9	31	0.025*
Students' perception of atmosphere (48)	Male	25.07(6.03)	26	9	41	
	Female	23.08(5.01)	24	8	36	0.099
Students social self-perception (28)	Male	15.02(5.04)	26	9	41	
	Female	23.07(5.02)	24	8	36	0.046*
Overall maximum mean score (200)	Male	108.03(27.04)	107	33	171	
	Female	103.01(20.05)	105	47	163	0.097

[a] independent t-test

3.3 DREEM's subscales interpretation

To analyze the subscales of the DREEM questionnaire, we used the score interpretations suggested by Roff et al. (1997). In this regard, 61% of students believed that their learning environment was positive (59% more positive than negative and 2% excellent). Nevertheless, 36% of students said that their learning environment has significant problems. Furthermore, eventually, only 1% of students thought that their learning environment was very poor. Table 4 shows the analysis of the students' responses to the subscales.

Table 4. Mean scores according to the total and subscales of the DREEM, and interpretation of the DREEM subscales

Total and subscales of DREEM	Mean(SD)	Median (Min-Max)	Interpretation of subscale (Min-Max)	f(%)
Total score of all (Max score: 200) Score (%)	105.01(22.00) 52.5%	106 (33-171)	Very poor (0–50) Significant problem (51–100) More positive than negative (101–150) Excellent (151–200)	2(1) 48(36) 77(59) 3(2)
Students' Perceptions of Learning (max score 48) Score (%)	24.03(6.01) 50.6%	24 (3-40)	Very poor (0–12) Negatively viewed teaching (13–24) A more positive perception (25–36) Teaching highly regarded (37–48)	9(6) 56(43.1) 59(45) 6(4)
Students' Perceptions of Teachers (max score 44) Score (%)	24.02(5.01) 54.54%	26 (8-39)	Abysmal (0–11) In need of some retraining (12–22) Moved the right direction (23–33) Model teachers (34–44)	2(1) 37(28) 85(65) 6(4)
Students' Academic Self-Perceptions (max score 32) Score (%)	17.06(4.02) 53.12%	17 (0-28)	Feeling of total failure (0–8) Many negative aspects (9–16) Feeling more on the positive side (17–24) Confident (25–32)	1(0) 47(36) 75(57) 7(5)
Students' Perceptions of Atmosphere (max score 48) Score (%)	24.04(5.01) 50%	24 (8-41)	Very poor environment (0–12) Many issues need changing (13–24) A more positive attitude (25–36) A good overall feeling (37–48)	3(2) 67(51) 57(43) 3(2)
Students' Social Self-Perceptions (max score 28) Score (%)	14.01(4.00) 50%	15 (0-26)	Miserable (0–7) Not a nice place (8–14) Not too bad (15–21) Very good socially (22–28)	10(7) 50(38) 65(50) 5(3)

4. Discussion

This study aimed to evaluate the perceptions of nursing students about their educational environment in a public university in Ahvaz, Iran. The researchers selected the 3rd and 4th year nursing students since these students spend most of their time in the clinical environment, and therefore, they had a more comprehensive view of the clinical and theoretical educational environment.

The overall score for all subscales of DREEM in this study came out to be 105.01(22.00). The present study revealed that the overall mean score of nursing student perception towards their educational environment was within the "more positive than negative" category. Therefore, the present findings showed that the educational environment from the perception of nursing students is only one step away from the excellent category. The findings of the current study were comparable to those of the DREEM studies among nursing students in Egypt (115.00) (Abusaad et al, 2015), Palestine (113.10) (Alhajjar & Daf, 2013), and Pakistan (119.00) (Victor et al., 2017), and lower than studies conducted in Indonesia (131.00) (Rochmawati et al., 2014), Sri Lanka (127.10) (Jayaweera et al., 2021) and Tajikistan (133.40) (Schubiger et al., 2019). In contrast to the results of this paper, a study conducted in Egypt (Sharkawy et al., 2013) among nursing students showed poor perception towards their learning environment. However, no

study was found to report excellent nursing students' perceptions of their educational environment. In the above-mentioned studies, an attempt has been made to investigate the educational environment of nursing students in different countries. It seems that this difference in DREEM sub-scales scores can be attributed to cultural and geographical differences, the amount of educational and clinical facilities available in those countries, different teaching styles and approaches among teachers in these countries, and even differences in the expectations of nursing students.

Personal items analysis is one of the crucial and interesting applications of the DREEM questionnaire. This directly reveals the strengths and weaknesses of various aspects of the educational environment (Altemani & Merghani, 2017). Explaining the strengths and weaknesses of the learning environment plays an important role in amplifying the educational environment of nursing students in their curriculum (Farooq et al., 2018). The final outcome of this action is the efficacy and expertise of nursing students to provide health care services at the highest standard level. The overall response of the nursing students to the "Students' Perceptions of Learning" (SPL) was 24.03 out of a total score of 48 indicating a more positive perception of this domain. Although the scores were not far from the negative attitude towards teaching, it seems that the students had relatively good experiences with the teaching methods of the teachers. The item with the lowest score in the field of learning was item number 48 (the teaching is too teacher-centered). In this regard, it can be said that in the teacher-centered education strategy, students will not be actively involved in the teaching-learning process, and this process will be adopted in such a way that the teacher will transfer a large amount of information to the students. Similar results have been reported for students' negative attitudes toward the teacher-centered of learning domain (Palés et al., 2015).

Students' Perception of Teachers (SPT) was the second domain, and the response of nursing students to this domain was 24.02 out of a total score of 44, and with respect to the DREEM inventory's interpretation regarding this domain, students realized that teachers are on the right path in teaching the nursing students. Students' scores in any of the items in this domain were not higher than 3 and less than 2, which indicates that although the students' perception of the teachers' communication, teaching, and soft skills were not so negative, it is necessary that the teachers enhance their competencies in these cases. As nursing students encounter patients in different clinical settings, the teacher should act as a role model for nursing students and help them to have high-quality patient care (Utami et al., 2020). These results highlight the need for faculty development programs to improve teaching skills. The findings of this study were in line with the findings of studies conducted in Eastern Nepal (Shrestha et al., 2019) and Sri Lanka (Jayaweera et al., 2021) in which nursing students also had a relatively positive perception of their teachers.

Students' Academic Self-Perceptions (SASP) was the third domain, and the response of nursing students to this domain was 17.06 out of a total score of 32, indicating moderate scores, which need further improvement. The item with the lowest score in the domain was item number 21 *(I feel I am being well prepared for my profession)*. This is an item that should be given special attention because, in the present study, the perceptions of the third and fourth-year nursing students were evaluated, and this means that these students are not yet ready to take on all the duties and responsibilities of a nurse. It seems that the annual admission of a large number of nursing students from the Ministry of Health in Iran and the lack of appropriate facilities and equipment are among the factors that affect nursing students' well-prepared for their profession. The results of this study contradicted the findings of a study conducted in Saudi Arabia (Rawas & Yasmeen, 2019). It seems that the better economic situation of Saudi Arabia than Iran, which provides more up-to-date facilities and equipment for nursing students in Saudi Arabia, is effective in creating this difference.

The response of nursing students toward the Students' Perception of Atmosphere (SPA), and Students' Social Self-Perception (SSSP), respectively, were 24.04 out of 48, and 14.01 out of 28 indicating moderate scores, which need further improvement. Item 46 (accommodation) of Students' Social Self-Perception (SSSP) has the highest score among all items in the SSSP domain. Similar findings have been reported in various studies (Al-Mohaimeed, 2013; Palés et al., 2015). Regarding the "accommodation" item, it seems that the existence of a warm and friendly relationship between students can solve their theoretical and clinical problems through Team-Based Learning (TBL), Problem-Based Learning (PBL), and peer instruction. While item

3 *(There is a good support system for students who get stressed)* had the lowest score under the SSSP domain; the finding of this study was consistent with the results of other studies (Al-Mohaimeed, 2013; Altemani & Merghani, 2017).

In the current study, the mean overall DREEM score between the two genders was not statistically significant. This was consistent with the finding of the study conducted by Soliman et al. (2017) and inconsistent with the findings among Nigerian students that the mean DREEM score of males was significantly higher than females (Roff et al., 2001). Probably having their own learning style and lack of identical perception of educational courses are the main causes of gender differences in the findings of the above studies.

5. Implications and limitations

The present study provides beneficial comprehension about the educational environment as perceived by the nursing students. Ensuring that students' perception of the educational environment is incorporated in developing a holistic curriculum and improving teaching and assessment strategies in order to enhance students' clinical competencies are among the issues that universities and policymakers need to address.

Some limitations in this study deserve our special attention. First, using a cross-sectional questionnaire-based study design is the main limitation of the current study, which may affect the generalizability of the findings. Therefore, longitudinal studies or randomized controlled trials are needed to further studies. Second, the current study used the self-report method to collect data, so response bias may exist considering that students underreported their negative emotions. Despite the limitations, this study provides empirical evidence on the perception of nursing students toward their educational environment.

6. Conclusion

In conclusion, the perception of the nursing students in this institution toward their educational environment was "more positive than the negative". Regarding the subdomains of the DREEM inventory, the results showed that all these subdomains need further improvement. Especially in the subdomains of SPL and SPP, which are based on the students' perceptions, it is necessary to pay attention to educational pedagogy and educational facilities and equipment. The recommendations arising from the present study include the importance of having a student support system due to their direct and long-term contact with patients, which in the event of any defect, accident, or error, having such a system leads to increased students' self-confidence and comfort to accept the role of the nurse. Also, it is suggested that students' perception of the educational environment be measured regularly, for instance, at the end of each academic year to create a healthy and effective environment for learning in the educational environment.

Author contribution

DR developed the main conceptual ideas and methodological design for the study. ZA and SSGZS contributed to data collection. MH performed the analysis and interpretations and took the lead in drafting the manuscript with discussion the results with all authors. All authors provided critical feedback and contributed to the final version of the manuscript. All authors have approved of the final version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately resolved.

Conflict of interest

None to be declared.

Declaration of interest statements

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

References

Abusaad, F. E. S., Mohamed, H. E.-S., & El-Gilany, A.-H. (2015). Nursing students' perceptions of the educational learning environment in pediatric and maternity courses using DREEM questionnaire. *Journal of Education and Practice, 6*(29), 26-32.

Akdeniz, M., Kavukcu, E., & Ilhanlı, N. (2019). DREEM in primary care: Students' perspectives on educational environment of family medicine internship in primary care centres: Experiences at Akdeniz University Faculty of Medicine in Turkey. *Postgraduate Medicine, 131*(6), 397-404. https://doi.org/10.1080/00325481.2019.1637759

Al-Balas, M., Al-Balas, H. I., Jaber, H. M., Obeidat, K., Al-Balas, H., Aborajooh, E. A., Al-Taher, R., & Al-Balas, B. (2020). Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: Current situation, challenges, and perspectives. *BMC Medical Education, 20*, 341. https://doi.org/10.1186/s12909-020-02257-4

Al-Mohaimeed, A. (2013). Perceptions of the educational environment of a new medical school, Saudi Arabia. *International Journal of Health Science (Qassim), 7*(2), 150-159. https://doi.org/10.12816/0006039

Alhajjar, B., & Daf, M. A. (2013). Evaluation of nursing education environment in the faculty of nursing, Islamic University of Gaza. *IUG Journal for Educational and Psychology Sciences, 21*(1), 619-630.

Altemani, A. H., & Merghani, T. H. (2017). The quality of the educational environment in a medical college in Saudi Arabia. *International Journal of Medical Education, 8*, 128-132. https://doi.org/10.5116/ijme.58ce.55d2

Bakhshialiabad, H., Bakhshi, G., Hashemi, Z., Bakhshi, A., & Abazari, F. (2019). Improving students' learning environment by DREEM: An educational experiment in an Iranian medical sciences university (2011-2016). *BMC Medical Education, 19*(1), 397. https://doi.org/10.1186/s12909-019-1839-9

Bjerkvik, L. K., & Hilli, Y. (2019). Reflective writing in undergraduate clinical nursing education: A literature review. *Nurse Education in Practice, 35,* 32-41. https://doi.org/10.1016/j.nepr.2018.11.013

Emanuel, V., & Pryce-Miller, M. (2013). Creating supportive environments for students. *Nursing Times, 109*(37), 18-20.

Farooq, S., Rehman, R., Hussain, M., & Dias, J. M. (2018). Comparison of undergraduate educational environment in medical and nursing program using the DREEM tool. *Nurse Education Today, 69*, 74-80. https://doi.org/10.1016/j.nedt.2018.06.031

Frothagh, A. N., & Gourchian, N. (2019). Study of the quality of teaching environment and learning of cardiology residents of Shahid Beheshti University of Medical Sciences based on DREEM questionnaire. *Researcher Bulletin of Medical Sciences, 24*(1), e3-e3.

Hamid, B., Faroukh, A., & Mohammadhosein, B. (2013). Nursing students' perceptions of their educational environment based on DREEM model in an Iranian university. *Malaysian Journal of Medical Sciences, 20*(4), 56-63.

Imanipour, M., Sadooghiasl, A., Ghiyasvandian, S., & Haghani, H. (2015). Evaluating the educational environment of a nursing school by using the DREEM inventory. *Global Journal of Health Science, 7*(4), 211-216. https://doi.org/10.5539/gjhs.v7n4p211

Jayaweera, P., Thilakarathne, A., Ratnayaka, M., Shashikala, T., Arachchige, R., Galgamuwa, L. S., Karunathilaka, N., & Amarasekara, T. (2021). Evaluation of learning environment among nursing undergraduates in state universities, Sri Lanka. *BMC Nursing, 20,* 193. https://doi.org/10.1186/s12912-021-00714-z

Jeyashree, K., Shewade, H. D., & Kathirvel, S. (2018). Development and psychometric testing of an abridged version of Dundee Ready Educational Environment Measure (DREEM). *Enviromntal Health and Preventive Medicine, 23,* 13. https://doi.org/10.1186/s12199-018-0702-7

Kaphagawani, N. C., & Useh, U. (2013). Analysis of nursing students learning experiences in clinical practice: Literature review. *Studies on Ethno-Medicine, 7*(3), 181-185.

Kaur, M., Sidhu, T. K, Mahajan, R., & Kaur, P. (2021). Evaluation of the institutional educational environment by using the Dundee Ready Educational Environment Measure. *International Journal of Applied and Basic Medical Research, 11*(2), 85-89. https://doi.org/10.4103/ijabmr.IJABMR_470_20

Kolb, D. A. (1984). *Experiential learning: Experience as the sourse of learnin and development.* Prentice Hall.

Koohpayehzadeh, J., Hashemi, A., Soltani Arabshahi, K., Bigdeli, S., Moosavi, M., Hatami, K., & Baradaran, H. R. (2014). Assessing validity and reliability of Dundee Ready Educational Environment Measure (DREEM) in Iran. *Medical Journal of the Islamic Republic of Iran, 28,* 60.

Palés, J., Gual, A., Escanero, J., Tomás, I., Rodríguez-de Castro, F., Elorduy, M., Arce, V. (2015). Educational climate perception by preclinical and clinical medical students in five Spanish medical schools. *International Journal of Medical Education, 6,* 65-75. https://doi.org/10.5116/ijme.5557.25f9

Patil, A. A., & Chaudhari, V. L. (2016). Students' perception of the educational environment in medical college: A study based on DREEM questionnaire. *Korean Journal of Medical Education, 28*(3), 281-288. https://doi.org/10.3946/kjme.2016.32

Rawas, H., & Yasmeen, N. (2019). Perception of nursing students about their educational environment in College of Nursing at King Saud Bin Abdulaziz University for Health Sciences, Saudi Arabia. *Medical Teacher, 41*(11), 1307-1314. https://doi.org/10.1080/0142159x.2019.1638502

Rochmawati, E., Rahayu, G. R., & Kumara, A. (2014). Educational environment and approaches to learning of undergraduate nursing students in an Indonesian school of nursing. *Nurse Education in Practice, 14*(6), 729-733. https://doi.org/10.1016/j.nepr.2014.08.009

Roff, S., McAleer, S., Harden, R. M., Al-Qahtani, M., Ahmed, A. U., Deza, H., Groenen, G. & Primparyon, P. (1997). Development and validation of the Dundee Ready Education Environment Measure (DREEM). *Medical Teacher, 19*(4), 295-299. https://doi.org/10.3109/01421599709034208

Roff, S., McAleer, S., Ifere, O. S., & Bhattacharya, S. (2001). A global diagnostic tool for measuring educational environment: Comparing Nigeria and Nepal. *Medical Teacher, 23*(4), 378-382. https://doi.org/10.1080/01421590120043080

Salih, K. M., Idris, M. E., Elfaki, O. A., Osman, N. M., Nour, S. M., Elsidig, H. A., Toam R. M., & Elfakey, W. E. M. (2018). MBBS teaching program, according to DREEM in College of Medicine, University of Bahri, Khartoum, Sudan. *Advances in Medical Educucation and Practice, 9,* 617-622. https://doi.org/10.2147/amep.s160218

Schubiger, M., Lechthaler, F., Khamidova, M., Parfitt, B. A., Prytherch, H., van Twillert, E., & Wyss, K. (2019). Informing the medical education reform in Tajikistan: Evidence on the learning environment at two nursing colleges. *BMC Medical Education, 19,* 85. https://doi.org/10.1186/s12909-019-1515-0

Sharkawy, S. A., El-Houfey, A. A., & Hassan, A. K. (2013). Students' perceptions of educational environment in the faculties of nursing at Assiut, Sohag and South Valley universities. *Assiut University Bulletin for Enviromental Research, 16*(2), 167-197.

Shrestha, E., Mehta, R. S., Mandal, G., Chaudhary, K., & Pradhan, N. (2019). Perception of the learning environment among the students in a nursing college in Eastern Nepal. *BMC Medical Education, 19,* 382. https://doi.org/10.1186/s12909-019-1835-0

Soliman, M. M., Sattar, K., Alnassar, S., Alsaif, F., Alswat, K., Alghonaim, M., Alhaizan, M., & Al-Furaih, N. (2017). Medical students' perception of the learning environment at King Saud University Medical College, Saudi Arabia, using DREEM Inventory. *Advances in Medical Education and Practice, 8,* 221-227. https://doi.org/10.2147/amep.s127318

Soltani Arabshahi, K., Kouhpayezade, J., & Sobuti, B. (2008). The educational environment of main clinical wards in educational hospitals affiliated to Iran university of medical sciences: Learners' viewpoints based on DREEM model. *Iranian Journal of Medical Education, 8*(1), 43-50.

Utami, R. S., Pujianto, A., Setyawan, D., Naviati, E., & Rochana, N. (2020). Critical care nurses' experiences of end-of-life care: A qualitative study. *Nurse Media Journal of Nursing, 10*(3), 260-274. https://doi.org/10.14710/nmjn.v10i3.31302

Victor, G., Ishtiaq, M., & Parveen, S. (2017). Nursing students' perceptions of their educational environment in the bachelor's programs of the Shifa College of Nursing, Pakistan. *Journal of Educational Evaluation for Health Professions, 13,* 43. https://doi.org/10.3352/jeehp.2016.13.43

Yoo, D. M., & Kim, D. H. (2019). The relationship between students' perception of the educational environment and their subjective happiness. *BMC Medical Education, 19*, 409. https://doi.org/10.1186/s12909-019-1851-0

REVIEW

Discovering Elements and Developing Strategies to Implement the Tailored Care Education for Patients with Diabetes through A Systematic Review

Satriya Pranata[1], Shu-Fang Vivienne Wu[2], Tsae-Jyy Tiffany Wang[2], Shu-Yuan Liang[2], Yeu-Hui Chuang[3], Kuo-Cheng Lu[4,5], Khoiriyah Khoiriyah[1]

[1]Department of Nursing, Faculty of Nursing and Health Sciences, Universitas Muhammadiyah Semarang, Semarang, Indonesia
[2]School of Nursing, National Taipei University of Nursing and Health Sciences, Taipei City, Taiwan
[3]College of Nursing, School of Nursing, Taipei Medical University, Taipei, Taiwan
[4]Department of Medical Research, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation
[5] Fu-Jen Catholic University Hospital, School of Medicine, Fu-Jen Catholic University, Taipei, Taiwan

Article Info	Abstract
	Background: The popular intervention in avoiding diabetes complications in several countries is health education. However, a tailored care education approach based on the phenotyping of patients' abilities, preferences, cultural orientation is still unclear. **Purpose:** To discover elements and develop strategies to implement tailored care education for patients with diabetes through a systematic review. **Methods:** This two-stage systematic review was conducted. The first stage was primary search and assessed the quality of articles followed by discovering elements and developing strategies of tailored care education for patients with diabetes in the second stage. **Results:** This review included 44 out of 1421 articles that were published in English and focused to discuss on tailored care education for patients with diabetes. Self-management, patient preferences, patient value, interprofessional collaboration, tailored support, glycemic control, and patient centre were among the elements. These factors were utilized to develop seven step strategies for providing diabetes patients with tailored care education. **Conclusion:** Traditional clinical intervention, decision-making, and future research trends are predicted to be transformed into a personalized care approach. Establishing the effectiveness of tailored care education programs in reducing the risk of diabetes complications among diabetic patients is needed.

1. Introduction

Compared to other people, diabetics have a higher risk of developing numerous complications. Every 30 seconds, people with diabetes are two to three times more likely to develop cardiovascular disease, and ten times to get end-stage renal disease, as well as a lower limb amputation (WHO, 2016). The International Diabetes Federation (IDF) estimates that total healthcare expenditure for diabetics aged 20 to 79 years is USD 966 billion in 2021; it will become USD 1.03 trillion by 2030 and USD 1.05 trillion by 2045 (IDF, 2021).

In numerous nations, health education is a popular intervention for preventing diabetes complications. However, a standardized approach to health education does not serve all patients equally (Hertroijs et al., 2018a). The education have to tailor-made to the specific patient's needs (social–cognitive determinants, intention, and behavior) (Pranata et al., 2021). Furthermore, people have the right and obligation to participate in the planning and delivery of their health care (Pranata, Shing, et al., 2021). Patient-centered is related with better levels of patient satisfaction and more effective patient education (Sassen, 2018). Clinical guideline recommendations that require more specific identification based on demands and treatment goals are now being

hampered by the availability of health data relevant to diabetic patients in particular (Pranata, Wu, et al., 2021).

The term "tailored care education" has been used to describe those research approach. The Vedas, India's ancient books, first described tailored care 4000 years ago (Dekkers & Hertroijs, 2018). It was originally known as Ayurvedic medicine, and its goal was to adapt therapy to each individual in order to keep the body, mind, and spirit in harmony. The goal of tailored care education currently is to improve patients' health goals by incorporating the specific requirements and preferences into the plan of treatment (Dekkers & Hertroijs, 2018; Hertroijs et al., 2018a). Education-based on phenotype is considered. Such considerations are able to group patients by their care needs and preferences for achieving personalized goals (Dekkers & Hertroijs, 2018; Hertroijs et al., 2018a; Lutes et al., 2020; Osborn et al., 2010). Modifying the program for patients with diabetes which includes a tailored care education can help reduce the number of complications (Cimo et al., 2020). Patient centre, preference, and cultural orientation refer to tailored care education (Cimo et al., 2020; Dekkers & Hertroijs, 2018; Hertroijs et al., 2018b; Lutes et al., 2020; Osborn et al., 2010; Solano et al., 2020). Education approaches by using flexibility in teaching to match personal needs, and empowering clients in self-management are examples of tailored care education implementations (Cimo & Dewa, 2019).

Although there have been many studies on tailored care interventions in diabetic patients, the strategy for implementing tailored care education is still unclear. One study mentions strategies for implementing tailored care education (Van de Velde et al., 2016), but another study also mentions other strategies with different way (Van de Velde et al., 2016; Wensing et al., 2014). The various implementation strategies are closely related to the unclear elements that involved the concept of tailored care education. The aim of this study was to discover elements and develop strategies to implement tailored care education for patients with diabetes through a systematic review.

2. Methods

2.1 Research design

This study qualifies as a systematic review because of the discovery, selection, assessment, and synthesis of high-quality research material relevant to the research issue. A systematic review entails the identification, selection, evaluation, and synthesis of high-quality research evidence (Bettany-Saltikov, 2012). Moreover, systematic review is undertaken in answer to a specific research issue using a rigorous research technique (Polit, 2017).

2.2 Search methods

We combined the keywords: tailored care, tailored care education for diabetes using the Boolean logic operators "AND" and "OR". EBSCO Host engine search included MEDLINE Complete, MEDLINE With Full Text, Academic Search Complete, Computers & Applied Sciences Complete, Education Research Complete, SPORTDiscus With Full Text, Professional Development Collection, OmniFile Full Text Select (H.W. Wilson), Newspaper Source, and APA PsycArticles were databases searched in this study.

2.3 Inclusion and exclusion criteria

We discovered studies in the literature that were clearly focused on tailored care education for diabetes and published in English from January 2016 to December 2021. On the other hand, articles not aligned with tailored care, incomplete, participants not having diabetes, and unrelated with tailored care education concepts were exclusion criteria of this study.

2.4 Screening of articles

As many as 1421 relevant papers about tailored care education for diabetes were found. Members of the study team (SP, SFVW, and KK) reviewed the title and abstract, then excluded articles based on the following criteria: duplication (n = 678), article not aligned with tailored care (n = 406), incomplete (n = 87), participants not having diabetes (n = 121), and unrelated with tailored care education concepts (n = 77). Following the exclusion criteria, the number of articles excluded were (n = 1369). The full texts of all 44 articles that matched the inclusion criteria were obtained, reviewed for the level of evidence and quality before study extraction (Figure 1).

2.5 Data extraction

In this stage, we assessed the tailored care education elements after summarizing the derived literature search findings in Table 1, further developed clinical strategies to implement tailored care education for patients with diabetes in Table 3. Every paragraph that referenced tailored care education was highlighted, split, and suggestions were generally marked by punctuation. We also created coding roles and coding sheets based on the study protocol, which comprised a list of mutually exclusive and exhaustive ideas (e.g., patient centre, and phenotype). The two specialists (SFVW and TJTW) coded, extracted, and combined the data separately, and then established a final consensus following discussion.

2.6 Quality appraisal

Researchers (SFVW, TJTW, SYL, YHC, and KCL) used the Joanna Briggs Institute Validity Scale 2011 to review level of evidence and assessed the quality of articles (Higgins & Deeks, 2011). The result is presented in Table 1.

Table 1. Extraction of the elements, level of evidence and quality of articles

No		Method	Population	Level of evidence	Summary of appraisal	SM	PP	PV	IC	TS	GC	PC
1.	(Berkowitz et al., 2020)	QS	Diabetes	6	Fair		✓	✓				
2.	(Benavides-Vaello et al., 2017)	QS	Diabetes	6	Fair	✓						
3.	(Berkowitz, Terranova, et al., 2019)	RC	Diabetes	4	Good							
4.	(Hedderson et al., 2018)	RCT	Diabetes	2	Good					✓		
5.	(Lake et al., 2018)	MM	Diabetes	2	Good		✓		✓			
6.	(Kassavou et al., 2020)	RCT	Diabetes	2	Good					✓		
7.	(Hu et al., 2016)	RCT	Diabetes	2	Good							
8.	(Solano et al., 2020)	RCT	Diabetes	2	Good						✓	
9.	(Tervaskanto-Mäentausta et al., 2017)	CS	Diabetes	7	Fair				✓			
10.	(Goodfellow et al., 2016)	RCT	Diabetes	2	Good				✓			
11.	(Campmans-Kuijpers et al., 2015)	RCT	Diabetes	2	Good					✓		✓
12.	(Huang et al., 2019)	RCT	Diabetes	2	Good			✓				
13.	(Choi et al., 2017)	CS	Diabetes	7	Fair			✓				
14.	(Brown et al., 2015)	CS	Diabetes	7	Fair			✓				
15.	(de Sequeira et al., 2019)	QS	Diabetes	6	Fair			✓				
16.	(Navodia et al., 2019)	SR	Diabetes	1	Good			✓				
17.	(Nelson et al., 2016)	CS	Diabetes	7	Good	✓	✓			✓		

Table 1. Continued

No	Method	Population	Level of evidence	Summary of appraisal	SM	PP	PV	IC	TS	GC	PC
18. (Krishna & Provenzano, 2019)	QS	Diabetes	6	Good	✓			✓	✓		
19. (Lake et al., 2020)	RCT	Diabetes	2	Good	✓						
20. (Caro-Bautista et al., 2021)	SR	Diabetes	1	Good	✓	✓					
21. (Patel et al., 2017)	QE	Diabetes	4	Fair	✓				✓		
22. (Nelson et al., 2021)	RCT	Diabetes	2	Good	✓				✓		
23. (Joo & Liu, 2021)	SR	Diabetes	1	Good	✓		✓		✓		
24. (Berkowitz, Terranova, et al., 2019)	RCT	Diabetes	2	Good	✓						
25. (Ballotari et al., 2017)	SR	Diabetes	1	Good	✓					✓	
26. (Nijpels et al., 2019)	LR	Diabetes	5	Fair							✓
27. (Camacho et al., 2015)	CS	Diabetes	7	Fair			✓	✓			
28. (Alamer et al., 2020)	QE	Diabetes	4	Fair	✓				✓	✓	
29. (Lim et al., 2016)	RCT	Diabetes	2	Good	✓					✓	
30. (Piombo et al., 2020)	MM	Diabetes	2	Good	✓		✓				
31. (D. F.L. Hertroijs et al., 2018)	MM	Diabetes	2	Good	✓	✓			✓		
32. (Liddy et al., 2016)	QS	Diabetes	6	Fair				✓			
33. (O'Neil et al., 2016)	RCT	Diabetes	2	Good	✓						
34. (Cummings et al., 2019)	RCT	Diabetes	2	Good	✓						
35. (Dorijn F.L. Hertroijs et al., 2018)	SR	Diabetes	1	Good		✓		✓			
36. (Keramat, 2018)	QS	Diabetes	6	Fair	✓	✓	✓				
37. (Gold et al., 2019)	MM	Diabetes	2	Good					✓	✓	
38. (Holmen et al., 2017)	SR	Diabetes	1	Good	✓						
39. (Dekkers & Hertroijs, 2018)	LR	Diabetes	5	Fair		✓					
40. (Iovane et al., 2017)	QE	Diabetes	4	Fair	✓				✓	✓	
41. (Kasteleyn et al., 2016)	RCT	Diabetes	2	Good					✓		
42. (Munsour et al., 2020)	RCT	Diabetes	2	Good					✓	✓	
43. (Afandi et al., 2020)	LR	Diabetes	5	Fair	✓	✓					
44. (Jeon et al., 2016)	CS	Diabetes	7	Fair					✓		

Note: SM: self-management; PP: patient preferences; PV: patient value; IC: interprofessional collaboration; TS: tailored support; GC: glycemic control; PC: patient centre; SR: systematic review; RCT: randomized controlled trial; MM: mix method; QE: quasi experiment; RC: retrospective cohort; CS: case study; QS: qualitative study; LR: literature review.

2.7 Data analysis

This review could not perform a meta-analysis due to heterogeneity in the methods and statistical values of the outcomes. Therefore, a thematic analysis was conducted (Nowell, 2017). The elements of tailored care education were discovered. These findings are illustrated under the themed headings in Table 2.
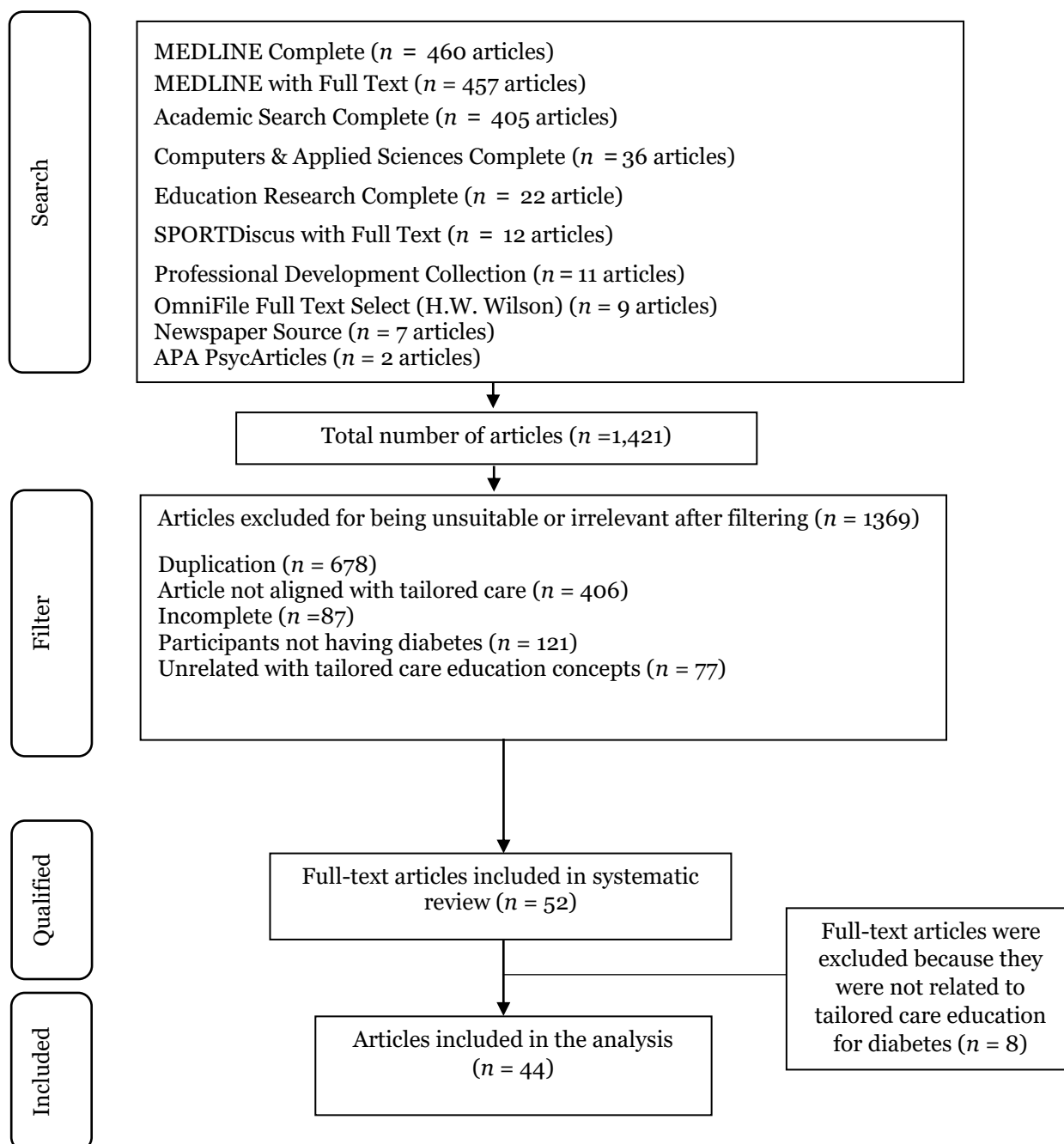
3. Results

MEDLINE Complete ($n = 460$ articles)

MEDLINE with Full Text ($n = 457$ articles)

Academic Search Complete ($n = 405$ articles)

Computers & Applied Sciences Complete ($n = 36$ articles)

Education Research Complete ($n = 22$ article)

SPORTDiscus with Full Text ($n = 12$ articles)

Professional Development Collection ($n = 11$ articles)
OmniFile Full Text Select (H.W. Wilson) ($n = 9$ articles)
Newspaper Source ($n = 7$ articles)
APA PsycArticles ($n = 2$ articles)

Search

Total number of articles ($n = 1,421$)

Filter

Articles excluded for being unsuitable or irrelevant after filtering ($n = 1369$)

Duplication ($n = 678$)
Article not aligned with tailored care ($n = 406$)
Incomplete ($n = 87$)
Participants not having diabetes ($n = 121$)
Unrelated with tailored care education concepts ($n = 77$)

Qualified

Full-text articles included in systematic review ($n = 52$)

Full-text articles were excluded because they were not related to tailored care education for diabetes ($n = 8$)

Included

Articles included in the analysis ($n = 44$)

Figure 1. Flowchart of screening articles on tailored care education for diabetes

3.1 Discovery elements of tailored care education and concept description

We outlined the tailored care education elements for patients with diabetes were self-management, patient preferences, patient value, interprofessional collaboration, tailored support, glycemic control, and patient centre. By extracting data from each article and comparing definitions, we were able to identify the concepts and then combine the results. As a result, after

consulting with the research team, we reached to a final decision. Table 2 shows the concept descriptions for each element, which are detailed below.

3.2 Definition of tailored care education for patient with diabetes
      Related with tailored care education elements, tailored care education definition was an approach in interdisciplinary collaboration among health professionals, patients, and families in which patients became the center of service through personalized consideration of patient preferences, values, ethnicities in the achievement of personalized goals in self-management and glycemic control (Caro-Bautista et al., 2021; Choi et al., 2017; Cimo & Dewa, 2019; Cummings et al., 2019; Iovane et al., 2017; Prato et al., 2010; Van de Velde et al., 2016).

Table 2. The concept description of tailored care education elements

No	Elements	Concept description
1.	Self-management	Reflecting the cognitive, emotive, and behavioural areas within the context of the culture.
2.	Patient preferences	Phenotyping and biopsychosocial characteristics were consideration to identify various health-care needs of patients
3.	Patient value	Diabetes patient impressed with medically adjusted meals, emphasizing the value of culturally acceptable food
4.	Interprofessional collaboration	Through culturally targeted diabetes education, health providers primarily offered information and used knowledge reinforcement to induce behavioral change
5.	Tailored support	The community will benefit from the support of an interdisciplinary team as well as family members in achieving optimal metabolic control
6.	Glycaemic control	Effects on diabetes control (e.g., haemoglobin A1c) and patient lifestyles should be evaluated in longer-term evaluation
7.	Patient centre	Several professional recommendations divide individuals with diabetes into three risk groups: very high/high, moderate, and low. This classification was based primarily on the kind of disease, metabolic control level, and therapy type, with the presence of other comorbidities and situational factors being adjusted.

3.3 Strategies of tailored care for patients with diabetes
      Broadly, the main strategy in applying tailored care education is to make various efforts, such as 1). Brief deducting teaching; 2). Assessment of patients' self-management levels and characteristics; 3). Writing a list of patients' needs, glycemic control and difficulties; 4). Rank a personal priority; 5). Setting a goal and drafting an action plan using brainstorming and a support group to archive patients' unique objective behaviors; 6). Follow-up; and 7). Goals-attempted report (Afandi et al., 2020; Ballotari et al., 2017; Campmans-Kuijpers et al., 2015; Caro-Bautista et al., 2021; Choi et al., 2017; Hertroijs et al., 2018b; Iovane et al., 2017; Joo & Liu, 2021; Navodia et al., 2019; Nelson et al., 2021; Nijpels et al., 2019; Patel et al., 2017; Van de Velde et al., 2016; Wensing et al., 2014). The development of strategies adopted from the elements of tailored care education can be read in Table 3.

Table 3. Developed clinical strategies of tailored care education based on elements

No	Elements	Clinical strategies
1.	Self-management	Within the scope of the culture, self-management reflected cognitive, emotional, and behavioral aspects (Benavides-Vaello et al., 2017; Krishna & Provenzano, 2019; Lake et al., 2018; Nelson et al., 2016, 2021).
2.	Patient preferences	Phenotyping of a patient's biopsychosocial characteristics can help health professionals to identify patients with various health-care needs (Berkowitz et al., 2020; Berkowitz, Terranova, et al., 2019; Caro-Bautista et al., 2021; Nelson et al., 2016).
3.	Patient value	Diabetes patient pleased with medically adjusted meals, emphasizing the value of culturally acceptable food (Choi et al., 2017; de Sequeira et al., 2019).

Table 3. Continued

No	Elements	Clinical strategies
4.	Interprofessional collaboration	Through culturally targeted diabetes education, health providers primarily offered information and used knowledge reinforcement to induce behavioral change (Goodfellow et al., 2016; Krishna & Provenzano, 2019; Tervaskanto-Mäentausta et al., 2017).
5.	Tailored support	The community will benefit from the support of an interdisciplinary team as well as family members in achieving optimal metabolic control (Alamer et al., 2020; Joo & Liu, 2021; Nelson et al., 2016).
6.	Glycaemic control	Glycaemic control referes to HbA1c level and patient's lifestyles (Alamer et al., 2020; Ballotari et al., 2017; Solano et al., 2020).
7.	Patient centre	Several professional recommendations divide individuals with diabetes based on the kind of disease, metabolic control status, therapy type, and the existence of other comorbidities and contextual factors, as well as continued follow-up and reporting of each patient's personalized goals into three risk groups were very high/high, moderate, and low (Campmans-Kuijpers et al., 2015; Nijpels et al., 2019).

4. Discussion

The main purpose of this study was to discover tailored care education elements and developed strategies to implement tailored care education for patients with diabetes. Seven elements of tailored care education for patients with diabetes has its own meaning to translate the overall tailored care education concept. These elements serve as a foundation for evolving seven-step strategies for facilitating the implementation of tailored care education for patients with diabetes.

Self-management solutions that were culturally relevant and addressed cognitive, emotional, and behavioral aspects in control desire to eat, advice in diet adjustment (Benavides-Vaello et al., 2017). More specific and realistic instruction is essential in self-management (Benavides-Vaello et al., 2017). In addition, grasp of which phenotype in the identification of patients with various health-care needs related with patient preferences. Only by taking into account the care preferences of patients, the health professionals can an efficient in tailored care education implementation (Hertroijs et al., 2018b). Patients' biopsychosocial characteristics are utilized to identify their care needs, abilities, and preferences for customizing solutions using a tailored care education approach (Dekkers & Hertroijs, 2018).

Diabetes patients impressed with medically adjusted meals, emphasizing the value of culturally acceptable food, refer to patient values. A transcultural intervention based on clinical and socio-cultural factors and tailored to the patients' lifestyles improves adherence to dietary restriction (Piombo et al., 2020). Through interprofessional collaboration, health professionals can provide group didactic teaching. Patients were given individual clarification at the end of an education session in order to create their own management plan. Through culturally tailored diabetes education, health providers primarily offered information and employed knowledge reinforcement to facilitate behavioral change (Choi et al., 2017). The consultations, emotional support, and technique of lifestyle teaching are the most significant factors of diabetes care (Hertroijs et al., 2018b). Resource center, motivator, and outside perspective are crucial roles of health professionals. Clinical information systems, decision support tools, flow sheets, and delivery system design are the examples of these advances (community resources) (Liddy et al., 2016).

Moreover, community health centre will benefit from tailored support from an interdisciplinary team, including training and technical assistance, to enable patients' action, which will give timely recommendations to primary care providers (Gold et al., 2019). The tailored support intervention improves health status and well-being, which are both promising (Kasteleyn et al., 2016). In addition, the help of their family members can be supporting system among diabetic patient to achieve their adequate metabolic and glycemic control (Iovane et al., 2017). Glycemic control included HbA1c should be evaluated in longer-term evaluation (Berkowitz, Delahanty, et al., 2019). The effects will be greater if medically adjusted meals are accompanied with diabetes self-management education or lifestyle changes (Berkowitz et al., 2020). Medically customized meals improved dietary pattern then decreased hypoglycemia. A transcultural

intervention based on clinical and socio-cultural factors and tailored to the patients' lifestyles improves adherence to dietary restriction (Piombo et al., 2020). For tailored care education, several professional recommendations are divided diabetic patients into extremely high/high, moderate, or low risk groups. It is referred to patients centre. The classification of patients centre is based on metabolic control level, and therapeutic type. Taking into account the hours of fasting during the day, weather, resources, personal eating, sleeping, and activity patterns, prior fasting experience, and patient preferences are example of tailored diabetes management in Ramadhan fasting context. Encourage clinicians to think outside the box when deciding whether or not to fast and how to change treatment regimens efficiently if fasting is deemed safe (Afandi et al., 2020).

In the early phases of implementing a tailored care education plan, brief deducting instruction is required. The application of brief deduction instruction is based on two key components. Self-management and interprofessional collaboration are two of these elements (Benavides-Vaello et al., 2017; Choi et al., 2017; Hertroijs et al., 2018a; Liddy et al., 2016). Sharing information through health seminars between health professionals together with diabetic patients might be used to provide brief deducting instruction (Choi et al., 2017). Health education, such as brief deducting teaching, will help patients with diabetes manage their health at home. As we have discovered, one of the crucial element of diabetes education was self-management (Benavides-Vaello et al., 2017). Self-management entails emphasizing a specific treatment plan for patients (Ballotari et al., 2017; Liddy et al., 2016; Navodia et al., 2019; Solano et al., 2020). Furthermore, patients with diabetes should practice self-management due to stresses precise problem solving and reduces the need of unnecessary treatments (Liddy et al., 2016). For health literacy, it is critical to confirm and clarify this understanding. It is vital to validate and explain this understanding in the context of health literacy. In a nutshell, medical experts, nurses, nurse specialists, and dietitians should all build multidisciplinary communication platforms and collaboration models (Benavides-Vaello et al., 2017). Health care professionals must disseminate patient information. It would help patients better comprehend the plans while they were at home (e.g., test, medicine, procedure, behavior modification).

Other processes in assessing patients' self-management level and characteristics include guiding the construct lists of their requirements, prioritize, personalized purpose, and personalized plans to achieve their objective (Holmen et al., 2017; Liddy et al., 2016; O'Neil et al., 2016; Piombo et al., 2020). This process can provide diabetic patients with specialized care and allow for the creation of a treatment plan based on more accurate diagnosis and care, resulting in improved treatment and care efficacy (de Sequeira et al., 2019).

A patient center that takes into account not only medical care but also glycemic monitoring, preferences, and values (Berkowitz, Delahanty, et al., 2019; Berkowitz, Terranova, et al., 2019; Dekkers & Hertroijs, 2018; Hertroijs et al., 2018a; Piombo et al., 2020). The agreement between health providers and patients on tailored glycemic control goals is based on tailored care education (Benavides-Vaello et al., 2017).

The aim for individualization was set based on the risk of hypoglycemia episodes among patients. Patient-centered tailored care education solutions for diabetic patients in clinical practice must include dynamic personalized glycaemic control and strategies produced by a care team (Berkowitz, Delahanty, et al., 2019; Piombo et al., 2020). The patient and health care team's goals can help to lessen an error in intervention, foster collaboration among health professionals with patients, improve patient goals, quality of life, and evade pointless medical treatments as well as lowering the medical burden (Berkowitz et al., 2020; Berkowitz, Delahanty, et al., 2019; Berkowitz, Terranova, et al., 2019; Piombo et al., 2020; Purwadi et al., 2021).

Strategies to rank the priorities of each patient, create goals, and write action can be accommodated by brainstorming and support groups to achieve glycaemic control and specific target behavior (Berkowitz, Delahanty, et al., 2019; Piombo et al., 2020). This strategy is known as personalized support based on patient value and desire (Dekkers & Hertroijs, 2018; Gold et al., 2019; Hertroijs et al., 2018a; Iovane et al., 2017; Kasteleyn et al., 2016; Piombo et al., 2020). Through brainstorming, patients able to learn each other and work together to solve individual health problems. The capacity to solve problems is thought vital for patients because it can assist them in making the best decisions, which are methodical, rational, and take into account diverse perspectives as a patient-centered approach (Afandi et al., 2020). Furthermore, brainstorming makes it easier for patients to communicate also obtain information they require, particularly

when it comes to establishing glycemic control and specific target behavior (Afandi et al., 2020; Choi et al., 2017; Hertroijs et al., 2018a; Liddy et al., 2016; Piombo et al., 2020).

5. Implications and limitations

Tailored care education is a new approach in the clinical setting and potentially improves self-management and reduce the risk of complications among patients with diabetes. However, the impact on patient outcomes is still debatable, as several studies in this analysis had design flaws that made it difficult to make conclusions. As a result, before presence evaluated on a large sample using the randomized controlled trial (RCT) approach, this strategy must first be examined on a small sample using a pilot study to identify impediments to implementation.

6. Conclusion

Elements to develop strategies for implementing tailored care education for diabetes are needed. Tailored care education strategies are an approach that emphasizes consideration of patient preferences, values and phenotypes. Intervention considerations based on the patient personal goals followed by a collaboration between health professionals and patients through tailored care education might be expected to minimize conflict recommendations of health professionals.

Author contribution

SP conceptualized, designed, wrote the first draft and framework as well as evaluated the data. SFVW conceptualized, interpreted the data and supervised. TJTW, SYL, YHC, KCL, KK conceptualized and interpreted the data. The published version of the manuscript has been read and approved by all authors.

Conflict of interest

The authors have reported no conflicts of interest.

References

Afandi, B. O., Beshyah, S. A., Hassanein, M. M., Jabbar, A., & Khalil, A. B. (2020). The individualization of care for people with diabetes during ramadan fasting: A narrative review. *Ibnosina Journal of Medicine and Biomedical Sciences, 12*(2), 98–107. https://doi.org/10.4103/ijmbs.ijmbs

Alamer, A., Palm, C., Almulhim, A. S., Te, C., Pendergrass, M. L., & Fazel, M. T. (2020). Impact of non-tailored one-way automated short messaging service (OASMS) on glycemic control in type 2 diabetes: A retrospective feasibility study. *International Journal of Environmental Research and Public Health, 17*(20), 1–10. https://doi.org/10.3390/ijerph17207590

Ballotari, P., Ferrari, F., Ballini, L., Chiarenza, A., Manicardi, V., & Giorgi Rossi, P. (2017). Lifestyle-tailored interventions for South Asians with type 2 diabetes living in high-income countries: A systematic review. *Acta Diabetologica, 54*(8), 785–794. https://doi.org/10.1007/s00592-017-1008-8

Benavides-Vaello, S., Brown, S. A., & Vandermause, R. (2017). "Can you keep it real?": Practical, and culturally tailored lifestyle recommendations by Mexican American women diagnosed with type 2 diabetes: A qualitative study. *BMC Nursing, 16*(1), 1–8. https://doi.org/10.1186/s12912-017-0232-4

Berkowitz, S. A., Delahanty, L. M., Terranova, J., Steiner, B., Ruazol, M. P., Singh, R., Shahid, N. N., & Wexler, D. J. (2019). Medically tailored meal delivery for diabetes patients with food insecurity: A randomized cross-over trial. *Journal of General Internal Medicine, 34*(3), 396–404. https://doi.org/10.1007/s11606-018-4716-z

Berkowitz, S. A., Shahid, N. N., Terranova, J., Steiner, B., Ruazol, M. P., Singh, R., Delahanty, L. M., & Wexler, D. J. (2020). "I was able to eat what i am supposed to eat" - Patient reflections on a medically-tailored meal intervention: A qualitative analysis. *BMC Endocrine Disorders, 20*(1), 1–12. https://doi.org/10.1186/s12902-020-0491-z

Berkowitz, S. A., Terranova, J., Randall, L., Cranston, K., Waters, D. B., & Hsu, J. (2019). Association between receipt of a medically tailored meal program and health care use. *JAMA Internal Medicine, 179*(6), 786–793. https://doi.org/10.1001/jamainternmed.2019.0198

Bettany-Saltikov, J. (2012). *How to do a systematic literature review in nursing: A step-by-step guide*. McGraw-Hill Education.

Brown, S. A., García, A. A., Steinhardt, M. A., Guevara, H., Moore, C., Brown, A., & Winter, M. A. (2015). Culturally tailored diabetes prevention in the workplace: Focus group interviews with Hispanic employees. *The Diabetes Educator, 41*(2), 175–183. https://doi.org/10.1177/0145721714567233

Camacho, Á., González, P., Castañeda, S. F., Simmons, A., Buelna, C., Lemus, H., & Talavera, G. A. (2015). Improvement in depressive symptoms among Hispanic/Latinos receiving a culturally tailored IMPACT and problem-solving intervention in a community health center. *Community Mental Health Journal, 51*(4), 385–392. https://doi.org/10.1007/s10597-014-9750-7

Campmans-Kuijpers, M. J., Baan, C. A., Lemmens, L. C., & Rutten, G. E. (2015). Change in quality management in diabetes care groups and outpatient clinics after feedback and tailored support. *Diabetes Care, 38*(2), 285–292. https://doi.org/10.2337/dc14-1860

Caro-Bautista, J., Villa-Estrada, F., Gómez-González, A., Lupiáñez-Pérez, I., Morilla-Herrera, J. C., Kaknani-Uttumchandani, S., García-Mayor, S., & Morales-Asencio, J. M. (2021). Effectiveness of a diabetes education program based on tailored interventions and theory of planned behaviour: Cluster randomized controlled trial protocol. *Journal of Advanced Nursing, 77*(1), 427–438. https://doi.org/10.1111/jan.14580

Choi, T. S. T., Walker, K. Z., & Palermo, C. (2017). Culturally tailored diabetes education for Chinese patients: A qualitative case study. *Journal of Transcultural Nursing, 28*(3), 315–323. https://doi.org/10.1177/1043659616677641

Cimo, A., & Dewa, C. S. (2019). Tailoring diabetes education to meet the needs of adults with type 2 diabetes and mental illness: Client and health-care provider perspectives from an exploratory pilot study. *Canadian Journal of Diabetes, 43*(6), 421-428.e3. https://doi.org/10.1016/j.jcjd.2018.09.008

Cimo, A., Loong, D., & Dewa, C. S. (2020). Exploring the outcomes of a pilot education program tailored for adults with type 2 diabetes and mental illness in a community mental health care setting. *Canadian Journal of Diabetes, 44*(6), 461-472.e1. https://doi.org/10.1016/j.jcjd.2020.06.015

Cummings, D. M., Lutes, L. D., Littlewood, K., Solar, C., Carraway, M., Kirian, K., Patil, S., Adams, A., Ciszewski, S., Edwards, S., Gatlin, P., & Hambidge, B. (2019). Randomized trial of a tailored cognitive behavioral intervention in type 2 diabetes with comorbid depressive and/or regimen-related distress symptoms: 12-month outcomes from. *Diabetes Care, 42*(5), 841–848. https://doi.org/10.2337/dc18-1841

de Sequeira, S., Halperin, I., & Lipscombe, L. L. (2019). Culturally tailored resources for South Asian immigrant women with gestational diabetes: Do they work and what's missing? a qualitative study. *Canadian Journal of Diabetes, 43*(8), 573–579. https://doi.org/10.1016/j.jcjd.2019.09.007

Dekkers, T., & Hertroijs, D. F. L. (2018). Tailored healthcare: Two perspectives on the development and use of patient profiles. *Advances in Therapy, 35*(9), 1453–1459. https://doi.org/10.1007/s12325-018-0765-2

Gold, R., Bunce, A., Cottrell, E., Marino, M., Middendorf, M., Cowburn, S., Wright, D., Mossman, N., Dambrun, K., Powell, B. J., Gruß, I., Gottlieb, L., Dearing, M., Scott, J., Yosuf, N., & Krancari, M. (2019). Study protocol: A pragmatic, stepped-wedge trial of tailored support for implementing social determinants of health documentation/action in community health centers, with realist evaluation. *Implementation Science, 14*(1), 1–18. https://doi.org/10.1186/s13012-019-0855-9

Goodfellow, J., Agarwal, S., Harrad, F., Shepherd, D., Morris, T., Ring, A., Walker, N., Rogers, S., & Baker, R. (2016). Cluster randomised trial of a tailored intervention to improve the management of overweight and obesity in primary care in England. *Implementation Science, 11*(1), 1–14. https://doi.org/10.1186/s13012-016-0441-3

Hedderson, M. M., Brown, S. D., Ehrlich, S. F., Tsai, A. L., Zhu, Y., Quesenberry, C. P., Crites, Y., & Ferrara, A. (2018). A tailored letter based on electronic health record data improves gestational weight gain among women with gestational diabetes mellitus: The gestational diabetes' effects on moms (GEM) cluster-randomized controlled trial. *Diabetes Care, 41*(7), 1370–1377. https://doi.org/10.2337/dc17-1133

Hertroijs, D. F. L., Brouwers, M. C. G. J., Elissen, A. M. J., Hiligsmann, M., Schaper, N. C., & Ruwaard, D. (2018a). Patients' preferences for diabetes care: A discrete choice experiment. *International Journal of Integrated Care, 18*(s2), 283. https://doi.org/10.5334/ijic.s2283

Hertroijs, D. F. L., Elissen, A. M. J., Brouwers, M. C. G. J., Schaper, N. C., & Ruwaard, D. (2018b). Relevant patient characteristics for guiding tailored integrated diabetes primary care: A systematic review. *Primary Health Care Research and Development, 19*(5), 424–447. https://doi.org/10.1017/S146342361800004X

Higgins, J. P. T., & Deeks, J. J. (2011). *Selecting studies and collecting data.* In J. P. T. Higgins & S. Green (Eds.), Cochrane handbook for systematic reviews of interventions (5th ed., Chap. 7). https://www.cochrane-handbook.org/

Holmen, H., Wahl, A. K., Småstuen, M. C., & Ribu, L. (2017). Tailored communication within mobile apps for diabetes self-management: A systematic review. *Journal of Medical Internet Research, 19*(6). https://doi.org/10.2196/jmir.7045

Hu, J., Amirehsani, K. A., Wallace, D. C., McCoy, T. P., & Silva, Z. (2016). A family-based, culturally tailored diabetes intervention for Hispanics and their family members. *Diabetes Educator, 42*(3), 299–314. https://doi.org/10.1177/0145721716636961

Huang, S. J., Galárraga, O., Smith, K. A., Fuimaono, S., & McGarvey, S. T. (2019). Cost-effectiveness analysis of a cluster-randomized, culturally tailored, community health worker home-visiting diabetes intervention versus standard care in American Samoa. *Human Resources for Health, 17*(1), 1–10. https://doi.org/10.1186/s12960-019-0356-6

IDF. (2021). *International Diabetes Federation Diabetes Atlas (10th ed).* https://diabetesatlas.org/

Iovane, B., Cangelosi, A. M., Bonaccini, I., Mastrorilli, C., Di Mauro, D., Fainardi, V., Chiari, G., Maltese, M., Caffarelli, C., & Vanelli, M. (2017). Effectiveness of a tailored medical support to overcome the barriers to education, treatment and good metabolic control in children with type-1 diabetes from ethnic minorities. *Acta Biomedica, 88*(4), 477–482. https://doi.org/10.23750/abm.v88i4.6779

Jeon, E., Park, H. A., Jo, S., Kang, H., & Lee, J. Y. (2016). Mobile apps providing tailored nursing interventions for patients with metabolic syndrome. *Studies in Health Technology and Informatics, 225,* 510–514. https://doi.org/10.3233/978-1-61499-658-3-510

Joo, J. Y., & Liu, M. F. (2021). Experience of culturally-tailored diabetes interventions for ethnic minorities: A qualitative systematic review. *Clinical Nursing Research, 30*(3), 253–262. https://doi.org/10.1177/1054773819885952

Kassavou, A., Mirzaei, V., Brimicombe, J., Edwards, S., Massou, E., Toby Prevost, A., Griffin, S., & Sutton, S. (2020). A highly tailored text and voice messaging intervention to improve medication adherence in patients with either or both hypertension and type 2 diabetes in a UK primary care setting: Feasibility randomized controlled trial of clinical effectiveness. *Journal of Medical Internet Research, 22*(5), 1–11. https://doi.org/10.2196/16629

Kasteleyn, M. J., Vos, R. C., Rijken, M., Schellevis, F. G., & Rutten, G. E. H. M. (2016). Effectiveness of tailored support for people with Type 2 diabetes after a first acute coronary event: A multicentre randomized controlled trial (the Diacourse-ACE study). *Diabetic Medicine, 33*(1), 125–133. https://doi.org/10.1111/dme.12816

Keramat, A. (2018). Self-care education needs in gestational diabetes tailored to the Iranian Culture. *Iranian Journal of Nursing and Midwifery Research, 23*(3), 222–229. https://doi.org/10.4103/ijnmr.IJNMR_108_17

Krishna, R., & Provenzano, D. (2019). Diabetes management—A positive patient perspective. *Canadian Journal of Diabetes, 43*(6), 437–439. https://doi.org/10.1016/j.jcjd.2019.05.007

Lake, A. J., Browne, J. L., Abraham, C., Tumino, D., Hines, C., Rees, G., & Speight, J. (2018). A tailored intervention to promote uptake of retinal screening among young adults with type 2 diabetes - An intervention mapping approach. *BMC Health Services Research, 18*(1), 1–19. https://doi.org/10.1186/s12913-018-3188-5

Lake, A. J., Hateley-Browne, J. L., Rees, G., & Speight, J. (2020). Effect of a tailored leaflet to promote diabetic retinopathy screening among young adults with type 2 diabetes: A randomised controlled trial. *BMC Ophthalmology, 20*(1), 1–13. https://doi.org/10.1186/s12886-020-1311-y

Liddy, C., Singh, J., Guo, M., & Hogg, W. (2016). Physician perspectives on a tailored multifaceted primary care practice facilitation intervention for improvement of cardiovascular care. *Family Practice, 33*(1), 89–94. https://doi.org/10.1093/fampra/cmv095

Lim, S., Kang, S. M., Kim, K. M., Moon, J. H., Choi, S. H., Hwang, H., Jung, H. S., Park, K. S., Ryu, J. O., & Jang, H. C. (2016). Multifactorial intervention in diabetes care using real-time monitoring and tailored feedback in type 2 diabetes. *Acta Diabetologica, 53*(2), 189–198. https://doi.org/10.1007/s00592-015-0754-8

Lutes, L. D., Cummings, D. M., Littlewood, K., Le, M. T., Kirian, K., Patil, S., Solar, C., Carraway, M., & Hambidge, B. (2020). A tailored cognitive-behavioural intervention produces comparable reductions in regimen-related distress in adults with type 2 diabetes regardless of insulin use: 12-Month outcomes from the COMRADE trial. *Canadian Journal of Diabetes, 44*(6), 530–536. https://doi.org/10.1016/j.jcjd.2020.05.016

Munsour, E. E., Awaisu, A., Hassali, M. A. A., Abdoun, E., Dabbous, Z., Zahran, N., & Ali, H. (2020). The effect of tailored consumer medicine information on patients with type 2 diabetes mellitus: A randomised controlled interventional study. *International Journal of Clinical Practice, 74*(8), 1–12. https://doi.org/10.1111/ijcp.13527

Navodia, N., Wahoush, O., Tang, T., Yost, J., Ibrahim, S., & Sherifali, D. (2019). Culturally tailored self-management interventions for South Asians with type 2 diabetes: A systematic review. *Canadian Journal of Diabetes, 43*(6), 445–452. https://doi.org/10.1016/j.jcjd.2019.04.010

Nelson, L. A., Greevy, R. A., Spieker, A., Wallston, K. A., Elasy, T. A., Kripalani, S., Gentry, C., Bergner, E. M., LeStourgeon, L. M., Williamson, S. E., & Mayberry, L. S. (2021). Effects of a tailored text messaging intervention among diverse adults with type 2 diabetes: Evidence from the 15-month REACH randomized controlled trial. *Diabetes Care, 44*(1), 26–34. https://doi.org/10.2337/dc20-0961

Nelson, L. A., Mayberry, L. S., Wallston, K., Kripalani, S., Bergner, E. M., & Osborn, C. Y. (2016). Development and usability of REACH: A tailored theory-based text messaging intervention for disadvantaged adults with type 2 diabetes. *JMIR Human Factors, 3*(2), e23. https://doi.org/10.2196/humanfactors.6029

Nijpels, G., Beulens, J. W. J., van der Heijden, A. A. W. A., & Elders, P. J. (2019). Innovations in personalised diabetes care and risk management. *European Journal of Preventive Cardiology, 26*(2_suppl), 125–132. https://doi.org/10.1177/2047487319880043

O'Neil, P. M., Miller-Kovach, K., Tuerk, P. W., Becker, L. E., Wadden, T. A., Fujioka, K., Hollander, P. L., Kushner, R. F., Timothy Garvey, W., Rubino, D. M., Malcolm, R. J., Weiss, D., Raum, W. J., Salyer, J. L., Hermayer, K. L., Rost, S. L., Veliko, J. L., & Sora, N. D. (2016). Randomized controlled trial of a nationally available weight control program tailored for adults with type 2 diabetes. *Obesity, 24*(11), 2269–2277. https://doi.org/10.1002/oby.21616

Osborn, C. Y., Amico, K. R., Cruz, N., O'Connell, A. A., Perez-Escamilla, R., Kalichman, S. C., Wolf, S. A., & Fisher, J. D. (2010). A brief culturally tailored intervention for Puerto Ricans with type 2 diabetes. *Health Education and Behavior, 37*(6), 849–862. https://doi.org/10.1177/1090198110366004

Patel, R. M., Misra, R., Raj, S., & Balasubramanyam, A. (2017). Effectiveness of a group-based culturally tailored lifestyle intervention program on changes in risk factors for type 2 diabetes among Asian Indians in the United States. *Journal of Diabetes Research*, 2017(1), 1-13. https://doi.org/10.1155/2017/2751980

Piombo, L., Nicolella, G., Barbarossa, G., Tubili, C., Pandolfo, M. M., Castaldo, M., Costanzo, G., Mirisola, C., & Cavani, A. (2020). Outcomes of culturally tailored dietary intervention in the North African and Bangladeshi diabetic patients in Italy. *International Journal of Environmental Research and Public Health, 17*(23), 1–12. https://doi.org/10.3390/ijerph17238932

Polit, D.F., & Beck, C. T. (2017). *Resource manual for nursing research: Generating and assessing Evidence for nursing practice* (10th ed.). Wolters Kluwer Health.

Pranata, S., Shing, L. C., Vranada, A., Chun, L. Y., & Armiyati, Y. (2021). The implementation of precision personalized care to improve diabetes patients' self-management at Taipei veteran

general hospital: An observational study. *Bali Medical Journal, 10*(3), 1304–1307. https://doi.org/10.15562/bmj.v10i3.2902

Pranata, S., Wu, S. V., Alizargar, J., Liu, J., Liang, S., & Lu, Y. (2021). Precision health care elements, definitions and strategies for patients with diabetes: A literature review. *International Journal of Environmental Research and Public Health, 18*(12), 6535. https://doi.org/10.3390/ijerph18126535

Pranata, S., Wu, S.F.V., Chu, C.H., & Nugroho, K.H. (2021). Precision health care strategies for older adults with diabetes in Indonesia: A delphi consensus study. *Medical Journal of Indonesia, 30*(3), 221–227. https://doi.org/10.13181/mji.oa.215525

Prato, S. Del, Lasalle, J., Matthaei, S., & Bailey, C. J. (2010). Tailoring treatment to the individual in type 2 diabetes practical guidance from the Global partnership for effective diabetes management. *International Journal of Clinical Practice, 64*(3), 295–304. https://doi.org/10.1111/j.1742-1241.2009.02227.x

Purwadi, H., Breaden, K., McCloud, C., & Pranata, S. (2021). The SALT and START triage systems for classifying patient acuity level: A systematic review. *Nurse Media Journal of Nursing, 11*(3), 413–427. https://doi.org/10.14710/nmjn.v11i3.37008

Sassen, B. (2018). *Nursing: Health education and improving patient self-management.* Springer International Publishing

Solano, M., Garner, J., Diez, A., & Adams, I. (2020). A Culturally-tailored type 2 diabetes (t2dm) self-management program improves self-management practices and glycemic control of Latinos in Ohio. *Journal of the Academy of Nutrition and Dietetics, 120*(9), A73. https://doi.org/10.1016/j.jand.2020.06.044

Tervaskanto-Mäentausta, T., Taanila, A., Ukkola, O., Mikkilä, L., Jokinen, J., & Varkki, E. (2017). Collaborative diabetes training in outpatient primary care. *Journal of European CME, 6*(1), 1288490. https://doi.org/10.1080/21614083.2017.1288490

Van de Velde, S., Roshanov, P., Kortteisto, T., Kunnamo, I., Aertgeerts, B., Vandvik, P. O., & Flottorp, S. (2016). Tailoring implementation strategies for evidence-based recommendations using computerised clinical decision support systems: Protocol for the development of the GUIDES tools. *Implementation Science, 11*(1), 1–8. https://doi.org/10.1186/s13012-016-0393-7

Wensing, M., Huntink, E., van Lieshout, J., Godycki-Cwirko, M., Kowalczyk, A., Jäger, C., Steinhäuser, J., Aakhus, E., Flottorp, S., Eccles, M., & Baker, R. (2014). Tailored implementation of evidence-based practice for patients with chronic diseases. *PLOS ONE, 9*(7), e101981. https://doi.org/10.1371/journal.pone.0101981

WHO. (2016). *Diabetes.* http://www.who.int/diabetes/en/. (Accessed, 2018 october 14).

NurseMedia
JOURNAL OF NURSING

ORIGINAL RESEARCH

The Experience of Nurses Who were Isolated due to COVID-19 Infection: A Qualitative Study

Check for updates
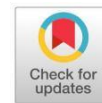
Ernawati Siagian[1], Gilny Rantung[1]

[1]Universitas Advent Indonesia, Bandung, Indonesia

Article Info	Abstract
  Corresponding Author: Ernawati Siagian Universitas Advent Indonesia, Bandung, Indonesia Email: ernawatisiagian@unai.edu	**Background:** In their duties, health care workers, especially nurses, have a high risk of being infected with COVID-19 both from patients and non-patients. Some nurses who are infected need to be treated and isolated in the hospital. It is important to understand nurses' experiences during isolation as this could change the way they provide nursing care for COVID-19 patients in the future. However, this topic has not been studied in Indonesia. **Purpose:** This study aimed to explore the experience of nurses who were isolated in the hospital due to COVID-19 infection. **Methods:** This qualitative study was conducted using a descriptive phenomenological approach. The participants were nurses who had been hospitalized in an isolation room, selected through purposive sampling. Data saturation was reached on the 7th participant, and a total of 7 nurses who were infected with COVID-19 participated. Data were collected through in-depth interviews and analyzed using Colaizzi's phenomenological method. **Results:** Data analysis resulted in three main themes: (1) Experience at diagnosis (Pre-isolation), with sub-themes: initial reaction, source/origin of infection, early symptoms, and reactions from family and close people; (2) Experiences during isolation, with sub-themes: Feelings in isolation rooms, body reactions to covid-19 therapy, medical response and swab results; and (3) Post-isolation experiences, with sub-themes: post-covid conditions, expectations for other covid patients, and expectations for medical personnel. **Conclusion:** This study identified nurses' experience of COVID-19 pre-isolation, isolation and post-isolation. Support from family members, colleagues and leaders are essential for their healing process. Appropriate care planning and approaches are expected to support nurses infected with COVID-19.

1. Introduction

The fight against the Coronavirus disease 2019 (COVID-19) continues in Indonesia and around the world. To date, there are more than 237,348,931 million confirmed cases globally and more than 4,227,038 confirmed cases in Indonesia (Johns Hopkins University Center for Systems Science and Engineering, 2021). The COVID-19 pandemic has greatly affected all aspects of society, while the impact of a pandemic on society and other aspects of life varies from country to country (United Nations Development Programme, 2020). Currently, treatments to fight COVID-19 are still in the process of research and development as well as prevention and control of this disease is the main challenge facing every country.

Patients with COVID-19 experience mild to severe respiratory and non-respiratory symptoms (Huang et al., 2020), along with the symptoms of viral infections that vary from mild to very severe. Signs of infection include fatigue, fever, cough, and difficulty breathing (Wu & McGoogan, 2020). Given the high risk of disease transmission, infected people require isolation (Wang et al., 2020). COVID-19 pandemics, such as severe acute respiratory syndrome (SARS) and the MERS pandemic, have caused severe physical and psychological crises in these patients even after discharge (Park et al., 2020).

Frontline healthcare workers in COVID-19 include doctors, nurses, radiology officers, laboratories and hospital staff in infection control (Cai et al., 2020; Mohindra et al., 2020). In particular, nurses and doctors play a critical role in the treatment of patients with COVID-19. During nursing care, nurses are involved in diagnosis, prevention, control, and direct patient

care, making themselves more vulnerable to getting infected (Sun et al., 2020). Moreover, many nurses and doctors are unsure about their safety while caring for infected patients, which creates stress (Aggar et al., 2022; Hendy et al., 2021; Lorente et al., 2021). The fast-changing information related to treatment and disease progression, lack of training, depleted personal protective equipment (PPE), lack of certain medications, workload, lack of staff support, conflict with physician or other nurses were also found as predictive factors that may affect stress and mental distress among nurses caring for COVID-19 patients (Hendy et al., 2021; Lai et al., 2020; Lorente et al., 2021).

Those involved in the treatment of COVID-19 patients have a high risk of exposure. Many healthcare workers worldwide have been infected and died from COVID-19 (Bandyopadhyay et al., 2020; Burdorf et al., 2020; Xiang et al., 2020). This phenomenon has also been reported in Indonesia (Soebandrio et al., 2021). When nurses contracted the virus, their mental burden gets heavier (Moghimian et al., 2022). For example, nurses in Wuhan experience physical and psychological shock (He et al., 2021). They felt lost, frightened, and blamed themselves that they may risk other people's lives and also their own (He et al., 2021). A study in Iran reported that COVID-19 infected nurses and physicians experienced fear, anxiety, feeling abandoned, and denial (Moghimian et al., 2022). Frustration and helplessness seem unavoidable to some nurses (Turale et al., 2020).

However, little is known about the experience of Indonesian nurses when they were diagnosed with COVID-19. In addition, explaining and understanding nurses' experiences in a specific context is important because individual points of view can differ based on their culture and socialization. It can also increase and expand the knowledge of health care providers and nursing managers about the physical, psychological and spiritual needs of nurses who are infected with COVID-19 and how to deal with them in the future. Thus, this study aimed to gain insight into the experiences of nurses who were infected by COVID-19 and had undergone isolation in the hospital.

2. Methods

2.1 Research design
This research was a qualitative descriptive phenomenological study based on the framework proposed by Colaizzi et al. (1978).

2.2 Setting and participants
This research was conducted at a private hospital in Bandar Lampung City, which is one of the health care and treatment centers for COVID-19 patients in Bandar Lampung, Indonesia. The population of this study was all nurses who worked in the hospital where this study took place. The inclusion criteria in this study were nurses who had been infected with COVID-19, isolated either independently or in a hospital, had completed a 2-week quarantine period, and were not currently experiencing infection or complications from COVID-19 shown with a negative PCR test. Purposive sampling was used to recruit the participants. Data saturation was reached from 7 nurse participants.

Research permission was obtained from the hospital director where the researchers conducted the study. The researchers received information on the names of nurses who have completed isolation from the hospital's nurse manager. Next, the first author, with the help of a nurse manager, looked for prospective participants by contacting them through WhatsApp and explaining the study's purpose. Some prospective participants refused to join as respondents due to physical and psychological issues. All participants in the study signed written informed consent prior to the interview.

2.3 Measurement and data collection
Data collection was conducted from February to May 2021. Data were obtained by face-to-face in-depth interviews. The first author conducted the interviews with Bahasa Indonesia at a time and place of the respondents' convenience. The interviewer carried out all the prevention protocols according to the guidelines of the National COVID-19 Committee, and the interview was conducted after the participant's quarantine period ended. The protocol implemented during data collection included 1-meter physical distancing, respiratory etiquette, and hand washing.

The interviews were conducted after the interviewer introduced herself and explained the research's purpose. There were 9 semi-structured questions used as a guide in the interview and to keep the discussion on the main topic (Table 1). Questions are based on qualitative interview guidelines in the form of a research matrix containing information in making interview guides developed by the author and nursing experts in qualitative studies. All interviews were audio-recorded and transcribed word by word on the same day. The data collection tools used in this study were the researchers themselves, interview guidelines, field notes, and a voice recorder.

Table 1. Interview questions

No	The Questions
1	"Please tell me how you felt when you first found out you tested positive for Covid-19?"
2	"Can you share your experience while being treated in the Covid-19 room?"
3	"Describe your experience undergoing Covid-19 therapy?"
4	"Could you please explain what things encourage you to stay motivated while being treated in the Covid-19 isolation room? Why?"
5	"Please explain what things are considered to be obstacles during quarantine while being treated in the Covid-19 isolation room? Why?"
6	"Who has the most impactful role in providing support so that you are able to undergo therapy until it is declared negative for Covid-19? In terms of what?"
7	"If a patient has just started therapy and asks for advice, how would you share the most important thing in undergoing Covid-19 therapy?"
8	"How do you describe your current quality of life?"
9	"Are there other important things that you still want to say to the health workers for them to fulfill in improving services for Covid-19 patients?".

2.4 Data analysis

Colaizzi's (1978) seven-step phenomenological approach was used to analyze the data. The seven steps were as follows: 1. Both authors read each participant's transcript to understand the description and make sense of it; 2. Each transcript was reread, and phrases that directly relate to the phenomenon under investigation were extracted; 3. Meaning of each significant statement were formulated; 4. The aggregated formulated meanings were integrated into clusters of themes, for example, 'pre-isolation'; 5. Three themes and 15 sub-themes were identified, and a detailed description was developed; 6. The essential structure of the description of the experience was identified; 7. Finally, the participants validated the findings description and the fundamental structure of the findings.

2.5 Study rigor

To establish this study's rigor, the researchers considered each participant's interview's credibility, dependability, and transferability (Lincoln & Guba, 1985). Therefore, the authors conducted an audit trial to achieve credibility throughout the data collection process. This process was done to ensure that the interpretation was based on participants' reports. In addition, the authors discussed ensuring the selection of the most relevant codes and sub-themes and themes. Furthermore, the dependability of this study was achieved, as the authors used interview guidelines as interview memoirs to all participants. This process was done to ensure consistency during data collection. Finally, appropriate selection of participants, data collection, and analysis with relevant quotations can be used to judge these findings' transferability.

2.6 Ethical considerations

This study was approved by the Research Ethics Committee of Universitas Advent Indonesia (Approval code: No.132/KEPK-FIK.UNAI/EC/XII/20). Participants were informed of the purpose of the study, voluntary participation, and the right to withdraw from the study. Consent was obtained from each participant.

3. Results

3.1 Characteristics of the participants

Using purposive sampling, seven participants were identified using purposive sampling, consisting of 3 male nurses (43%) and 4 female nurses (57%) aged between 25 and 47 years old. The number of days for treatment ranged from 10 days to 21 days (Table 2).

Table 2. Participants' characteristics

Participant Number	Gender	Age (Years)	Isolation (Days)
R1	Female	27	21
R2	Female	30	10
R3	Male	25	21
R4	Male	31	14
R5	Male	47	18
R6	Female	40	12
R7	Female	28	10

The initial codes were classified into themes and sub-themes based on their meaning and conceptual similarity. As a result, 3 themes and 15 sub-themes emerged from the data (Figure 1). The themes are 'Pre-isolation', 'During isolation', and 'post-isolation'.

3.2 Theme 1: Experience at diagnoses (Pre-isolation)

Pre-isolation is participants' descriptions of their experiences before being isolated in the hospital isolation unit. Two sub-themes emerged from the interview data: participants 'initial reactions and early symptoms.

3.2.1 Initial reaction

Participants' reactions when first identified COVID-19 positive were fearful and anxious about their condition, family situation, and the social consequences of the disease. The participants feared death. They perceive death as an unpleasant and unexpected event. (P3) said, "...we often deal with patients who die, especially in the ER. It [the death] all happens so quickly. It's terrifying. I'm afraid that I will end up like that."

Most of the participants were also worried that they would die without their families being present. For example, one participant said, "When I saw the death of another patient, their family were unable to see them for the last time. I was afraid I would die like this" (P6).

Most participants reported fear and worry that they would infect their family members. P4 shared his feelings by saying, "I always think of my children. I'm worried they may also get exposed [by corona virus]." Likewise, (P7) explained how she tried not to pass the disease on to her husband: "... I refused to be held by my husband. I'm afraid of transmitting it [COVID-19] to him" (P7)

Moreover, the majority of participants reported fear of being ostracized by the environment and society. (P2) explained, "It happened in other places. Nurses and their families were evicted from the neighborhood where they lived. I'm terrified to be outcasted and ostracized." This situation makes them unwilling to report their condition to the authorities. One participant said about this issue: "... I was afraid to inform the neighborhood leader, people may know and ostracized me" (P7).

To some participants, being contracted to COVID-19 was hard to believe because they are certain that they have complied with the preventive measure. For example, (P3) reported, "... I had mixed feelings; how could I get COVID? I always wear full PPE!". Participants were also trying to digest the surprising information, and not a few of them were getting emotional as they could not accept the COVID test result. (P2) said, "...I didn't believe I got COVID. It was hard to accept being diagnosed positive for COVID. I was crying."

3.2.2 Early symptoms

Participants mentioned several symptoms when they were talking about how their body initially reacted to the infection. The symptoms include body aches, general weakness, fever,

cough, sore throat, loss of taste and smell. Comments below illustrate the initial symptoms reported by participants:

> "I was wondered, why I'm not feeling well. I had headache, sore throat, body aches, weakness, [and] nausea. Very uncomfortable." (P7)

> "The first symptoms were just fever, a day of fever and cough. On the fifth day, I lost my sense of smell and lost my taste." (P3)

3.3 Theme 2: Experience in the isolation room

This theme was about participants' experiences when isolated in the hospital. Participants who have undergone isolation as part of the treatment and spread prevention shared several impressions and experiences include: 'Feelings of being in isolation room', 'Physical symptoms', 'Spiritual experiences', 'Communications', 'Motivations', 'Facilities in the isolation room', 'Activities during isolation', 'Attention from the health care team', and 'Swab results.

3.3.1 Feelings of being in an isolation room

Most participants reported that they were alone, stressed, and frustrated while undergoing isolation treatment. For example, one participant stated, "... I feel like I'm being dumped, no one was there with me in the room except an old woman who can't communicate" (P6). The expression of disappointment was seen from P6. The loneliness made her feel stressed; (P6) added, "I can go crazy if I stay here for a long time. I don't know whom I can interact with."

For participants who were isolated in the emergency room, the situation became much worst because they were exposed to more COVID-19 patients with various levels of severity. In addition, the busy and loud emergency room environment was not conducive for participants to rest, which eventually created stress and frustration. (P5) explained, "I was treated temporarily in the ER isolation because the inpatient isolation was full. There were a lot of screaming patients, and some of them were in bad conditions. I was so stressed, I cried."

3.3.2 Physical symptoms

During their isolation period, some participants reported a more deteriorating physical condition. Similar to their initial symptoms, participants in this stage were still experiencing headaches, body aches, general weakness, loss of appetite, loss of taste and smell. In addition, however, they were also experiencing shortness of breath, coughing to the point of urinating, nausea, vomiting, and diarrhea. "My body was frail compared to several days before isolation ... I started to have a bloated stomach, nauseated, vomited, and also a decreased sense of smell" (P4). Likewise, (P5) commented, "...On the 3rd day, every time I came out of the bathroom, I was short of breath, like someone who ran a long distance, I felt very stuffy". Several participants also stated that enduring these symptoms was very tiring. As (P7) said, "It's tough to endure. That condition made me exhausted."

3.3.3 Spiritual Experiences

Participants reported that they had spiritual experiences that helped them keep going through the isolation processes. Some participants felt closer to God during their illness and prayed harder. For example, (P7) said, "I prayed more often and drew closer to God." (P2) also explained that her spiritual practices make her strong to overcome problems experienced while in isolation, "Suffering from COVID-19, I became aware of the importance of having a relationship with God who gives me strength and keeps me healthy" (P2).

In addition, many participants reported that they found peace and power simply by remembering God. As (P4) said, "I believe that God will not give anything that is something we cannot bear, and it will not exceed our own strength."

3.3.4 Communications

Communication was an important point that participants often reported—particularly communication with other patients, health workers, and families. Many participants conveyed that communication with other patients in the isolation unit was excellent and supportive. (P6), for example, was glad to be able to communicate and create a friendship with other patients. She

said, "It's nice to have roommates to share with finally. We talked and got to know each other" (P6). Another participant commented: "By chance, I share my room with my coworkers who also get COVID. We encourage each other to stay motivated" (P4). To some participants, maintaining communication with their loved one were significant to help them survive as (P6) said, "While being treated in the isolation room, my sisters always contacted me. They strengthened me."
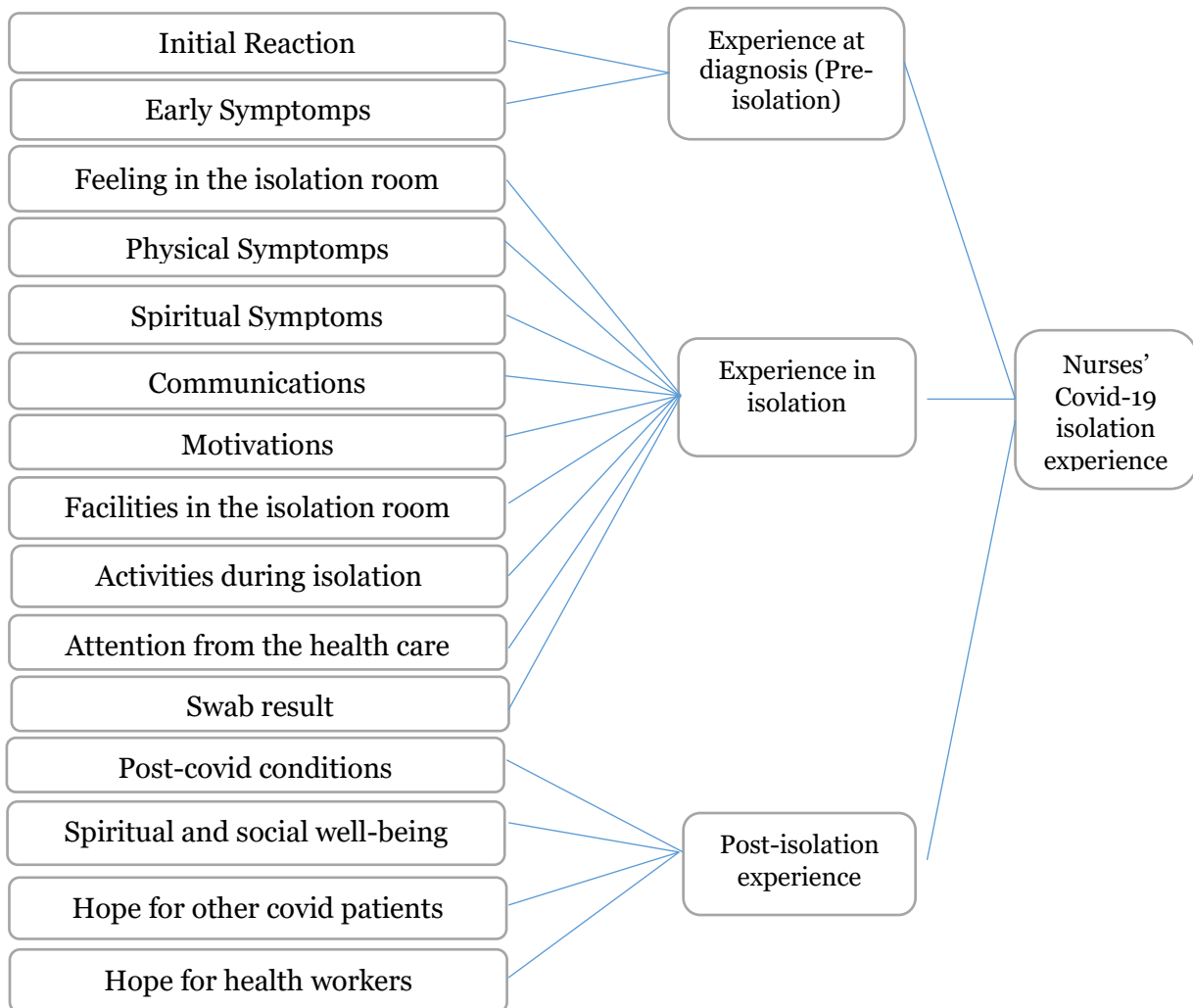

Figure 1. The subthemes and themes

3.3.5 *Motivation*

Several factors motivated participants to recover from COVID and thrive. First, most of the participants realized the significant role and support of family and friends in recovering from the COVID-19 disease and overcoming the psychological stress. According to participants, even though the family was not physically present with them during hospitalization and quarantine, the support of family members, such as nutritional, emotional, and religious support, was very effective in helping them recover and cope. For example, one participant said, "Family, children and coworkers, they prayed together and motivated me through video calls. Everything they did during my isolation had strengthened me through the treatment process." (P7).

In addition, participants also reported that their family are their reasons to survive and stay alive. As (P1) said, "I have to keep going and motivate myself to recover fast because my mother is widowed and old. I don't want to make her worry about my conditions." Likewise, R3 conveyed his concerns about his family during the isolation period, "I have two children. They needed me. I need to recover soon."

Participants also reported high self-motivation to recover, stating that they should not allow life's stresses to harm their health. (P2), for example, said, "I have to be able to motivate myself... So, I thought positively and tried to be happy." Similarly, (P1) revealed, "If I think negatively, I will stay in the isolation room longer" (P1).

3.3.6 *Facilities in the isolation room*
The majority of the participants reported that the facilities in the isolation room was inadequate, uncomfortable and caused disappointment. (P6) was one of the participants who were not pleased with the facilities due to the unclean environment. He said, "Geez, the room was dirty ... maybe it hasn't been cleaned when the previous patient was discharged" (P6). Another was not fully satisfied, noticing that there was no essential life-saving resource in the room. He said, "The facilities are okay even though oxygen is not available in my room, maybe because this is a newly opened room" (P1)

3.3.7 *Activities during isolation*
Some participants stated that reporting on their activities gave them energy such as sunbathing, breathing exercises, being independent in meeting physical needs, and helping other patients. For example, (P2) was excited to share her activity during the isolation period. She stated, "I always sunbathe, and in my room, I practised breathing by singing. I felt much better afterwards" (P2).

As nurses, participants also help other patients in their room meet their needs even when they status as patients. For example, (P7) shared, "My roommate, she's elderly, was suffocated, so I helped take care of her." Likewise, (P6) reported, "I'm in a room with an old woman who was short of breath and using oxygen. So I took care of her."

3.3.8 *Attention from the health care team*
Some participants stated that they received less attention from nurses and doctors. They assumed that this was because of their profession as nurses, so the other health care providers consider them to be able to take care of themselves as long as there are no significant physical problems. As (P3) said, "It's because I am a nurse. So when a nurse or doctor comes, I didn't get a full explanation of my conditions, and they considered that I can take care of myself."

3.3.9 *Swab results*
Swab results need to be negative before participants are allowed to exit the isolation unit and return home. However, participants stated that the results of the PCR swab took a long time, so their time to come out of isolation took longer. For example, (P2) reported, "The PCR results were too long... I have to wait a few days [after the swab] until I can go home." Not just waiting for a few days, some participants even had to wait weeks. "I waited for the results of the second PCR for two weeks. Hopefully, in the future, the results can be faster" (P6)

3.4 *Theme 3: Post-isolation experiences*
Participants' experiences after the isolation were completed and when they were able to return home had changed many different aspects of their lives. These experiences also created hopes and expectations for other COVID patients and health workers. The post-isolation experience consists of 'post-COVID conditions', 'spiritual and social well-being', 'hope for other covid patients' and 'hope for health workers.'

3.4.1 *Post-COVID conditions*
The physical conditions of participants after the isolation and after their test came back negative did not make their stamina and strength return as normal before they had COVID-19. Many participants reported that the condition of their body post-COVID is easy to get tired, especially when doing daily activities. One participant commented, "Although my test was negative, there's a thing called post-COVID reaction. My body gets tired easily... Even now, after 2 months, I'm not as fit as I used to be" (P6).

Participants' COVID experiences had changed the way they live and encouraged better discipline in the prevention measurement of COVID-19. They understand the importance of

complying with health principles, such as taking the benefit of sunbathing, eating healthy food, washing hands, wearing masks, and social distancing to maintain one's health. For example, (P3) described, "Now I disciplined myself to wear a mask and regularly sunbathe. I'm also trying to have a healthy diet, fruits and vegetables, and regularly consume vitamin supplements".

3.4.2 Spiritual and social well-being

Participants reported that post-COVID experience, they are more spiritually aware and find peace through spiritual activities. "My spiritual life has changed. I have a special prayer time commitment in the morning and evening. I thank God for giving me a second chance" (P3).

Participants also reported that they found happiness to help and support friends who indicated COVID-19. For example, (P6) said, "If I hear a friend has COVID, I'll be happy to send them food. I'll support them." Another participant echoed this, "Yesterday a friend of mine and his family had a positive COVID-19 test result, so I sent them food supplies... I feel glad doing little things to make them happy and less stress with the situation" (P4).

3.4.3 Hope for other COVID patients

Participants reported their experience in getting through the isolation period by emphasizing the importance of motivation, positive thinking, and stresslessness. These are hopes they have for COVID-19 patients. For example, (P2) said, "My message is, I've been through it and recovered, so you do too," and another commented, "don't stress it too much, keep eating, have lots of rest and make yourself happy" (P7).

3.4.4 Hope for health workers

Participants had different expectations for health workers caring for patients with COVID-19, especially those working in the isolation room. Some participants suggested that nurses need to improve communication with their patients and support patients in hospital isolation; as (P3) argued, "I hope that the nurses can motivate the patient more and have a conversation with them. Try to comfort them. Most of the time, nurses are the only person they can talk to." Other participants emphasized the importance of COVID-19 knowledge to nurses so they would provide effective care to their patients. "Nurses who work in the isolation unit need to increase their knowledge and skills related to COVID-19 and its treatments. Hopefully, they can provide the best nursing care" (P5).

4. Discussion

This study explored the experience of nurses who were isolated in the hospital due to COVID-19 infection. Three themes were generated from the interviews, those were pre-isolation experiences, experience in the isolation room, and post-isolation experiences.

4.1 Theme 1. Experience at diagnoses (Pre-Isolation)

Nurses' initial responses to the fact that they were COVID-19 positive included feared and worried. This study also indicated that COVID-19 patients experienced fear and anxiety in several dimensions, such as a terrible fear of death, fear of infection and fear of being isolated by the environment. These results are consistent with data obtained by Taylor et al. (2020), who identified five symptom factors of coronavirus-related stress and anxiety: (1) danger and contamination, (2) fear of economic consequences, (3) coronavirus-related xenophobia, (4) compulsive examination and reassurance, and (5) symptoms of traumatic stress. In their findings, Taylor et al. (2020) also highlighted that their participants also expressed fear of a hard and painful death as they observed the deaths of other patients, with deteriorating clinical conditions, awareness of the COVID 19 high mortality rate worldwide shown in the media, and being away from family members. Banzett et al. (2020) reported that patients in the acute phase of the disease might often fear death due to worsening clinical conditions. Patients confirmed with COVID-19 tend to experience stress related to the conditions they experience, which can affect their physical, emotional, mental, social, and spiritual state (Roman et al., 2020). The finding related to COVID-19 patients is also accords with that of Sarfika et al. (2021) involved 1,622 participants from 34 provinces in Indonesia and reported that the prevalence of depression in Indonesia was 28.5% mild depression, 18.4% moderate depression, and 24.8%

severe depression. In addition, social media exposure (SME), age, gender, occupation, and self-rated health (SRH) was significantly influencing depression ($p<0.05$) (Sarfika et al., 2021).

Nurses in this study were frustrated by stigmatization and afraid of being ostracized. Research in India shows that some patients are stigmatized because of COVID-19 (Sahoo et al., 2020). Patients with COVID-19 are always stigmatized due to feelings of rejection and the negative view of society towards the disease (Moradi et al., 2020). The negative consequences of the stigma of controlling COVID-19 disease include hiding the condition, avoiding treatment and immediately implementing healthy lifestyle behaviours, and interfering with patient identification and supervision (Asadi-Aliabadi et al., 2020; Bhattacharya et al., 2020).

4.2 Theme 2. Experience in the isolation room

As a result of their isolation, the nurses in this study frequently felt frustrated and alone. According to Kar et al. (2020), quarantined COVID-19 people experienced various mental disorders, such as boredom, loneliness, anger, depression, anxiety, rejection, and hopelessness. Nurses in this study were worried about fulfilling their family responsibilities while they were away from family and isolated. This situation also caused sadness, especially when separated from loved ones. The statement of stress experienced by nurses was generated thinking about their health condition that would worsen. This finding is consistent with a study by Giallonardo et al. (2020) who reported that patients in isolation might have been affected psychologically due to the number of uncontrolled COVID-19 cases and the death rate.

Spiritual experiences, positive thoughts and perceptions of social support influenced participants' perspectives on this disease and their attitudes towards this disease in the stages of diagnosis, treatment, hospitalization and post isolation. They increased the level of adjustment to the disease condition. Shaban et al. (2020) also found that people diagnosed with COVID-19 modified their behaviors, including healthy eating, positive thinking, lifestyle changes, and becoming more spiritual. The participants' spiritual awakening is a God-centered spirituality that means finding God's meaning as a source of strength in their difficult situation (Shaban et al., 2020). Furthermore, Jesmi et al. (2021) also reported that patients with COVID-19 use religious mechanisms such as religious activities and beliefs to reduce their tensions and worries. Improving and training coping mechanisms according to the patient's culture can positively affect these patients. Striving for recovery shows optimism and hope for the future in patients with COVID-19. Spiritual and religious experiences, as solid sources of adjustment, optimism, hope, and meaning, enable individuals to reduce participants' bitter experiences with their illness.

The positive mood of COVID-19 confirmed patients would increase high dopamine in the blood and will optimize and boost the immune system. So, the strategy to support immunity is to maintain a good mood, such as by video calling family and loved ones, playing with handphones and listening to music. A study showed that listening to music for COVID-19 confirmed patients undergoing isolation in the COVID-19 ward is an effective way to reduce anxiety and hallucinations that cause fear and helps to have a more positive experience (Habib, 2021). Meanwhile, listening to music can reduce psychological problems based on subjective reactions to situations. Listening to music is an interacting component in preventing anxiety, boredom, stress and post-traumatic disorders (Panteleeva et al., 2018). It is stated that worship, prayer and al-Quran reading are good alternatives to treat illness psychological well-being and improve quality of life (Umarella et al., 2020).

Based on research by Aungsuroch et al. (2020), support from family members shows that humans are social beings who cannot live without social support. Positive emotions play an important role in recovery and psychological adjustment (Sun, et al., 2020). Support from friends can positively respond to health promotion (Habib, 2021). Support from the medical team is urgently needed for patients with confirmed COVID-19 in undergoing treatment and isolation. The care and intervention that the medical team provides professionally every day will generate gratitude from the patient (Wang et al., 2020). Improving facilities, especially swab results, are currently still taking a long time. According to the Ministry of Health of the Republic of Indonesia (2020a), in cases of investigators who are self-isolating, monitoring is carried out by health workers, and monitoring can be carried out if the results of the RT-PCR examination for two consecutive days with an interval of > 24 hours show negative results.

4.3 Theme 3. Post-isolation experiences

The post-COVID-19 syndrome experienced by nurses are varied. Some stated that the post-COVID-19 syndrome could still be felt even though it had been declared negative for COVID-19. This is in line with Shah et al. (2021) who stated that in October 2020, NICE (the national institute for health and care excellence) has recognized the uncertainty of the long-term effects of the SARS-CoV-2 virus and defined post-COVID-19 syndrome as a symptom that lasts longer up to 12 weeks. Long-term physical condition complaints in patients with confirmed COVID-19 vary over time and fluctuate, depending on the severity of the disease and the patient's health status, considering comorbidities and overall weakness. This condition presents with symptoms that can change over time and can affect systems in the body. Common symptoms of the post-COVID-19 syndrome include extreme tiredness and weakness, shortness of breath on light activity, joint pain, persistent low-grade fever, headache, vertigo, runny nose, sore throat, voice changes and difficulty swallowing, loss or change in smell and taste. Prolonged mood swings, hair loss, gastrointestinal disturbances including loss of appetite, abdominal pain, diarrhea, vomiting, inability to concentrate and insomnia (Higgins et al., 2021; Shah et al., 2021).

During post-COVID experience, they are more spiritually aware and find peace through spiritual activities. Spirituality can provide hope and meaning in difficult situations, including during the COVID-19 pandemic (Tuason et al., 2021). Spiritual creates positive emotions in a person. Spirituality and religion can help people in grief in times of crisis and can be a useful "sedative" for humans (Fardin, 2020). Support from the medical team is urgently needed for patients with confirmed COVID-19 undergoing treatment in the isolation room. The care and intervention that the medical team provides professionally every day will generate gratitude from the patient (Wang et al., 2020). The provision of care and treatment from the medical team can improve self-management approaches that help patients be more enthusiastic to fight the disease they are suffering from. The satisfaction of clinical interventions received and the quality of care during treatment in the COVID-19 isolation room, as well as the respect received from medical team professionals (Olufadewa et al., 2020).

Dissatisfaction with the clinical intervention received and the quality of care in the COVID-19 isolation room was caused by restrictions on the hours of entry of the COVID-19 medical team into the COVID-19 isolation room. Based on a study by mitigation team of the Indonesian Medical Association (Ministry of Health of the Republic of Indonesia, 2020b), the work shift must pay attention to the duration of work by the regulations, namely *Permenkes* (Health Minister's Regulation) No. 52 of 2018. Shorter working hours are allowed in conditions of abnormal work pressure or high risk, such as the COVID-19 medical team must wear hazmat continuously throughout the shift. Short shifts are recommended over long shifts to help protect against the risk of mental fatigue from heavy workloads. Fatigue can increase the risk of injury and worsen health conditions that are prone to infectious diseases, increase psychological stress that affects the health of the medical team and the quality and safety of the care provided. It is necessary to educate the COVID-19 medical team to confirm COVID-19 patients undergoing treatment in the COVID-9 isolation room regarding changes in the rotation and duration of the medical team's work in the COVID-19 isolation room. This was done to reduce the exposure of health workers to viruses aimed at maintaining physical and mental health and maintaining the quality of service for the medical team.

Cabrini et al. (2020) stated that during the COVID-19 outbreak, healthcare providers were recognized as national heroes. Studies show that patients recovering from COVID-19 regard family as the most important source of support (Shaban et al., 2020). Regarding family support, nurses also take advantage of the patient's family support to overcome the psychological damage caused by COVID-19 (Sun et al., 2020). The nurse's motivation for responsibility and calling for caring for patients and a deep feeling of empathy because of the patient's condition and being away from family members affect patient satisfaction when being treated.

5. Implications and limitations

This study provides insight into the experiences of nurses who were infected with COVID-19 and undergoing isolation in the hospital. Their feelings and needs while diagnosed with COVID-19 and isolated in COVID-19 units are identified in this study. The finding highlights the necessity of family and caregivers' support throughout their isolation period. Useful guidance and training on preventing COVID-19 transmission to nurses are also required, along with

regulations related to PPE (personal protective equipment) and how nurses may return to work after recovering from COVID infection. In addition, the study also has implications for nurses. Nurses diagnosed with COVID-19 may use their experience as a lesson when dealing with COVID-19 patients. From their experiences, the nurse can be more empathetic to patients and families and become more sensitive to patients' physical, social, and spiritual needs in isolation.

The authors acknowledge that this study has limitations. To get information about nurses' experience, we collected qualitative data from one hospital sample. Therefore, the findings may not be generalized as Indonesian nurses' experiences. Additionally, the study is limited by the lack of information on how nurses cope with isolation. Although some information provided may reflect how nurses deal with their situation, the focus of this study was on their experiences only, and results may not reflect actual nurses coping mechanisms towards their isolation treatments. We encouraged further research to be conducted in larger scope of area and wider range of healthcare professionals.

6. Conclusion

This study explored nurses' experiences of COVID-19. It resulted in three main themes: experience at diagnosis (Pre-isolation), experiences during isolation, and post-isolation experiences. It was highlighted from the findings that psychological, social, and spiritual support from family, fellow nurses and nurse managers were significant for nurses' recovery. By understanding pre, during and post COVID-19 isolation, nursing managers will be able to plan appropriate care and use the proper approach to support infected nurses, and this area needs further research. Moreover, nursing managers can protect the nurses during their duty through infection control education and training, as well as regulations that help nurses work during COVID-19 pandemic.

Acknowledgment

Author contribution

Both authors (ES, GR) participated sufficiently in the concept, design, analysis, writing, and critical revision of the manuscript. The first author (ES) conducted the interviews and data collection.

Conflict of interest

There is no conflict of interest in this research.

References

Aggar, C., Samios, C., Penman, O., Whiteing, N., Massey, D., Rafferty, R., Bowen, K., & Stephens, A. (2022). The impact of COVID-19 pandemic-related stress experienced by Australian nurses. *International Journal of Mental Health Nursing, 31*(1), 91–103. https://doi.org/10.1111/inm.12938

Asadi-Aliabadi, M., Tehrani-Banihashemi, A., & Moradi-Lakeh, M. (2020). Stigma in COVID-19: A barrier to seek medical care and family support. *Medical Journal of The Islamic Republic of Iran*, 2020, 13–15. https://doi.org/10.47176/mjiri.34.98

Aungsuroch, Y., Juanamasta, I. G., & Gunawan, J. (2020). Experiences of patients with coronavirus in the Covid-19 pandemic era in Indonesia. *Asian Journal for Public Opinion Research, 8*(3), 377–392. https://doi.org/10.15206/ajpor.2020.8.3.377

Bandyopadhyay, S., Baticulon, R. E., Kadhum, M., Alser, M., Ojuka, D. K., Badereddin, Y., Kamath, A., Parepalli, S. A., Brown, G., Iharchane, S., Gandino, S., Markovic-Obiago, Z., Scott, S., Manirambona, E., Machhada, A., Aggarwal, A., Benazaize, L., Ibrahim, M., Kim, D., ... Khundkar, R. (2020). Infection and mortality of healthcare workers worldwide from COVID-19: A systematic review. *BMJ Global Health, 5*(12), 1-11. https://doi.org/10.1136/bmjgh-2020-003097

Banzett, R. B. B., Sheridan, A. R., Baker, K. M., Lansing, R. W., & Stevens, J. P. (2020). "Scared to death" dyspnoea from the hospitalised patient's perspective. *BMJ Open Respiratory Research, 7*(1), 2019–2021. https://doi.org/10.1136/bmjresp-2019-000493

Bhattacharya, P., Banerjee, D., & Rao, T. S. (2020). The "untold" side of COVID-19: Social stigma and its consequences in India. *Indian Journal of Psychological Medicine, 42*(4), 382-386. https://doi.org/10.1177/0253717620935578

Burdorf, A., Porru, F., & Rugulies, R. (2020). The COVID-19 (Coronavirus) pandemic: Consequences for occupational health. *Scandinavian Journal of Work, Environment and Health, 46*(3), 229–230. https://doi.org/10.5271/sjweh.3893

Cabrini, L., Landoni, G., & Zangrillo, A. (2020). Minimise nosocomial spread of 2019-nCoV when treating acute respiratory failure. *The Lancet, 395*(10225), 685. https://doi.org/10.1016/S0140-6736(20)30359-7

Cai, H., Tu, B., Ma, J., Chen, L., Fu, L., Jiang, Y., & Zhuang, Q. (2020). Psychological impact and coping strategies of frontline medical staff in Hunan between January and March 2020 during the outbreak of Coronavirus disease 2019 (COVID) in Hubei, China. *Medical Science Monitor, 26*, 1–16. https://doi.org/10.12659/MSM.924171

Colaizzi, P., Vale, R., & King, M. (1978). *Existential-phenomenological alternatives for psychology*. Oxford University Press.

Fardin, M. A. (2020). COVID-19 epidemic and spirituality: A review of the benefits of religion in times of crisis. *Jundishapur Journal of Chronic Disease Care, 9*(2), e104260. https://doi.org/10.5812/jjcdc.104260

Giallonardo, V., Sampogna, G., Del Vecchio, V., Luciano, M., Albert, U., & Carmassi, C., Carrà, G., Cirulli, F., Dell'Osso, B., Nanni, M. G., Pompili, M., Sani, G., Tortorella, A., Volpe, U., & Fiorillo, A. (2020). The impact of quarantine and physical distancing following COVID-19 on mental health: Study protocol of a multicentric Italian population trial. *Frontiers in Psychiatry, 11,* 533. https://doi.org/10.3389/fpsyt.2020.00533

Habib, P. T. (2021). COVID-19 symphony: A review of possible music therapy effect in supporting the immune system of COVID-19 patient. *Highlights in BioScience, 4,* bs202105. https://doi.org/10.36462/h.biosci.202105

He, J., Liu, L., Chen, X., Qi, B., Liu, Y., Zhang, Y., & Bai, J. (2021). The experiences of nurses infected with COVID-19 in Wuhan, China: A qualitative study. *Journal of Nursing Management, 29*(5), 1180–1188. https://doi.org/10.1111/jonm.13256

Hendy, A., Abozeid, A., Sallam, G., Abboud Abdel Fattah, H., & Ahmed Abdelkader Reshia, F. (2021). Predictive factors affecting stress among nurses providing care at COVID-19 isolation hospitals at Egypt. *Nursing Open, 8*(1), 498–505. https://doi.org/10.1002/nop2.652

Higgins, V., Sohaei, D., Diamandis, E. P., & Prassas, I. (2021). COVID-19: From an acute to chronic disease? Potential long-term health consequences. *Critical Reviews in Clinical Laboratory Sciences, 58*(5), 297–310. https://doi.org/10.1080/10408363.2020.1860895

Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., Zhang, L., Fan, G., JXu, J., Gu, X., Cheng, Z., Yu, T., Xia, J., Wei, Y., Wu, W., Xie, X., Yin, W., Li, H., Liu, M., ... Cao, B. (2020). Clinical features of patients infected with 2019 novel Coronavirus in Wuhan, China. *The Lancet, 395*(10223), 497–506. https://dx.doi.org/10.1016%2FS0140-6736(20)30183-5

Jesmi, A. A., Mohammadzade-Tabrizi, Z., Rad, M., Hosseinzadeh-Younesi, E., & Pourhabib, A. (2021). Lived experiences of patients with Covid-19 infection: A phenomenology study. *Medicinski Glasnik, 18*(1), 18–26. https://doi.org/10.17392/1247-21

Jin, Y. H., Cai, L., Cheng, Z. S., Cheng, H., Deng, T., Fan, Y. P., Fang, C., Huang, D., Huang, L. Q., Huang, Q., Han, Y., Hu, B., Hu, F., Li, B. H., Li, Y. R., Liang, K., Lin, L. K., Luo, L. S., Ma, J., ... Wang, X. H. (2020). A rapid advice guideline for the diagnosis and treatment of 2019 novel Coronavirus (2019-nCoV) infected pneumonia (standard version). *Military Medical Research, 7*(4), 1–23. https://doi.org/10.11855/j.issn.0577-7402.2020.01.01

Johns Hopkins University Center for Systems Science and Engineering. (2021). *COVID-19 dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)*. John Hopkins University & Medicine: Coronavirus Resource Center.

Kar, S. K., Yasir Arafat, S. M., Kabir, R., Sharma, P., & Saxena, S. K. (2020). *Coping with mental health challenges during COVID-19.* In S. K. Saxena (Ed.), Coronavirus disease 2019 (COVID-19). Medical virology: From pathogenesis to disease control. (Vol. 2019, pp. 199–213). Springer. https://doi.org/10.1007/978-981-15-4814-7_16

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., & Hu, S. (2020). Factors associated

with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Network Open, 3*(3), 1–12. https://doi.org/10.1001/jamanetworkopen.2020.3976

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* SAGE. https://uk.sagepub.com/en-gb/asi/naturalistic-inquiry/book842

Lorente, L., Vera, M., & Peiró, T. (2021). Nurses´ stressors and psychological distress during the COVID-19 pandemic: The mediating role of coping and resilience. *Journal of Advanced Nursing, 77*(3), 1335–1344. https://doi.org/10.1111/jan.14695

Ministry of Health of the Republic of Indonesia. (2020a). *Keputusan Menteri Kesehatan Republik Indonesia nomor HK.01.07/MENKES/247/2020 tentang pedoman pencegahan dan pengendalian Covid-19 [The Decree of the Minister of Health of the Republic of Indonesia number HK.01.07/Menkes/247/2020 regarding prevention and control of Coronavirus disease (COVID-19)].* Minister of Health of the Republic of Indonesia

Ministry of Health of the Republic of Indonesia. (2020b). P*edoman pencegahan dan pengendalian Coronavirus disease (COVID-19) [The guidelines for prevention and control of Coronavirus disease (COVID-19)].* Ministry of Health of the Republic of Indonesia.

Moghimian, M., Farzi1, K., Farzi, S., Moladoost, A., & Safiri, S. (2022). Exploring the experiences of nurses and physicians infected with COVID-19. *Journal of Education and Health Promotion, 11*(35), 1–6. https://doi.org/10.4103/jehp.jehp_604_21

Mohindra, R., R, R., Suri, V., Bhalla, A., & Singh, S. M. (2020). Issues relevant to mental health promotion in frontline health care providers managing quarantined/isolated COVID19 patients. *Asian Journal of Psychiatry, 51,* 102084. https://doi.org/10.1016/j.ajp.2020.102084

Moradi, Y., Mollazadeh, F., Karimi, P., Hosseingholipour, K., & Baghaei, R. (2020). Psychological disturbances of survivors throughout COVID-19 crisis: A qualitative study. *BMC Psychiatry, 20*(1), 1–8. https://doi.org/10.1186/s12888-020-03009-w

Olufadewa, I. I., Adesina, M. A., Oladokun, B., Baru, A., Oladele, R. I., Iyanda, T. O., Ajibade, O. J., & Abudu, F. (2020). "I was scared I might die alone": A qualitative study on the physiological and psychological experience of COVID-19 survivors and the quality of care received at health facilities. *International Journal of Travel Medicine and Global Health, 8*(2), 51–57. https://doi.org/10.34172/ijtmgh.2020.09

Panteleeva, Y., Ceschi, G., Glowinski, D., Courvoisier, D. S., & Grandjean, D. (2018). Music for anxiety? Meta-analysis of anxiety reduction in non-clinical samples. *Psychology of Music, 46*(4), 473–487. https://doi.org/10.1177/0305735617712424

Park, H. Y., Park, W. B., Lee, S. H., Kim, J. L., Lee, J. J., Lee, H., & Shin, H. S. (2020). Posttraumatic stress disorder and depression of survivors 12 months after the outbreak of Middle East respiratory syndrome in South Korea. *BMC Public Health, 20*(1), 1–9. https://doi.org/10.1186/s12889-020-08726-1

Roman, N. V, Mthembu, T. G., & Roman, N. (2020). Spiritual care – ' A deeper immunity ' – A response to Covid-19 pandemic spiritual care in the South African. *African Journal of Primary Health Care & Family Medicine, 12*(1), e1–e3. https://doi.org/10.4102/phcfm.v12i1.2456

Sahoo, S., Mehra, A., Suri, V., Malhotra, P., Yaddanapudi, L. N., Puri, G. D., & Grover, S. (2020). Lived experiences of the corona survivors (patients admitted in COVID wards): A narrative real-life documented summaries of internalized guilt, shame, stigma, anger. *Asian Journal of Psychiatry, 53, 102187.* https://doi.org/10.1016/j.ajp.2020.102187

Sarfika, R., Malini, H., Putri, D. E., Buanasari, A., Abdullah, K. L., & Freska, W. (2021). Factors influencing depression among Indonesians during the COVID-19 outbreak. *Nurse Media Journal of Nursing, 11*(3), 380–388. https://doi.org/10.14710/nmjn.v11i3.36783

Shaban, R. Z., Nahidi, S., Castillo, C. S., Li, C., Gilroy, N., N, M. V, O'Sullivan, Sorrell, T. C., White, E., Hackett, K., & Bag, S. (2020). SARS-CoV-2 infection and COVID-19: The lived experience and perceptions of patients in isolation and care in an Australian healthcare setting. *American Journal of Infection Control, 48*(12), 1445–1450. https://doi.org/https://doi.org/10.1016/j.ajic.2020.08.032

Shah, W., Hillman, T., Playford, E. D., & Hishmeh, L. (2021). Managing the long term effects of covid-19: Summary of NICE, SIGN, and RCGP rapid guideline. *The BMJ, 372,* 10–13. https://doi.org/10.1136/bmj.n136

Soebandrio, A., Kusumaningrum, T., Yudhaputri, F. A., Oktavianthi, S., Safari, D., Malik, S. G., & Myint, K. S. A. (2021). COVID-19 prevalence among healthcare workers in Jakarta and neighbouring areas in Indonesia during early 2020 pandemic. *Annals of Medicine, 53*(1), 1896–1904. https://doi.org/10.1080/07853890.2021.1975309

Sun, N., Wei, L., Shi, S., Jiao, D., Song, R., Ma, L., Wang, H., Wang, C., Wang, Z., You, Y., Liu, S., & Wang, H. (2020). A qualitative study on the psychological experience of caregivers of COVID-19 patients. *American Journal of Infection Control, 48*(6), 592–598. https://doi.org/10.1016/j.ajic.2020.03.018

Taylor, S., Landry, C. A., Paluszek, M. M., Fergus, T. A., Mckay, D., & Asmundson, G. J. G. (2020). Development and initial validation of the COVID stress scales. *Journal of Anxiety Disorders, 72*, 102232. https://doi.org/10.1016/j.janxdis.2020.102232

Tuason, M. T., Güss, C. D., & Boyd, L. (2021). Thriving during COVID-19: Predictors of psychological well-being and ways of coping. *PLoS ONE, 16(3), e0248591.* https://doi.org/10.1371/journal.pone.0248591

Turale, S., Meechamnan, C., & Kunaviktikul, W. (2020). *Challenging times: Ethics, nursing and the COVID-19 pandemic. International Nursing Review, 67*(2), 164-167. https://doi.org/10.1111/inr.12598

Umarella, S., Farid, M., & Ab Rahman, Z. (2020). Medicine and Al-Quran recital approaches used on COVID-19 patients: A systematic review. *Systematic Reviews in Pharmacy, 11*(12), 1163–1170.

United Nations Development Programme. (2020). *COVID-19 socio-economic impact.* https://www.undp.org/coronavirus/socio-economic-impact-covid-19

Wang, M., Zhou, Y., Zong, Z., Liang, Z., Cao, Y., Tang, H., Song, B., Huang, Z., Kang, Y., Feng, P., Ying, B., & Li, W. (2020). A precision medicine approach to managing 2019 novel Coronavirus pneumonia. *Precision Clinical Medicine, 3*(1), 14–21. https://doi.org/10.1093/pcmedi/pbaa002

Wu, Z., & McGoogan, J. M. (2020). Characteristics of and important lessons from the Coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72314 cases from the Chinese center for disease control and prevention. *JAMA - Journal of the American Medical Association, 323*(13), 1239–1242. https://doi.org/10.1001/jama.2020.2648

Xiang, Y. T., Jin, Y., Wang, Y., Zhang, Q., Zhang, L., & Cheung, T. (2020). Tribute to health workers in China: A group of respectable population during the outbreak of the COVID-19. *International Journal of Biological Sciences, 16*(10), 1739–1740. https://doi.org/10.7150/ijbs.45135

ORIGINAL RESEARCH

Facilitating the Development of Clinical Competence in a Low-Resource Setting: Perceptions and Challenges of Nurse Educators

David Abdulai Salifu[1,2], Yolande Heymans[1], Christmal Dela Christmals[1]

[1]Centre for Health Professions Education, Faculty of Health Sciences, North-West University, South Africa
[2]School of Nursing and Midwifery, University for Development Studies, Tamale, Ghana

Article Info	Abstract
	Background: The inability of nursing education institutions, particularly in low-resource settings to train competent nurses has been partly attributed to the challenges faced by nurse educators in the teaching of practical skills and in facilitating the development of clinical competence. Unfortunately, the perceptions and challenges faced by nurse educators in clinical nursing educationin diploma nursing education in low-resource settings have not been explored. **Purpose:** This study aimed to explore and describe the perceptions and challenges of nurse educators in the teaching of practical skills and in facilitating the development of clinical competence in diploma nursing education in Ghana, a low-resource setting. **Methods:** A qualitative descriptive design was used in this study. Nine nurse educators tasked with teaching practical skills and facilitating the development of clinical competence from three accredited diploma-awarding public nursing colleges – one in each of the three geographical zones of Ghana – were purposively sampled and interviewed using a semi-structured interview guide. The data were analysed with the aid of ATLAS.ti software through the thematic framework approach of qualitative data analysis. **Results:** Four themes, namely nurse educator and student factors, skills learning environment factors, institutional challenges, and regulatory issues, were identified and described the challenges of practical skills teaching and clinical competence development confronting nurse educators in the study setting. **Conclusion:** To address these challenges, policy measures should be implemented to ensure adequate national investment in nursing education and incentives to promote nurse educator development and performance. Nurse educators and their labour union should therefore strongly advocate for this transformation in nursing education.

1. Introduction

Meeting the demands of various patient populations and promoting global health requires a competent nursing workforce. This is particularly important because nurses make up the majority of the global healthcare workforce and play critical roles in providing universal health coverage (UHC) (Christmals et al., 2021; World Health Organization, 2018). Given the crucial role that nurses play in the health delivery system, nursing education is expected to produce competent nurses to meet the ever-changing challenges of the health care environment in terms of disease burden and technological advancements. However, current approaches to nursing education in low-resource settings promote knowledge acquisition rather than equipping nurses with the necessary clinical competence to function independently in the complex health care environment (Salifu et al., 2019; Salifu et al., 2022). In addition, insufficient orientation programmes for integrating newly qualified nurses into the health care environment complicates their transition into independent professionals upon graduation (Cook et al., 2012; Jeffries, 2005). The lack of clinical competence exhibited by post-registration nurses lends credence to this assertion (Hussein & Osuji, 2016; Inayat et al., 2020; Jamshidi et al., 2016; Nehrir et al., 2016; Salifu et al., 2019; Voldbjerg et al., 2016). These challenges are attributed to sustained resource inadequacies, especially in low-resource countries.

Training nurses with the basic requisite clinical competence and capacity to seamlessly transition into the clinical environment has, therefore, become a necessity for nurse educators, particularly because the quality of nursing education has a direct correlation with the quality of nursing care provided to individuals and populations (World Health Organisation, 2012). As a result, nursing education institutions (NEIs) have been urged to come up with new strategies to help nurses develop clinical competence in readiness for practice upon graduation. A well-developed competency-based curriculum with simulation-based clinical education promises to be an effective strategy to train nurses with the needed competence to respond to the demands of the practice setting effectively (Pirie et al., 2016). Simulation pedagogy, defined as the use of role play, manikins, and task trainers to act out scenarios to mirror real clinical situations in a nonthreatening manner, has been described as instrumental in assisting students building their confidence and clinical competence (Agha et al., 2015; Bvumbwe & Mtshali, 2018a; Farzi et al., 2018; J. Kim et al., 2016).

Although many first-world countries have embraced competency-based curricula with simulation-based clinical education as a major component (Benton, 2012; Frenk et al., 2010; Hill & Williams, 2017; Spitzer & Perrenoud, 2006), the design and implementation of competency-based curriculum and simulation programmes in low-resource settings is challenging (Bvumbwe & Mtshali, 2018a; Bvumbwe & Mtshali, 2018b). The inability of nurse educators to use interactive and student-centred teaching and learning strategies in promoting learning, and the lack of a context-appropriate framework to guide the design, implementation, and evaluation of simulation pedagogy appear to be the major barriers to its utilisation in low-resource settings (World Health Organisation, 2016). Nurse educators have been criticised for not having the appropriate qualifications and competence to teach in NEIs, particularly in low-resource settings (Munangatire & Naidoo, 2017; Salifu et al., 2019; Watson et al., 2021; Younas et al., 2019). Seemingly, the majority of nurse educators in NEIs of low-resource settings, notably in accredited diploma-awarding nursing colleges, hold a bachelor's degree and might have no teaching nor clinical experience at the time of recruitment. Consequently, meeting the World Health Organisation's (WHO's) nurse educator core competencies (World Health Organisation, 2016) may be difficult for these nurse educators, who appear to face challenges in their efforts to facilitate student learning and clinical competence development. Moreover, nurse educators in low-resource settings have been reported to encounter contextual challenges in their effort to ensure effective nursing education and the development of clinical competence (Dahlke et al., 2016; S. Kim et al., 2016; Papathanasiou et al., 2014). For example, amidst the general lack of infrastructure and resources in both educational and clinical settings, opportunities for professional growth and development such as refresher courses or workshops, and incentives for continuing education are also limited for nurse educators in low-resource settings (Salifu et al., 2019; Talley, 2006; Younas et al., 2019).

Unfortunately, previous research appears more focused on exploring the challenges of nurse educators in the fulfilment of their teaching roles in baccalaureate programmes (Bvumbwe & Mtshali, 2018b; Eta et al., 2011; Wongpimoln et al., 2021; Younas et al., 2019). None of the studies have explored the perceptions and challenges encountered by nurse educators in their efforts to facilitate the development of clinical competence among diploma nursing students in a low-resource setting. Without such contextually relevant data, recommendations and strategies to enhance effective diploma nursing education in low-resource settings might be difficult. Despite the recommendation to make undergraduate nursing programmes an entry requirement for nursing, the majority of Ghana's professional nurse workforce is made up of diploma nurses trained by nursing colleges (Asamani et al., 2020; Bell et al., 2013; World Health Organisation, 2009). It is therefore imperative to explore and describe the perceptions and challenges that nurse educators encounter in the teaching of practical skills and facilitating the development of clinical competence in diploma nursing education in low-resource settings. This study therefore aims to explore and describe the perceptions and challenges of nurse educators in in the teaching of practical skills and in facilitating the development of clinical competence in diploma nursing education in Ghana, a low-resource setting.

2. Methods
2.1 Research design
In order to drive policy changes aimed at improving nursing education, this study employed

a qualitative descriptive design to explore and describe the perceptions and challenges of nurse educators in the teaching of practical skills and in facilitating the development of clinical competence in diploma nursing education in Ghana, a low-resource setting (Sandelowski, 2000). The approach allowed for the phenomenon to be described in terms that reflected the everyday accounts of the event from the view points of the participants.

2.2 Setting and participants

The study was conducted in three purposefully selected accredited diploma-awarding public nursing colleges (NCs) from three geographical zones of Ghana: Northern, Middle, and Southern Ghana. These NCs were selected because they are regarded as model schools in the three zones of Ghana, producing a significant number of nurses. The target population of 15 included all nurse educators with the responsibility of teaching practical skills. A purposive sample of nine nurse educators (three from each geographical area) were recruited to participate in the study. The recruitment of participants was stopped for all the three zones after the ninth participant, when no new information emerged, indicating data saturation. The use of a purposive sampling technique enabled the recruitment of participants with a wide range of experiences in the teaching of practical skills and clinical competence development (Palinkas et al., 2015). To aid in the research process and the recruitment of participants for the study, focal persons were recruited from each of the study sites. An invitation to participate in the research was addressed to the heads of the NCs, together with a brief description of the study's goal and inclusion criteria, and shared with eligible participants through the research focal persons. The inclusion criteria included: (1) nurse educators with full appointment and working in an accredited diploma-awarding public nursing college, (2) nurse educators with full appointment in an accredited diploma-awarding public nursing college with the responsibility of teaching practical skills and facilitating clinical competence development, (3) nurse educators with full appointment in an accredited diploma-awarding public nursing college with at least three years working experience in the teaching of practical skills, (4) nurse educators with full appointment in an accredited diploma-awarding public nursing college who are fluent in English, and (5) were willing to participate in the study. Four weeks later, an information session was held via an online Zoom session with the prospective research participants, during which the goal of the research was presented in further detail and all concerns were addressed.

2.3 Data collection

In order to better understand the perceptions and challenges of nurse educators in facilitating the development of clinical competence, this study used semi-structured interviews (Adams, 2015). An interview guide was developed to maintain consistency in the interviews. The interview guide was developed after a review of the literature and with assistance from experienced qualitative nurse researchers, was pre-tested with nurse educators from an analogous institution. The results of the pre-test and feedback from the nurse researchers were incorporated into the final interview guide, which consisted of six open-ended questions with probes. The main questions of the interview guide included; "Tell me about your work as a nurse educator in this school", "How do you assist students to develop clinical competence in readiness for practice?", "Describe the pedagogical strategies you use in assisting students to develop clinical competence in readiness for practice", "What challenges (if any) do you encounter in your effort to facilitate student learning and the development of clinical competence?", "Tell me what other roles you play in the school besides the teaching of practical skills and how that affects your delivery", and "Describe ways in which you think nurse educators could be supported to effectively teach practical skills and facilitate the development of clinical competence in diploma nursing education".

Due to the COVID-19 pandemic, the first author (D.A.S) facilitated the interviews over the phone, with the support of a research assistant. The use of phone calls was preferred over other media, such as Google Meet or Zoom, because of the erratic internet service in the setting. Moreover, the erratic internet service is unable to support video over media, such as Google Meet or Zoom. Sub-questions were re-asked based on the responses of participants to facilitate clear communication and ensure a thorough exploration of the perceptions and challenges of nurse educators in facilitating the development clinical competence. The research assistant served as a note-taker, recording crucial points that emerged during each interview with the nine

participants, as well as a timekeeper. Each interview lasted between 45 and 60 minutes and was conducted in English. A second round of interviews, lasting 45 to 60 minutes, was done with three of the participants to obtain additional information and clarification on issues raised during the first round of interviews. The data collection was stopped for all the three zones after the ninth participant, when no new information emerged, indicating data saturation. With the consent of the participants, the interviews were audio recorded and transcribed verbatim by the first author. The data were collected between 26 January and 31 May 2021.

2.4 Data analysis

The data was analysed using the framework approach of thematic analysis with the aid of ATLAS.ti. The process commenced with the researcher immersing himself in the raw data by actively listening to recorded audios, reading transcripts, and studying notes to become familiar with the data (Pope et al., 2000). This step enabled the researchers to identify key issues and concepts based on the study objective, which were then used to generate a thematic framework. The thematic framework would guide the coding and identification of themes and sub-themes to describe the perceptions and challenges of nurse educators in facilitating the development of clinical competence in a low-resource setting. The first and second authors independently developed a thematic framework, codes, themes, and sub-themes, which were compared to reach consensus. In situations where the first and second authors could not agree, the third author acted as an arbitrator.

2.5 Trustworthiness

Trustworthiness is the adoption of techniques to guarantee the accuracy of findings in qualitative study (Brink et al., 2017). Central to ensuring the trustworthiness of qualitative studies include credibility, confirmability, dependability, and transferability (Polit & Beck, 2006). These were all addressed in this study, as follows: (1) Credibility: The first author (D.A.S) transcribed all of the audio recordings verbatim, and the transcripts and audio recordings were compared to checked for accuracy by the second author (C.D.C). The second author confirmed that the transcripts were a true reflection of the recordings; thus, there was no need for revision. (2) Confirmability: Participants were also given the results of the study to certify that they were accurate reflections of their responses (member checking). The data collection and analysis occurred concurrently, the analysis was done by D.A.S and C.D.C by independently coding two of the transcripts and comparing codes to reach agreement, which was then used by D.A.S to code all the transcripts. The third author (Y.H.) then reviewed all the codes, themes, and sub-themes to ensure accuracy. (3) Dependability: The researchers used audio recordings, field notes, and demographic data collection forms to ensure all necessary data was collected. An audit trial was maintained throughout the entire research process. (4) Transferability: Despite the inclusion of all data in the analysis, findings of this study may not be transferable. However, a thorough description of the study setting, methodology, and study participants were provided to determine use of the findings in similar circumstances.

2.6 Ethical considerations

The Health Research Ethics Committee of North-West University (NWU-00431-20-A1) and the Health Service Ethics Review Committee of Ghana (GHS-ERC019/08/20) both gave their approval for this study. Individual consent forms for participation in the study were administered and supervised by the research focal persons in strict accordance with the guidelines of the NWU and GHS ethics committees. The informed consent forms were emailed to the research focal persons. Each research focal person then printed out the forms and administered to the purposefully selected participants who met with them in selected offices within the study settings for signing. The research focal persons and participants wore facemask, and adhered to social distancing and the use of alcohol hand rub during the process. After the signing, the informed consent forms were enveloped and posted to the first author (D.A.S) by the focal persons to sign his portion. Each participant was assigned a unique code in order to preserve their privacy and confidentiality. The participants in the study were not manipulated in any manner, and there was no risk of injury to them. Participants were informed ahead of time that participation in the study was entirely voluntary and that they might withdraw at any moment with no consequences.

3. Results

3.1 Demographic information of participants

This study included nine nurse educators (seven females and two males). Participants ranged in age between 26 and 55 years. Table 1 illustrates the demographic characteristics of the participants.

Table 1. Demographic characteristics of participants

Participant	Gender	Age (years)	Academic qualification	Professional qualification (teaching)	Teaching experience (years)
Nurse educator 1	F	36	Master's degree	Bachelor of Education Health Sciences	7
Nurse educator 2	F	35	Bachelor's degree	Bachelor of Education Health Sciences	2
Nurse educator 3	F	40	Bachelor's degree	Bachelor of Education Health Sciences	8
Nurse educator 4	F	30	Bachelor's degree	Post-graduate diploma in education (PGDE)	4
Nurse educator 5	M	39	Master's degree	None	6
Nurse educator 6	M	42	Master's degree	Masters in Nursing education	6
Nurse educator 7	F	42	Master's degree	Bachelor of Education Health Sciences	5
Nurse educator 8	F	40	Master's degree	Master of Education	3
Nurse educator 9	F	55	MPhil	Diploma in Education	20

Four themes, namely nurse educator and student factors, skills learning environment factors, institutional challenges, and regulatory issues are identified and described in Figure 1.

3.2 Theme 1: Nurse educator and student factors

Factors such as pedagogical strategies adopted in the teaching of practical skills, heavy workload of nurse educators, and student attitude were perceived to have a direct influence in the development of clinical competence.

3.2.1 Pedagogical strategies

Demonstration and return demonstration, lectures, dummies, student demonstrations, smaller group teaching, and deliberate practice were identified as the teaching and learning strategies that nurse educators and students use to facilitate the development of clinical competence. However, the use of lectures and demonstrations were perceived by some nurse educators to be ineffective in facilitating the development of clinical competence. Some participants believed the use of the strategies only promoted a mastery of procedural steps. As a result, some participants with prior experience in simulation pedagogy recommended the use of simulation as a superior alternative to the didactic approach in practical skills teaching. The participants hold the view that if simulation pedagogy was well designed and implemented, with well-trained nurse educators and guidelines to support it, it would better facilitate the teaching of practical skills and the development of clinical competence.

"… whilst I'm teaching, I'm demonstrating at the same time for them, so just after the first demonstration, I give them the chance or the opportunity to also come and practice before I move on to the next one." Nurse Educator 4

"Our current approaches, in fact it promotes rote learning, students have to cram everything and when they forget one thing that's all…" Nurse Educator 5

"So, if all clinicians, all teachers are involved in training on simulation-based approach to teaching, there are guidelines, everybody knows how to approach these topics, it would help." Nurse Educator 6
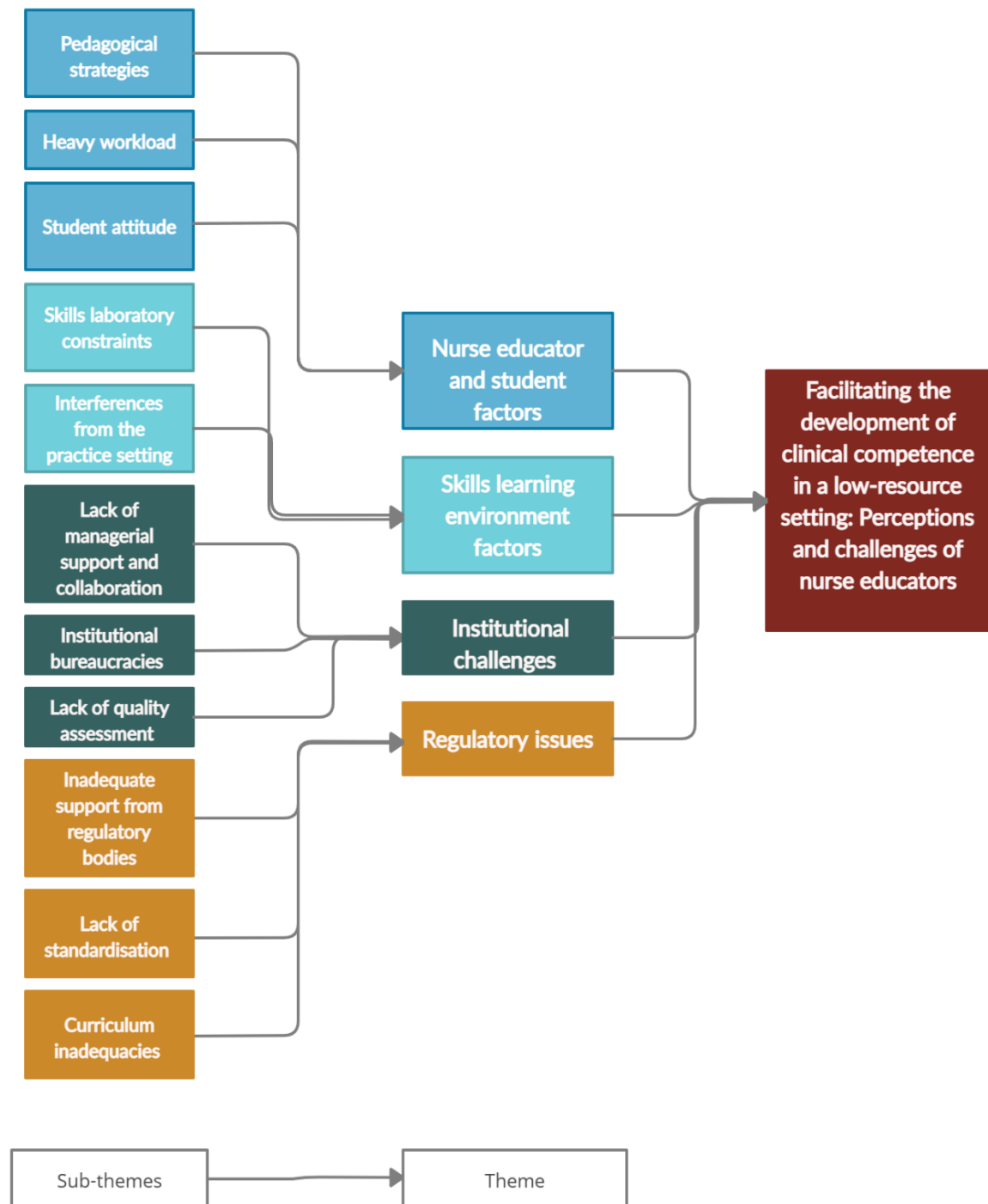
Figure 1. The themes and sub-themes that emerged from the data

3.2.2 Heavy workload

The role and responsibilities of nurse educators in NEIs are directly influenced by local contextual factors. Furthermore, the ability to assist in student learning and the development of clinical competence was directly influenced by the heavy workload of nurse educators. Nurse educators' workload was mostly dictated by the poor nurse educator-to-student ratio. Nurse educators viewed the fulfilling of teaching roles, extra-academic activities such as supervising students on clinical placement, patient/family care study, and research work as heavy workload and a significant source of work pressure that hampered their capacity to facilitate effective practical skills teaching and the development of clinical competence. Also, nurse educators in

charge of teaching practical skills were frequently allocated extra courses and preparation of final year students for licensing examination that competed with their practical education roles for time.

> "Apart from teaching, I am a member of the clinical committee, so sometimes you have a lot of work to do even though whatever you are doing it's for the benefit of the students, but it also affects your lecture time because I had to lecture at 9:30 am today but I had to also go to Tamale Teaching Hospital to supervise students (TTH).". Nurse Educator 1

> "In addition to practical skills teaching, I also teach nutrition and dietetics, I also need to do revision for basic nursing, that is where sometimes the pressure mounts up." Nurse Educator 2

The absence of skills laboratory coordinators or clinical instructors assigned to and stationed in the skills laboratories to assist with practical skills teaching added to nurse educators' workload and made the accomplishment of their role challenging. Nurse educators had to teach theory and practical skills while also planning and setting up the skills laboratory for practice sessions as a result of the lack of skills laboratory coordinators or instructors.

> "You have to find time to go the skills laboratory, teach them, help them to practice and also watch them practice. So, it's quite challenging and because of that a lot of tutors shy away from teaching such courses." Nurse Educator 1

The heavy workload of nurse educators and the pressure associated with teaching practical courses, increases nurse educator's stress and work pressure, resulting in some nurse educators developing a lack of interest in the teaching of practical related courses. Notwithstanding these challenges associated with the teaching of practical courses as expressed by some participants, some nurse educators were enthusiastic about teaching practical skills. These nurse educators stated that their willingness to teach and see students practising in the skills laboratory was motivated by their passion for teaching and the desire for the students to succeed.

> "The tedious nature of teaching practical skills makes nurse educators not interested in teaching courses that have to do with skills training." Nurse Educator 1

> "I have always loved to teach. So far, I think it is good, it has been a nice experience because you are able to interact with the students in so many ways not just the classroom but outside the classroom and it helps me myself as a nurse educator to learn a lot." Nurse Educator 5

3.2.3 Student attitude

Participants described the negative attitude of students towards the teaching and learning of practical skills as a hindrance to the accomplishment of their goal as nurse educators. Nurse educators perceived students to lack the commitment and seriousness for learning. Most of the students engaged in disruptive classroom behaviour and were often disinterested in deliberate practice. According to some nurse educators, some students only get serious about learning practical skills when it is time to take their licensing exams, a practice they described as inimical to the development of clinical competence. Some participants attributed the negative attitude of students such as disinterest towards the learning of practical skills to academic pressure. They hold the view that, the students were overburdened with enormous academic activities. Nurse educators believed that the students' lack of dedication to learning was attributable to the fact that most of them were pushed to enrol in the programme by their families rather than their own desire to be nurses.

> "...what we do, some don't take it seriously. Sometimes you want people to volunteer to practice, to try their hands on something and nobody shows interest, but getting to the licensing exams they are all serious because now they know they are going to face the exams." Nurse Educator 1

"I think the students are already overburden with academic activities and the number of courses that we have to do in a semester." Nurse educator 6

"Is like some of them have been compelled to enter nursing, the person comes and you ask the person why do you want to be a nurse? And surprisingly some will tell you, it's my father who said I should come to the nursing college." Nurse Educator 2

3.3 *Theme 2: Skills learning environment factors*
Aside from nurse educator and student factors, skills laboratory constraints and interferences from the practice setting had a significant impact on nurse educators' ability to facilitate the development of clinical competence.

3.3.1 *Skills laboratory constraints*
The lack of logistics and equipment in the skills laboratory, according to some nurse educators, was a key problem in the teaching and learning of practical skills. Nurse educators indicated that of the few available items, most were out of date, obsolete, or not ideal for use; however, they were often compelled to use them. Non-reusable consumables were usually not discarded after use but stored and re-used instead. The reuse of non-reusable consumables prevented students from learning the ideals of nursing practice. Improvising for non-available resources became the order of the day in the skills laboratory as reported by nurse educators. Others resorted to the use of videography to get around the logistics and equipment limitations. For example, one nurse educator had this to say about the reuse of non-reusable consumables:

"Sometimes you have to reuse the non-reusable, for instance, cannulas, we don't discard them because how to even get them is a problem." Nurse Educator 1

Aside from the logistical and equipment issues, the skills laboratory space was noted as being too small to accommodate the current student numbers. This, coupled with the current increase in student numbers contributed to overcrowding in the skills laboratories, resulting in an unconducive learning environment with a negative impact on the teaching and learning of students. In this regard, some participants had this to say:

"The skills laboratory is not big enough to take the current numbers that we have so I will say the size of the skills lab is not really the best." Nurse Educator 7

"They will stand for hours, sometimes before you realise somebody has collapsed then you have to stop the whole teaching process and help with first aid treatment or help send the student to the hospital. It has happened on about two three occasions." Nurse Educator 8

Nurse educators were also unable to complete practical teaching sessions due to time constraints. The limited time also precluded the division of students into smaller groups in order to mitigate the detrimental effects of overcrowded classes. Thus, time constraint and overcrowding in classes left students with inadequate practise time. Furthermore, the students were unable to access the skills laboratory for self-learning. A key problem was the lack of a trained person stationed in the skills laboratory to ensure accessibility and facilitate student learning. The lack of such persons, according to some nurse educators, hampered deliberate practice because the skills laboratory was mostly locked made inaccessible to the students:

"Sometimes because of time factor, we are unable to complete what we set out to do in a given period, we hardly complete a task before the time elapses, so sometimes we are unable to allow them to practice on that same day." Nurse Educator 6

"… we are supposed to have somebody manning the skills lab, a tutor manning the skills lab so that if the students want to go there and practice, there is somebody there who would guide the students, we don't have it." Nurse Educator 9

3.3.2 Interferences from the practice setting

Some nurse educators identified that nursing students were often not given adequate support during clinical placement. According to nurse educators, students were mostly abandoned in the practice setting with no help to hone their clinical competence. They believed that clinicians' supernumerary roles on the wards prevented them from providing the necessary support for student learning. Nurse educators perceived that the lack of student support during clinical placement had a negative impact on their role in facilitating the development of clinical competence among students.

> "Most of the clinicians are not even helping them when they go to the clinical side to build on the knowledge that they have had in the classroom." Nurse Educator 2

The existence of a theory-practice gap further complicated the issue of interferences from the practice setting. According to participants, there were differences between what nurse educators taught students in the skills laboratories and what clinicians socialised them to during clinical placements. Participant felt the lack of effective collaboration between NEIs and the practice settings, the nonavailability of resources in the practice setting, as well as the absence of a common procedure manual for the teaching of practical skills were partly responsible for the existence of the theory-practice gap. With a sense of frustration, one nurse educator with 20 years' experience in teaching had this to say:

> "… it makes it difficult for them to pick some of the procedures because they go to the clinical site and a different thing is being done because they don't have the items available or they are also in a rush to do it, … so how is the student going to learn." Nurse Educator 9

The utilisation of students as substitute staff during clinical placement was another concern in relation to interferences from the practice setting. According to nurse educators, students were usually assigned to wards at random, not based on their learning objectives but as stand-ins for professionals. As a result, students assumed the role of qualified employees rather than students with learning needs to be met. One participant, for example, related:

> "… sometimes the student come and because of shortage of staff the management may try to put them in areas where they think they need staff, sometimes they may substitute them for the qualified staffs who are not available." Nurse Educator 6

3.4 Theme 3: Institutional challenges

Institutional challenges within the NCs that also contributed to the difficulties nurse educators faced in their efforts to help students develop clinical competence included lack of managerial support and collaboration, institutional bureaucracies, and lack of quality assessment and enforcement.

3.4.1 Lack of managerial support and collaboration

Poor participants cited a lack of managerial support as well as poor collaboration among nurse educators as contributing factors to the challenges in the teaching and learning of practical skills. Some participants believed that the management of some NCs was not supportive enough in the provision of the necessary logistics to aid in practical skills teaching and learning. This, they believed, contributed to the resource constraints and their ramifications.

Furthermore, some nurse educators were reported to have declined to assist in the teaching of practical skills when their support was needed. Some participants claimed that the failure of some nurse educators to assist with practical skills teaching was due to their own forgetfulness of the skills. Despite some participants' reports of a perceived lack of managerial support, others said they were given the managerial support they required to do their job.

> "…there are people that do not teach basic nursing and when I call them to come and assist, they are way too difficult, and some people have even forgotten the skills." Nurse Educator 3

"Support from management is perfect because with my skills lab, I have almost everything that are needed to teach." Nurse Educator 4

Poor teamwork between the practice and school settings also hindered the teaching and learning of practical skills, in addition to poor collaboration between NCs and the clinical sites. To counteract the impacts of this challenge, some nurse educators implemented the collaborative teaching approach in a personal capacity, where they would team up with clinicians and send students to the ward to be taught by the clinicians.

"...sometimes you can arrange with the ward then the students go to maybe a particular staff that you think can help them whiles they have the procedure then the person takes them through and they observe." Nurse Educator 1

3.4.2 Institutional bureaucracies
The pleas of nurse educators for management to supply the required logistics to support practical skills teaching and learning were often met with "no funds syndrome." Where funding was not an impediment, the failure of school management to procure a user department list of needed items was another challenge that contributed to the skills laboratory's lack of resources. School management often acquired what they thought was needed rather than what user departments sought. Not only was the failure to procure the required items a concern, but so were the bureaucracies and delays in purchasing the necessary logistics. Some participants expressed dissatisfaction with the length of time it took to obtain things that were needed urgently.

"...you complain to management, they will tell you that no funds to purchase those things, so we have to manage." Nurse Educator 8

"...they procure what they feel is more important but not based on our recommendations." Nurse Educator 1

"... what I realise is that, when you write for the items, it will be done just that it delays. That makes it a challenge. So, by the time the items come, the students that were supposed to use it might have finished that area." Nurse Educator 6

Nurse educators had to resort to "begging" for resources and assistance to overcome resource constraints that were the results of management's inability to provide the needed logistics to support practical skills teaching and learning – nurse educators often appealed for support from non-governmental organisations (NGOs) and church groups.

"...we appeal to the students that if they have their church groups or any other denominational activities like donations, they should come and give some to the skills lab so that when they come for practice they wouldn't be standing, but as for the school itself according to them there are no funds." Nurse Educator 8

3.4.3 Lack of quality assessment
The Institutional issues were exacerbated by a lack of quality assessment and enforcement procedures. Despite the fact that the ministry of health had developed quality assessment guidelines for evaluating nurse educators, they were rarely followed in the accredited diploma-awarding public nursing colleges. As a result, nurse educators were rarely evaluated in the performance of their duties—this seeded uncertainty among nurse educators about their progress in fulfilling their objectives.

"... to me I think that I'm covering what should be covered. But as to whether it is really what it is supposed to be is another thing." Nurse Educator 8

The NCs also admitted large numbers of students into programmes in the absence of quality assessment and enforcement procedures. Enrolling large numbers of students in programmes without taking into account the curriculum's contextual factors, such as infrastructure and human

resource capacity of the various NCs, have resulted in overcrowding and the overburdening of the few available resources, jeopardising the teaching and learning of practical skills. The large class sizes limited students from having hands-on practice opportunities making the attainment of learning goals difficult. In the absence of quality assessment and enforcement policies, nurse educators appeared helpless in the face of the increasing student enrolments and blamed the situation on management and the regulatory bodies. For example, with a sense of frustration, one participant compared the negative impact of the current large student numbers and opportunities for learning with her time as a student (contained in the second quotation).

"... the increasing numbers, the numbers are too huge and because of that teaching skills and teaching theory becomes difficult." Nurse Educator 9

"Unlike our time where we were few in number and the resources were there so on closing or when we close from lectures, we have access to the skills lab where we go and then with our partners and practice, with the current numbers, that is not possible." Nurse Educator 6

Nurse educators appeared to be aware of the standards in terms of how many students to take to the demonstration room at a time; however, the overwhelming number of the students and time constraint did not allow for the students to be divided further into smaller groups. To overcome the negative effect of the large class sizes, some nurse educators often divided the class into two if the class size was larger than 60, although this was often perceived as tedious because the same nurse educator would have to shuttle between the two classes to teach. To this effect, one participant explained:

"...ideally, a skills lab takes not more than, ... in some countries, the skills lab should not take more than 20 students, but then we don't have the luxury of time to divide them in bits like that." Nurse Educator 7

"... it is quite tedious because you have to do the same thing twice." Nurse Educator 1

3.5 Theme 4: Regulatory issues

In addition to nurse educator and student factors, skills learning environment factors, and institutional challenges were regulatory issues such as inadequate regulatory body support, lack of standardisation, and curriculum inadequacies, which were also identified as factors interfering with the nurse educator's role.

3.5.1 Inadequate support from regulatory bodies

Nurse educators perceived the support provided by NEI regulatory bodies as inadequate. They reported being recruited as nurse educators from the clinical practice setting (CPS) and assigned courses to teach without any pre-training or orientation on the role. Moreover, opportunities for career advancement and capacity building for nurse educators were limited. In the absence of these opportunities, nurse educators perceived their teaching roles as challenging for both students and nurse educators. When refresher programmes were available, the mode of selecting participants was another matter as some nurse educators perceived the process to be biased and unhelpful. Some participants stated that in some cases, nurse educators who did not have any practical skills teaching role were rather chosen to attend workshops on practical skills teaching. The bias selection of nurse educators to attend workshops or refresher programmes was seen as demotivating by participants. In the absence of regular refresher programmes to update nurse educators in their teaching roles, they have often resorted to past clinical experience or relied on the ward for updates on current happenings in the clinical area to sharpen their practical teaching skills.

"...nothing like that has been done. I don't even remember the last time I went for any workshop." Nurse Educator 8

"…when it comes to workshops sometimes you don't know how the selections is done, you the one handling the course wouldn't be given the opportunity to go and have the needed training. Others rather will be picked." Nurse Educator 3

"…the expertise or skills we acquired through what we practised at the hospitals, what we see and we practice, that is what we have come with and we are teaching now." Nurse Educator 7

Apart from the lack of career advancement and capacity building programmes, nurse educators found the lack of adoption of a formal support structure such as preceptorship by the regulatory bodies to assist teaching and learning in the CPS to be problematic. Participants blamed the lack of preceptors in the ward for guiding student learning as contributing to the theory-practice gap.

"… if there were preceptors and you take them through what your students are required to know when the students are in the ward, definitely they would be the ones supervising them and being with them so the students know that what I am doing in school is the same thing they are doing in the ward and so it becomes consistent, unfortunately, that is not the case." Nurse Educator 1

3.5.2 Lack of standardisation
The lack of a common guideline to facilitate practical skills teaching in the NCs negatively impacted the development of clinical competence. Nurse educators were of the view that the lack of common guidelines introduced inconsistency in practical skills teaching thereby causing confusion for students. One participant indicated that the only existing guideline for practical skills teaching was obsolete and has never been revised since its inception several more than two decades ago. In the absence of a standard procedure guideline to facilitate the teaching of practical skills, nurse educators have often resorted to the use of Nursing and Midwifery Council (NMC) licensing practical exams rating scales for practical skills teaching. Nurse educators observed these measures to promote memorisation of the steps rather than mastering the content, which ended up only promoting rote learning. The lack of common guidelines and standardisation has also left much uncertainty and confusion among nurse educators, clinicians, and examiners on matters concerning standard practice, thus further widening the theory-practice gap.

"…in the absence of a common guideline, we have students conflicting in the clinical area that is not to the benefit of the job." Nurse Educator 5

"Look at the procedure manual that they wrote long time ago and it has never undergone any review. And this thing too we are talking about several time. That since the time that you wrote this book several things have changed." Nurse Educator 6

"So, most of the time we like to use the NMC component task, this causes the students to memorise the steps." Nurse Educator 1

"…because there are no guidelines, many teachers are not able to actually impact that knowledge, clinical competence, it is manifested in even anytime we get involved with exams we always find out that there is variety of approaches to even one particular item, not standardized." Nurse Educator 5

3.5.3 Curriculum inadequacies
Some nurse educators perceived the present NMC curriculum used by the NCs to be inadequate. They found the curriculum to be fraught with, among others, ambiguous competencies, scanty course outlines, overloaded course content, poor alignment of course contents, too much theory, absence of practical teaching strategies, and bad referencing. Some participants reported that some of the references provided under the courses in the curriculum were outdated, while others were difficult to come by since they were not available in the country.

"And there is a time you will see according to the given curriculum looking at the content, students have to do this but sometimes the statements are vague not specific. There are very vague." Nurse Educator 6

"I have a problem with the curriculum because, one, when you consider the curriculum and the other nursing institutions outside Ghana, you realise that for the objectives and the specific area and the specific resources that you need are often stated in the curriculum, over here they give you especially the literature resources, the books and you can't even find them here in Ghana. What kind of thing is that? Those books are not even available. There are certain books that they recommend, you can't even find them here in Ghana. Is not as if they are books that have been written now, they are old, very old." Nurse Educator 7

Some participants said the curriculum did not indicate which practical teaching methodologies to use in facilitating practical skills teaching. One participant, one participant mentioned that practical teaching strategies were provided in the curriculum, but without much depth or recommended frameworks to support their usage.

"…it doesn't specify anything of that sort, it does not at all. It only gives you content, if I have mine here, I would have read to you for us to see. I don't have them here. It doesn't at all. It doesn't make mention of any approaches to use." Nurse Educator 6

4. Discussion

This study sought to explore and describe the perceptions and challenges of nurse educators in the teaching of practical skills and in facilitating the development of clinical competence among diploma nursing students in Ghana, a low-resource setting. The study's findings revealed challenges experienced by nurse educators that hinder them from teaching practical skills effectively and facilitating the development of clinical competence. The findings centred on regulatory and institutional issues, nurse educator, student and skills learning environment factors.

Notwithstanding the efforts by the central government to provide basic infrastructure and equipment for NEIs in Ghana, findings from this study reveal poor infrastructure and inadequate basic equipment, including medical and surgical logistics in skills laboratories of NCs. Moreover, opportunities to enhance the competence of nurse educators through incentives for career advancement and professional development appear limited. In the absence of these opportunities, nurse educators tend to rely overly on lectures and demonstrations in the teaching of practical skills and clinical competence development, which some participants described as ineffective in facilitating the development of clinical competence. Despite the NMC's effort to ensure the development of what is thought of as a competency-based curriculum, some participants felt that the curriculum is fraught with inadequacies that make it fall short of being described as a competency-based curriculum. The challenges confronting nurse educators in this study's setting appear to have nurse educators confused about which strategies best to adopt in the teaching of practical skills and in facilitating the development of clinical competence in the setting.

4.1 Nurse educator and student factors

Previous studies appear to corroborate most of the findings of this study. Some authors argue that the use of traditional practical skills teaching methods such as demonstration and return demonstration, and lectures, encourage rote learning and mastery of procedural steps rather than promote critical thinking, clinical reasoning, and sound clinical judgment (Agha et al., 2015; Aqel & Ahmad, 2014). In supporting the point, Benner et al. (2010) cautioned that students were mostly disengaged when the lecture approach was adopted in practical skills teaching. When compared to traditional practical skills teaching strategies such as demonstration and return demonstration, immersive student-centred, and experiential teaching and learning strategies such as simulation have shown to be more effective in helping boost students' confidence and clinical competence (Agha et al., 2015; Aqel & Ahmad, 2014; Farzi et al., 2018; J. Kim et al., 2016; Shin & Kim, 2013). Nurse educators in this study appear to be aware of the benefits associated with the use of simulation-based clinical nursing education. However, as it may appear, the

underutilisation of simulation pedagogy in nursing education in the study setting may be due to the lack of knowledge and capacity of nurse educators to design, implement, and evaluate the concept/pedagogical strategy. In lending credence to this assertion, a qualitative study by Munangatire and Naidoo (2017) exploring the experiences and perceptions of nurse educators on high-fidelity simulation in a resource-limited setting identified a lack of knowledge and capacity of nurse educators as a barrier to the implementation of simulation. Pragmatic interventions directed at promoting innovative practical skills teaching strategies that are more immersive and student-centred may help boost the confidence and critical thinking skills of nursing students in the setting and help enhance the development of clinical competence.

The inability of nurse educators to adopt contemporary practical skills teaching strategies such as simulation was further compounded by the lack of opportunities for career advancement and professional development. The lack of important educational resources, opportunities for career advancement, and professional development for nurse educators in low-resource settings has previously been noted as a factor affecting clinical competence development (Eta et al., 2011; Munangatire & Naidoo, 2017; Younas et al., 2019). Despite the WHO's objective of developing the core nurse educator competencies (World Health Organisation, 2016) to ensure adequate preparation of nurse educators who are able to contribute to improved nursing education, most of the nurse educators in this study were recruited from the clinical setting without any prior training or orientation in teaching or communication – being knowledgeable and clinically competent does not often guarantee effective teaching (Wongpimoln et al., 2021; World Health Organisation, 2013). Rather, to be efficient on the job role as a nurse educator, formal training and orientation are required to equip nurses with knowledge in communication and varied teaching methods to adopt in practical skills teaching (Inayat et al., 2020). Without adequate training, nurse educators often remain fixed on the use of didactic methods in practical skills teaching (Benner et al., 2010). The use of lectures and demonstrations in the teaching of practical skills in this study setting may not have been a surprise finding after all. For the realisation of effective nursing education and the training of competent nurses, major transformations in nursing education were undertaken in some regions of the world (Benner et al., 2010; Frehywot et al., 2013; Frenk et al., 2010). One of the most significant reforms was massive investment in nursing education to provide the necessary infrastructure and educational resources and build the capacity of nurse educators (Benner et al., 2010; Frehywot et al., 2013).

Evidence from the literature indicates that nurse educators' workload in low-resource settings may be daunting and stressful, reducing their ability to teach practical skills successfully (Eta et al., 2011; Younas et al., 2019). Clearly, as the findings of this study suggest, the supernumerary role assumed by nurse educators with the responsibility of teaching practical skills appears to increase their workload, which is directly related to their ability to effectively facilitate the development of clinical competence. Such increased workloads could be detrimental to the mental health of nurse educators, causing stress, fatigue, and feelings of dissatisfaction (Younas et al., 2019). Although research has been conducted on stress in nursing, it appears concentrated on determining the stress of nurses and nursing students (Baye et al., 2020; Rafati et al., 2017). Little emphasis is placed on exploring the effect of stress and burnout on nurse educators. Given this research gap, future research should be directed at exploring the impact of increased workload with its resultant effect on stress and burnout on nurse educators, especially in low-resource settings.

4.2 Skills learning environment factors

The workload of nurse educators is further compounded by interferences from the practice setting, such as the lack of support for students, the existence of theory-practice gap, and using students as substitute staff. In other parts of the world, support for student learning and newly qualified nurses in the CPS is provided for through the use of the preceptorship model (Begley, 2007). Unfortunately, a lack of support for students' learning during clinical practicum was reported by nurse educators in this study. While students did not always receive any formal support in the CPS, nurse educators in this study noted that students were often used as substitute staff and assumed full professional responsibilities when wards were understaffed. Mirroring these findings, Begley (2007), Salifu et al. (2019), and Salifu et al. (2022) confirmed the lack of support and the utilisation of students as an additional pair of hands in the CPS. These perceived challenges confronting students in the CPS, particularly in low-resource settings interfere directly

with the duties and responsibilities of nurse educators, increasing their workload and burden as they are now required to supervise a large number of students in a variety of clinical settings.

In order to effectively develop clinical competence in nursing education, theory and practice must be synchronised. However, consistent with the findings of Salifu et al., (2019) and Younas et al., (2019), the theory-practice gap was identified as a major issue confronting nursing education in this study setting. The lack of a common procedure manual and standard guidelines to streamline the teaching of practical skills and activities of nurse educators and clinical instructors are inextricably linked to the continued existence of the theory-practice gap in the setting (Salifu et al., 2022). At the time of writing this research report, the only procedure manual designed to facilitate practical skills teaching by the NMC was introduced in 1995 and has never been reviewed since (Anim-boamah et al., 2021). Seemingly, the use of such obsolete academic material does not promote evidence-based practice and the development of clinical competence. The call for the standardisation of practical skills teaching is largely a strategy to maintain uniformity in nursing education across countries while taking into consideration peculiar contextual relativities. Future research must be directed at exploring strategies to bridge the theory-practice gap in low-resource settings.

4.3 Institutional challenges

In spite of the obvious lack of investment in nursing education, this study found that large number of students were admitted into NEIs in low-resource settings. Benner et al., (2010), cautioned against increasing student enrolments without a strong nurse educator workforce and accompanying infrastructure and resources. The issue of large student numbers limiting nursing education quality in low-resource settings has been discussed in the literature (Jamshidi et al., 2016; Salifu et al., 2019; Salifu et al., 2022; Younas et al., 2019). Globally, NEIs are impacted by budgetary constraints as funding and investments in higher education fluctuates (Bvumbwe & Mtshali, 2018a; GANES, 2011). When financial resources become scarce, higher educational institutions in other regions of the world have shown that they are more motivated to increase student enrolment (Spitzer & Perrenoud, 2006). However, in other low-resource settings, expansion in infrastructure, the development of nurse educator capacity, and improvement in the provision of academic materials, including investments in electronic learning informed the increase in student enrolment into nursing and medical programmes to ensure quality education (Frehywot et al., 2013; Frenk et al., 2010).

4.4 Regulatory issues

Curriculum developers often find it a challenge to adequately align learning objectives, content areas, teaching and learning activities with programme outcomes to ensure the effective development of clinical competence (Clapper, 2011). More interestingly, despite their best intentions, curriculum developers may not be incorporating teaching and learning activities that match the students' learning needs and styles (Clapper, 2011). Still further, developing a competency-based curriculum is even more difficult in a low-resource setting (Bvumbwe & Mtshali, 2018a; Bvumbwe & Mtshali, 2018b), probably because the right people with the expertise in curriculum development in nursing education are often not hired. Corroboratively, in this study, nurse educators felt that the curriculum designed by the NMC and used to guide the training of diploma nurses was not designed to promote the development of clinical competence. In an attempt to overcome this challenge, nurse educators often resorted to the use of varied teaching and learning activities that participants have described as bothersome and ineffective. The issue of curriculum inadequacy in the study setting appears manifest presumably because those hired and charged by the NMC to develop and revise the curriculum for NCs may lack the necessary expertise or training in curriculum development in nursing education. In other countries, experts in nursing education with experience, knowledge, and training in curriculum development in nursing education often spearhead curriculum development processes (Bokonji et al., 2019).

5. Implications and limitations

This study provides intriguing findings in relation to the experiences and perceptions of nurse educators in the teaching of practical skills and clinical competence development in Ghana. Given the challenges that nurse educators face in the teaching of practical skills and clinical competence

development, aggressive policy directives are needed to provide NEIs and nurse educators with the necessary resources and facilities for career advancement and professional development in order for them to be effective in their role.

There are limitations to this study. The study purposefully selected only three model schools from the three geographical zones of the study setting out of about 73 accredited diploma-awarding public nursing colleges. Therefore, it cannot be guaranteed that the findings of the study are representative of the other colleges that were not considered model schools, thereby, limiting the generalisability of the findings of the study even within the same geographic region. However, because all of the NEIs in the setting are regulated by the same bodies and operate under the same guidelines, there are similarities in their operations and available opportunities for growth and development. With the challenges experienced by these model schools, it is believed that other NEIs not included in this study may have more challenging issues than, if not similar to, the findings of the present study concerning the facilitation of clinical competence development.

6. Conclusion

The lack of major educational resources and incentives for nurse educators' career advancement and professional development were found to significantly contribute to the challenges of practical skills teaching and clinical competence development. To address these challenges, policy measures should be implemented to ensure adequate national investment in nursing education and incentives to promote nurse educator development and performance. Nurse educators and their labour union should therefore strongly advocate for this transformation in nursing education. Moreover, more research may have to be done to establish collaborative policies to help deal with these issues. Effective collaboration at the national level may help in the identification of financial sources to support the provision of infrastructure and support the career advancement and professional development of nurse educators to guarantee effective nursing education.

Author contribution

Conception and design of the study: D.A.S.; Supervision: C.D.C. and H.Y.; Data collection: D.A.S with the aid of a research assistant; Data analysis: D.A.S analyzed the data which was confirmed by C.D.C., and Y.H. for accuracy; Drafting of manuscript: D.A.S. drafted the manuscript; Review and editing of the manuscript: D.A.S, C.D.C. and Y.H. All the authors are in agreement of the final version of the manuscript.

Conflict of interest

None declared

References

Adams, W. C. (2015). Conducting semi-structured interviews. In: Wholey, J. S., Hartry, H. P. and Newcomer, K. E., (Eds.), *Handbook of practical program evaluation* (pp.492-505). Jossey-Bass, San Francisco. https://doi.org/10.1002/9781119171386.ch19

Agha, S., Ahamrani, A. Y., & Khan, M. A. (2015). Satisfaction of medical students with simulation-based learning. *Saudi Medical Journal, 36*(6), 731–736. https://doi.org/10.15537/smj.2015.6.11501

Anim-boamah, O., Christmals, C. Dela, & Armstrong, S. J. (2021). Nursing students' experiences on clinical competency assessment in Ghana. *Nurse Media Journal of Nursing, 11*(3), 278–293. https://doi.org/https://doi.org/10.14710/nmjn.v11i3.39079

Aqel, A. A., & Ahmad, M. M. (2014). High-fidelity stimulation effects on CPR knowledge, skills, acquisition, and retention in nursing students. *Worldviews on Evidence-Based Nursing, 11*(6), 394–400.

Asamani, J. A., Amertil, N. P., Ismaila, H., & Orem, J. N. (2020). The imperative of evidence-based health workforce planning and implementation: Lessons from nurses and midwives unemployment crisis in Ghana. *Human Resources for Health, 18*(16). https://doi.org/10.1186/s12960-020-0462-5

Baye, Y., Demeke, T., Birhan, N., Semahegn, A., & Birhanu, S. (2020). Nurses' work-related stress and associated factors in governmental hospitals in Harar, Eastern Ethiopia: A cross-sectional study. *PLoS ONE, 15*(8), 1–12. https://doi.org/10.1371/journal.pone.0236782

Begley, T. (2007). Who am I now? The experience of being a post-registration children's student nurse in the first clinical placement. *Nurse Education Today, 27*(5), 375–381. https://doi.org/10.1016/j.nedt.2006.05.020

Bell, S. A., Rominski, S., Bam, V., Donkor, E., & Lori, J. (2013). Analysis of nursing education in Ghana: Priorities for scaling-up the nursing workforce. *Nursing and Health Sciences, 15*(2), 244–249. https://doi.org/10.1111/nhs.12026

Benner, P., Sutphen, M., Leonard, V., & Day, L. (2010). *Educating nurses: A call for radical transformation*. Jossey-Bass, San Francisco.

Benton, D. (2012). Advocating globally to shape policy and strengthen nursing's influence. *The Online Journal of Issues in Nursing, 17*(1). https://doi.org/10.3912/OJIN.Vol17No01Man05

Bokonji, D., Ra, M., Ma, S., Oru, M., Rybarova, L., Vidovi, K., Drieghe, B., Wieren, J. Van, Çurçija, E., & Seiti, L. (2019). Competence-based curriculum development in nursing education: A story from the Western Balkans. *Nursing Education Perspective, 40*(6) 28–30. https://doi.org/10.1097/01.NEP.0000000000000521

Brink, H., Van Der Walt, C., & Van Rensburg, G. (2017). *Fundamentals of research methodology for health care professionals (4th ed.)*. Juta and Company Ltd: Cape Town.

Bvumbwe, T., & Mtshali, N. G. (2018a). Transforming nursing education to strengthen health system in Malawi: An exploratory study. *Open Nursing Journal, 12*(1), 93–105. https://doi.org/10.2174/1874434601812010093

Bvumbwe, T., & Mtshali, N. (2018b). Nursing education challenges and solutions in Sub Saharan Africa: An integrative review. *BMC Nursing, 17*(3), 1–11. https://doi.org/10.1186/s12912-018-0272-4

Christmals, C. D., Aziato, L., & Rispel, L. C. (2021). Perceptions of the functioning and effectiveness of nursing regulators in Ghana and South Africa: A cross-sectional study. *BMJ Open, 11,* 50580. https://doi.org/10.1136/bmjopen-2021-050580

Clapper, T. C. (2011). Interference in learning: What curriculum developers need to know. *Clinical Simulation in Nursing, 7*(3), e77–e80. https://doi.org/10.1016/j.ecns.2010.08.001

Cook, D. A., Brydges, R., Hamstra, S. J., Zendejas, B., Wang, A. T., Erwin, P. J., & Hatala, R. (2012). Comparative effectiveness of technology-enhanced simulation versus other instructional methods. *Society for Simulation in Healthcare, 7*(5), 308–320. https://doi.org/10.1097/SIH.0b013e3182614f95

Dahlke, S., O'Connor, M., Hannesson, T., & Cheetham, K. (2016). Understanding clinical nursing education: An exploratory study. *Nurse Education in Practice, 17,* 145–152. https://doi.org/10.1016/j.nepr.2015.12.004

Eta, V. E. A., Atanga, M. B. S., Atashili, J., & D'Cruz, G. (2011). Nurses and challenges faced as clinical educators: A survey of a group of nurses in Cameroon. *Pan African Medical Journal, 8,* 1–8. https://doi.org/10.4314/pamj.v8i1.71085

Farzi, S., Shahriari, M., & Farzi, S. (2018). Exploring the challenges of clinical education in nursing and strategies to improve it: A qualitative study. *Journal of Education and Health Promotion, 7,* 115. https://doi.org/10.4103/jehp.jehp_169_17

Frehywot, S., Vovides, Y., Talib, Z., Mikhail, N., Ross, H., Wohltjen, H., Bedada, S., Korhumel, K., Koumare, A. K., & Scott, J. (2013). E-learning in medical education in resource constrained low- and middle-income countries. *Human Resources for Health, 11*(1), 1–15. https://doi.org/10.1186/1478-4491-11-4

Frenk, J., Chen, L., Bhutta, Z. A., Cohen, J., Crisp, N., Evans, T., Fineberg, H., Garcia, P., Ke, Y., Kelley, P., Kistnasamy, B., Meleis, A., Naylor, D., Pablos-Mendez, A., Reddy, S., Scrimshaw, S., Sepulveda, J., Serwadda, D., & Zurayk, H. (2010). Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *The Lancet, 376*(9756), 1923–1958. https://doi.org/10.1016/S0140-6736(10)61854-5

Global Alliance for Leadership in Nursing Education and Science (GANES). (2011). *Investing in nursing education to advance global health.* http://casn.ca/wp-content/uploads/2014/12/GANESPositionFinal5.26.11.pdf

Hill, L., & Williams, E. P. (2017). *Contemporary models for clinical nursing education.* Hattiesburg, Mississippi, USA: Sigma Repository http://hdl.handle.net/10755/623704

Hussein, M. T. E., & Osuji, J. (2016). Bridging the theory-practice dichotomy in nursing: The role of nurse educators. *Journal of Nursing Education and Practice, 7*(3), 20–25. https://doi.org/10.5430/jnep.v7n3p20

Inayat, S., Younas, A., Sundus, A., & Khan, F. H. (2020). Nursing students' preparedness and practice in critical care settings: A scoping review. *Journal of Professional Nursing, 37*(1). https://doi.org/10.1016/j.profnurs.2020.06.007

Jamshidi, N., Molazem, Z., Sharif, F., Torabizadeh, C., & Kalyani, M. N. (2016). The challenges of nursing students in the clinical learning environment: A Qualitative study. *The Scientific World Journal*, 2016, 1846178. https://doi.org/org/10.1155/2016/1846178

Jeffries, P. R. (2005). A framework for designing, implementing, and evaluating: Simulations used as teaching strategies in nursing. *Nursing Education Perspectives, 6*(2), 96–103. https://doi.org/10.1043/1536-5026(2005)026<0096:AFWFDI>2.0.CO;2

Jeffries, P. R. (2016). *The NLN Jeffries simulation theory* (1st Ed). Wolters Kluwer Health.

Kim, J., Park, J., & Shin, S. (2016). Effectiveness of simulation-based nursing education depending on fidelity: A meta- analysis. *BMC Medical Education, 16*, 1–8. https://doi.org/10.1186/s12909-016-0672-7

Kim, S. J., Kim, S., Kang, K.-A., Oh, J., & Lee, M.-N. (2016). Development of a simulation evaluation tool for assessing nursing students' clinical judgment in caring for children with dehydration. *Nurse Education Today, 37*, 45–52. https://doi.org/10.1016/j.nedt.2015.11.011

Munangatire, T., & Naidoo, N. (2017). Exploration of high-fidelity simulation: Nurse educators' perceptions and experiences at a school of nursing in a resource-limited setting. *African Journal of Health Professions Education*, 9(1), 44–47. https://doi.org/10.7196/AJHPE.2017.v9i1.739

Nehrir, B., Vanaki, Z., Mokhtari Nouri, J., Khademolhosseini, S. M., & Ebadi, A. (2016). Competency in nursing students: A systematic review. *International Journal of Travel Medicine and Global Health, 4*(1), 3–11. https://doi.org/10.20286/ijtmgh-04013

Nursing and Midwifery Council (NMC). (2018). *Future nurse: Standards of proficiency for registered nurses.* London, UK: Nursing and Midwifery Council https://www.nmc.org.uk/globalassets/sitedocuments/standards-of-proficiency/nurses/future-nurse-proficiencies.pdf

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533–544. https://doi.org/10.1007/s10488-013-0528-y

Papathanasiou, I. V, Tsaras, K., & Sarafis, P. (2014). Views and perceptions of nursing students on their clinical learning environment: Teaching and learning. *Nurse Education Today, 34*(1), 57–60. https://doi.org/10.1016/j.nedt.2013.02.007

Pirie, J., Kappus, L., Sudikoff, S. N., & Bhanji, F. (2016). Simulation curriculum development, competency-based education, and continuing professional development. In: Grant V., Cheng, A. (eds), *Comprehensive healthcare simulation: Pediatrics* (pp. 181-193). Springer, Cham. https://doi.org/10.1007/978-3-319-24187-6_14

Polit, C. T., & Beck, D. F. (2006). Essentials of nursing research: Methods, appraisal, and utilization. *Nurse Research, 13*(4), 91–92. https://doi.org/10.7748/nr.13.4.91.s11

Pope, C., Ziebland, S., & Mays, N. (2000). Analyzing qualitative data: Qualitative research in health care. *British Medical Journal, 320*, 114–116.

Rafati, F., Nouhi, E., Sabzevari, S., & Dehghan-Nayeri, N. (2017). Coping strategies of nursing students for dealing with stress in clinical setting: A qualitative study. *Electronic Physician, 9*(12), 6120–6128. http://dx.doi.org/10.19082/6120

Salifu, D.A., Gross, J., Salifu, M. A., & Ninnoni, J. P. K. (2019). Experiences and perceptions of the theory-practice gap in nursing in a resource-constrained setting: A qualitative description study. *Nursing Open, 6*(1), 72–83. https://doi.org/10.1002/nop2.188

Salifu, D. A., Heymans, Y., & Christmals, C. Dela. (2022). Teaching and learning of clinical competence in Ghana: Experiences of students and post-registration nurses. *Healthcare 10*(3), 538. https://doi.org/10.3390/HEALTHCARE10030538

Sandelowski, M. (2000). Whatever happened to qualitative description? *Research in Nursing & Health, 23*(4), 334–340. https://doi.org/10.1002/1098-240x(200008)23:4<334::aid-nur9>3.0.co;2-g

Shin, I., & Kim, J. H. (2013). The effect of problem-based learning in nursing education: A meta-analysis. *Advanced Health Science Education Theory Practice, 18*(5), 1103–1120. https://doi.org/10.1007/s10459-012-9436-2

Spitzer, A., & Perrenoud, B. (2006). Reforms in nursing education across Western Europe: Implementation processes and current status. *Journal of Professional Nursing, 22*(3), 162–171. https://doi.org/10.1016/j.profnurs.2006.03.011

Talley, B. (2006). Nurses and nursing education in Ghana: creating collaborative opportunities. *International Nursing Review, 53*(1), 47–51. https://doi.org/10.1111/j.1466-7657.2006.00431.x

Voldbjerg, S. L., Gronkjaer, M., Sorensen, E. E., & Hail, E. O. C. (2016). Newly graduated nurses' use of knowledge sources: A meta-ethnography. *Journal of Advanced Nursing, 72*(8), 1751–1765. https:doi.org/10.1016/j.nedt.2018.02.008

Watson, R., Hayter, M., & Jackson, D. (2021). Is the PhD well for nursing faculty running dry? *Journal of Nursing Management, 29*(6), 1349–1350. https://doi.org/10.1111/jonm.13308

Wongpimoln, B., Pholputta, L., Ngernthaisong, C., & Sarnkhaowkhom, C. (2021). Transitional experiences from clinical nurse experts to novice nurse lecturers in the university for local development in Thailand: A phenomenological study. *Nurse Media Journal of Nursing, 11*(2), 197–209. https://doi.org/10.14710/NMJN.V11I2.37366

World Health Organisation. (2009). *Global standards for the initial education of professional nurses and midwives.* Geneva, Switzerland: World Health Organisation. http://www.who.int/hrh/nursing_midwifery/en/

World Health Organisation. (2016). *Nurse educator core competencies.* Geneva, Switzerland: World Health Organisation https://www.who.int/hrh/nursing_midwifery/nurse_educator050416.pdf

World Health Organisation (2012). *Plan of action for scaling up quality nursing and midwifery education and practice for the African region 2012–2022.* Brazzaville: WHO Region Office for Africa

World Health Organisation (2013). *Transforming and scaling up health professionals' education and training: World Health Organization guidelines 2013.* World Health Organization. who.int/iris/bitstream/handle/10665/93635/9789241506502_eng.pdf;jsessionid=87B4A0ECDDA6510BD2F68A5192F78FC9?sequence=1

World Health Organisation (2018). *World health statistics 2018: Monitoring health for the SDGs, sustainable development goals.* Geneva: World Health Organization https://www.hst.org.za/publications/NonHST%20Publications/World%20Health%20Statistics%202018.pdf

Younas, A., Zeb, H., Aziz, S. B., Sana, S., Albert, J. S., Khan, I. U., Inayat, S., Khan, F. H., & Rasheed, S. P. (2019). Perceived challenges of nurse educators while teaching undergraduate nursing students in Pakistan: An exploratory mixed-methods study. *Nurse Education Today, 81*(2019), 39–48. https://doi.org/10.1016/j.nedt.2019.07.002

ORIGINAL RESEARCH

Emotion Regulation and Self-Injury Status among Nursing Students: A Cross-Sectional Study

Dyah Ayu Nur Safira[1], Nur Oktavia Hidayati[1], Citra Windani Mambang Sari[1]

[1]Faculty of Nursing, Universitas Padjadjaran, Bandung, Indonesia

Article Info	Abstract
  Corresponding Author: Nur Oktavia Hidayati Faculty of Nursing, Universitas Padjadjaran, Bandung, Indonesia Email: nur.oktavia@unpad.ac.id	**Background:** One of the factors associated with the incident of self-injury among college students is emotion dysregulation, but many factors, namely self-criticism, daily guilt, and social factors are associated with emotion dysregulation as well. However, little is known about how the process happens and how the emotion regulation relates to other factors associated with the incident of self-injury. **Purpose:** This study aimed to identify the relationship between emotion regulation and self-injury status among nursing students. **Methods:** A descriptive correlational study was conducted among 783 nursing students in a public university in Indonesia. Stratified random sampling was used to recruit the samples. The data were collected online using the Difficulties of Emotion Regulation Scale (DERS) and Deliberate Self-Harm Inventory (DSHI). The univariate analyses in the form of percentage and bivariate analyses with the Point Biserial test were performed for data analysis. **Results:** The results showed that the minimum and maximum scores of emotion regulation in nursing students were 41 and 163, respectively. The mean score and standard deviation of emotion regulation were 96.75 and 20.948, subsequently. As many as one-third (32.6%) of students committed self-injury. The Point Biserial test showed a relationship between emotion regulation and self-injury status (sig. 2-tailed = 0.000). **Conclusion:** There is a relationship between emotion regulation and self-injury status among nursing students. This study suggests the importance of health promotion and nursing intervention regarding emotion regulation as a prevention and treatment of self-injury among nursing students.

How to cite: Safira, D. A. N., Hidayati, N. O., & Sari, C. W. M. (2022). Emotion regulation and self-injury status among nursing students: A cross-sectional study. *Nurse Media Journal of Nursing, 12*(1), 32-41. https://doi.org/10.14710/nmjn.v12i1.41571

1. Introduction

Emotion regulation is an attempt to influence the emotion within themselves and redirects the flow of emotions that people experience spontaneously (Koole & Aldao, 2015; McRae & Gross, 2020). According to Lear et al. (2019), a lack of ability to regulate emotions can lead to negative emotions. Negative emotions that are uncontrolled can cause self-criticism, daily guilt, and punishment-deservingness (Lear et al., 2019). Self-criticism, daily guilt, and punishment-deservingness are the impacts of the lack of ability to regulate emotions and they can lead to self-injury. In addition, a person who has impaired emotion regulation is also likely to experience anxiety and depression (Young et al., 2019).

In a study by Heath et al. (2009), emotional and social factors that influenced students in Canada who engaged with self-injury were 91% and 65.2%, respectively. In that study, it was mentioned that emotional factors were the inability of students to regulate their emotions, while social factors included friendship circles and social media. A study showed that, in Malaysian students, there are four main factors associated with self-injury; they were the inability to regulate emotions, the use of self-injury as a form of emotion regulation, the fact that students who did self-injury often perceived negatively on themselves, and students who struggled to deal with the negative impact of self-injury (Tan et al., 2018). However, the research conducted by Peterson et al. (2019) in the United States proved that the worse the difficulty in emotion regulation, the higher the risk of a college student to be engaged in self-injury. It was also supported by the research conducted in Canada by Yurkowski et al. (2015) that the inability to regulate emotions in college students was related to self-injury. Inability to regulate emotions can also affect the frequency of self-injury in students (Zelkowitz et al., 2017).

A previous study showed that the period of study being undertaken by college students is a period that has a high risk of the phenomenon of non-suicidal self-injury (Kiekens et al., 2019). In Belgium, 10.3% of first-year college students and 6% of second-year college students committed self-injury (Kiekens et al., 2019). In the research conducted by Tresno et al. (2012) in Indonesia, the phenomenon of self-injury in college students reached 38%. College students with a history of self-injury have a predisposition to attempt suicide (Hamza & Willoughby, 2016). The first onset of suicidal thoughts and behaviors at the university level is greater than in the general population (Mortier et al., 2017). This proves that self-injury in college students during this pandemic is very worrying and although self-injury was initially done without any intention of suicide, over time the act will have a terrible impact, namely suicide attempt.

Nurses as health workers have a role and function to improve the level of health of the individuals, groups, and communities. This level of health does not only focuson the physical aspects, but also the psychological aspects, or it can be said as holistic health care (Nurhalimah, 2016).According to Wolff et al. (2019), as an effort in the prevention of self-injury, it is necessary to understand the treatment of emotion dysregulation. Learning to manage oneself' emotions, patients' emotions, and unpredictable work environment while learning to make the best clinical decisions is an essential need for nursing students (Dubert et al., 2016). Nursing students in the future will become professional nurses who serve and care for many kinds of individuals with different traits, so there is a need to be able to regulate their emotions to deal with that condition. Nurses also need to have the ability to regulate emotions because they work in the area that is always related to other people, prioritizing the interests and welfare of others (Rahayu & Fauziah, 2019). Nurses with high emotional regulation ability have a sense of control and confidence in the emotional context, therefore, they have high motivation and personal well-being so that they can improve the quality of service at work (Donoso et al., 2015). One of the efforts to produce professional nurses is to ensure that students studying in universities have a healthy mentality by avoiding self-injury and being able to properly regulate their emotions. However, little is known about how the process happens and how the emotion regulation relates to other factors associated with the incident of self-injury. Accordingly, this study attempted to identify the relationship between emotion regulation and self-injury status in nursing students.

2. Methods

2.1 Research design

This study used a descriptive correlational design to seek for the relationship between emotion regulation and self-injury status among nursing students.

2.2 Setting and samples

This study was conducted in the faculty of nursing in a university in Bandung, Indonesia. The research population was 849 active students of nursing from the first year to the fourth year. The stratified random sampling was used to recruit the samples. There were four levels in the 849 active students, namely first year, second year, third year, and fourth year. Each level was calculated using the Slovin formula with a margin of error of 0.01 to determine the number of samples for each level, so that 783 students were obtained. The inclusion criteria were students of the undergraduate program at the faculty of nursing and administratively active in the academic semester. Students who were undergoing the student exchange program or being on an academic leave were excluded.

2.3 Measurement and data collection

This study utilized the Difficulties of Emotion Regulation Scale (DERS) developed by Gratz and Roemer (2004) to collect data of emotion regulation variable. InDERS, there are 36 statements classified into six dimensions of emotion regulation that have the potential to be difficult, namely non-acceptance of emotional responses, difficulty in engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. The instrument was developed to measure difficulties in emotion regulation. The statements in DERS are answered by selecting one of 5 options: (5) almost always, (4) often, (3) about half the time, (2) sometimes, and (1) rarely. Of the 36 statements, 11 statements are reversed scoring, including item 1, 2, 6, 7, 8, 10, 17, 20, 22, 24, and 34. The data generated on this instrument were included in the continuous variable. The

interpretation of the 36 statements resulted in a minimum score of 36 and a maximum score of 180. Higher scores indicate more difficulty in emotion regulation which can affect the ability of emotion regulation. After the data had been obtained, the researchers conducted normality tests with Kolmogorov-Smirnov and Shapiro-Wilk. The result showed a normal data distribution so that the mean value was analyzed. The mean value was obtained from the total number of respondents' scores divided by the total number of respondents.

Another instrument used in this study was the Deliberate Self-Harm Inventory (DSHI) for self-injury variable developed by Gratz (2001). The instrument consists of 17 questions with 16 closed questions with two answer options namely (1) Yes and (0) No. If the respondent answered at least one of the first 16 questions with a "Yes" answer or answered the question at number 17 with an answer that matches the definition of self-injury, then he/she committed self-injury. Whereas if the respondent answered "No" on the first 16 questions or answered the question at number 17 with an answer that was not suitable to the definition of self-injury, then he/she did not commit self-injury.

DERS and DSHI have been tested for their reliability. DERS showed a test-retest reliability score of 0.80 (p<0.01) (Gratz & Roemer, 2004). Meanwhile, DSHI showed a Cronbach's alpha of 0.82, indicating a high internal consistency, and test-retest reliability score of r=0.92 (p<0.001) (Gratz, 2001). Also, both DSHI and DERS had undergone validity test. In DERS, the items of the statement are associated with other factors related to emotion regulation, namely negative mood regulation, avoidance of emotion expression, and expression of emotions. The items in DERS were tested with these factors and the result was that DERS was positively related to NMR and emotion avoidance, while only 3 DERS items were related to emotional expression (Gratz & Roemer, 2004). This proves that DERS instruments have been tested for validity using construct validity. Meanwhile, DSHI also had been tested for validity using construct validity. The construct validity used items in the DSHI that were related to the other self-injury factors, namely suicide attempts, frequency of self-injury, and borderline personality organization. The result was that DSHI related to all factors tested, so the DSHI instrument had been tested for validity (Gratz, 2001).

In this study, the researchers used the Indonesian version of the questionnaires. Permission to use the instrument from each instrument developer was obtained. After that, the researchers did a back-translation from English to Indonesian with the assistance of a translation agency. The external validity test was also conducted. External validity test or face validity test is the method of comparing the criteria in the instrument with the real circumstances in the field (Allen, 2017). This face validity test was conducted online using Google form among 15 students of nursing students from the first year to the fourth year in approximately 10-20 minutes. The result showed that all students understood all items of the instruments.

For this study, the researchers also identified demographic data of the respondents and things related to self-injury. In the demographic data, researchers identified gender, year level, and campus region. Meanwhile, in the things related to self-injury, the question items used were the things the researchers found during the preparation of the article. These items were used to strengthen data related to the risk of self-injury in the respondents.

The COVID-19 pandemic prevented the researchers and respondents to meet in person, so that the data collection was conducted online using Google form. The link to the questionnaires was distributed to each level of student with the assistance of the class leaders through Line/ WhatsApp application from 15 to 26 April 2021. The research instrument started with informed consent and approval of each respondent. Students who agreed to participated were requested to fill out the questionnaires honestly. The researchers also examined the entirety of the data to ensure the suitability and completeness of the response on every aspect of the question or statement. If the respondent's answers were incomplete or inappropriate, then the researchers re-contacted the respondents personally to get appropriate and more complete answers.

2.4 Data analysis

The data collected in this study were analyzed using the univariate and bivariate analyses. In the univariate data analysis, both data processing results from DSHI and DERS instruments were presented in percentage. Meanwhile, in the bivariate analysis, a correlation test was conducted using the Point Biserial test to know whether the two variables were related or unrelated. These variables consisted of interval variables (DERS) and ratio variables (DSHI).

2.5 Ethical considerations

This study obtained ethical approval from the Ethics Committee for Research of Universitas Padjadjaran with a reference number of 208/UN6.KEP/EC/2021. This study had also obtained permission from the university where the study took place. Respondents were informed of the purpose of the study and estimated time to participate in this research as well as the guarantee of the confidentiality of the identity and personal data. They also had the right to choose to participate or not in this study. Such information was provided online via Whatsapp and Google form. The respondents could complete the questionnaires any time within the study timeframe so that this participation would not interfere with respondents' activities. The questionnaires had been made as appropriate so as not to cause negative effects on respondents at the time of completion. There was a trigger warning before the respondents filled out the questionnaires that the topic was sensitive. If the respondents felt that this topic was dangerous for themselves, they were not allowed to fill out the questionnaires.

3. Results

3.1 Characteristics of the respondents

The majority of the respondents were female nursing students (90.5%). Most of them were from Jatinangor/Garut campus (85.4%) and the third year became the most participating group (29.5%) than others. The detail result is presented in Table 1.

Table 1. Demographic frequency distribution of respondents (n=783)

Demographic Data	f	%
Gender		
Male	74	9.5
Female	709	90.5
Year Level		
Fourth-year	228	29.1
Third-year	231	29.5
Second-year	148	18.9
First-year	176	22.5
Campus Region		
Jatinangor/Garut	669	85.4
Pangandaran	114	14.6

Table 2 shows that the majority of respondents (92%) were living with parents but some had difficulty communicating with their parents (19.7%) and had a history of mistreatment in childhood though the number belonged to a minority (30%). Almost half of the respondents (49.4%) had a feeling that they deserved to be punished in certain conditions, and then more than half of the respondents (54.9%) had a self-criticism habit in certain conditions too. Then, feeling guilty continuously in certain conditions (daily guilt) and feeling sensitive to the emotion feelings had a majority number with 60.3% and 74.8%, respectively. Some respondents (15.5%) often took a look at something related to self-injury on social media and had friends/families who had done self-injury (33.8%).

Table 2. Respondents' specific characteristics related to self-injury and emotion regulation (n=783)

Characteristics of Respondents	f	%
Living with parents		
Yes	720	92
No	63	8
Difficulty communicating with parents		
Yes	154	19.7
No	629	80.3
Childhood abuse		
Yes	235	30
No	548	70

Table 2. Continued

Characteristics of Respondents	f	%
Punishment deservingness		
Yes	387	49.4
No	396	50.6
Self-criticism		
Yes	430	54.9
No	353	45.1
Daily Guilt		
Yes	472	60.3
No	311	39.7
Emotionally sensitive feelings		
Yes	586	74.8
No	197	25.2
Taking a look at things related to self-injury on social media		
Yes	121	15.5
No	662	84.5
Friendship/family circle committing self-injury		
Yes	265	33.8
No	518	66.2

3.2 Emotion regulation scores and self-injury status among nursing student

Table 3 shows that the minimum and maximum scores of the emotion regulation in nursing student were 41 and 163, subsequently. The mean score was 96.75 and 20.948 was the standard deviation. In the dimension of difficulties in emotion regulation, limited access to emotion regulation strategies had the highest mean score (M=20.52) compared to other dimensions.

Table 3. Emotion regulation in respondents (n=783)

Variable	Mean(SD)	Min-Max
Emotion regulation	96.75 (20.948)	41 – 163
Dimension of Difficulties in Emotion Regulation		
1. Non-acceptance of emotional responses	18.65 (5.56)	6 – 30
2. Difficulty engaging in goal-directed behavior	16.26 (4.17)	5 – 25
3. Impulse control difficulties	14.98 (5.42)	6 – 30
4. Lack of emotional awareness	13.58 (3.55)	6 – 26
5. Limited access to emotion regulation strategies	20.52 (6.29)	8 – 40
6. Lack of emotional clarity	12.74 (4.12)	5 – 25

Furthermore, this study also showed that one-third of students committed self-injury (Table 4).

Table 4. Self-injury status in respondents (n=783)

Variable	f	%
Self-injury Status		
Commit	255	32.6
Did not commit	528	67.4

3.3 The correlation between emotion regulation and self-injury status

Based on Table 5, the significant value in this study was 0.000. The significant value was less than 0.05, so it could be interpreted that there was a relationship between emotion regulation and self-injury status in nursing students.

Table 5. Relationship between emotion regulation and self-injury status (n=783)

Variable	n	r	*p*-value
Emotion Regulation Self-Injury Status	783	0.337	0.000

4. Discussion

This study showed that there is a significant relationship between emotion regulation and self-injury status. There are six dimensions in difficulties in emotion regulation. They are non-acceptance of emotional responses, difficulty engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity (Gratz & Roemer, 2004). Based on this study, limited access to emotion regulation strategies dimension has the highest mean score compared to other dimensions. That result indicates more difficulty to access emotion regulation strategies (Gratz & Roemer, 2004). Furthermore, according to Gratz (2007), the ability to regulate emotions will reduce the need to perform maladaptive behaviors such as self-injury. In addition, identifying and managing emotions is also one of the efforts that can be made to prevent self-injury (Muehlenkamp & Cauley, 2016). Emotion regulation is also one of the strategies to minimize negative emotions related to self-injury (Zelkowitz et al., 2016).

This study showed that one-third of students committed self-injury. Silva et al. (2017) said that more than half of college students that committed self-injury needed professional help, but only 18.1% were looking for professionals to deal with their problems. A college student who commits self-injury can lead thoughts or actions to end his/her life if there is no effort for furthermore (Hamdan-Mansour et al., 2021). Self-injury can also improve a person's ability to commit suicide attempts (Van Orden et al., 2010). In a study by Kiekens et al. (2018), self-injury by college students was a risk factor for attempted suicide. According to Klonsky et al. (2013), self-injury is not only a sign of the severity of a mental illness but it is more than that. It is because self-injury is not based on mental illness and it remains a risk of suicide attempts.

The researchers in this study identified some risk factors and causes of self-injury that had been presented. According to Klonsky et al. (2011), most of the causes of self-injury are influenced by childhood experiences and family environments where there is a very close relationship between self-injury with family violence, poor communication between parents and their child, and lack of emotional validation. When the child is emotionally harmed by the primary caregiver, the bonding relationship with each other will be disrupted and will extend to the disruption of interpersonal abilities which will trigger self-injury. In addition, a pattern of relationships in children is established with the primary caregiver that affects the ability in emotion regulation where it is associated with self-injury (Yates, 2009).

There are some specific characteristics in respondents related to self-injury, one of which is having a habit of self-criticism in certain conditions. In this study, more than half of the respondents had a habit of criticizing themselves continuously under certain conditions. It is in line with the research conducted by Lear et al. (2019) that self-criticism is indirectly related to self-injury. The indirect relationship between self-criticism and self-injury will lead to the feeling that one deserves a punishment caused by negative emotions and thoughts (Lear et al., 2019). This is in line with the results of the present research in which almost half of the students had the feeling in certain conditions that they deserved to punish themselves. In addition, this study proves that more than half of the students had a persistent feeling of guilt in certain conditions (daily guilt). A previous study by Lear et al. (2019) showed that feelings of guilt that were continuous (daily guilt) were related to self-injury in college students because negative thoughts and emotions in college students resulted from daily guilt could cause self-injury.

The lack of ability to regulate emotions can cause intense negative emotions that become a characteristic in a person who commits self-injury (Davis et al., 2014). The relationship between emotion regulation and self-injury status was also proven in a study by Zelkowitz et al. (2016), that emotion regulation in college students had a significant relationship with self-injury. While in a study by Ewing et al. (2019), the inability to regulate their emotion which was related to self-injury in students was based on stressful experiences. Increased stress experience will increase the risk of self-injury in students through the inability to regulate emotions (Ewing et al., 2019). Hasking and Claes (2019) also stated that the inability to regulate emotions was a risk factor of maladaptive behavior within the university sphere, one of which was self-injury. According to Miller and Racine (2020), the dimension of difficulties in emotion regulation that influences impulsive behavior the most is the lack of emotional clarity. The lack of the ability to understand emotional clarity indicates the risk of self-injury (Miller & Racine, 2020). However, based on the present study, the lack of emotional clarity dimension has the lowest mean score compared to other dimensions.

Academics and university staffs and mental health practitioners have a responsibility to maintain student welfare and minimize the occurrence of self-injury (Hamdan-Mansour et al., 2021). Efforts to prevent and handle the phenomenon of self-injury in college students can be identified from the specific characteristics of respondents related to self-injury that have been previously presented. These characteristics are related to negative emotions that can affect the ability to regulate emotions. Self-criticism, daily guilt, and punishment-deservingness will occur if a person has been overcome by negative emotions and thoughts that negative emotions can control one's mind due to the lack of ability to regulate emotions (Lear et al., 2019).

As an effort to prevent maladaptive behavior, such as self-injury, it is important to conduct assessments and treatments related to risk factors in the maladaptive behavior within the university (Hasking & Claes, 2019). It is a consideration to involve knowledge related to emotion regulation for self-injury treatment in college students due to the relationship between emotion and self-injury regulation (Yurkowski et al., 2015). In the research conducted by Turner et al. (2014), therapy with emotion regulation was effective for reducing self-injury. The therapy of emotion regulation is to focus the client on the development of emotion regulation and the ability for acceptance (Turner et al., 2014). Meanwhile, Miller and Racine (2020) also stated in their research that the ability to understand emotion clarity that was part of the emotion regulation could be a way to handle, reduce, and prevent self-injury that exists in the university sphere. Besides that, according to Dubert et al. (2016), mindfulness therapy can affect the ability to regulate emotions. Therefore, mindfulness therapy can be an option to be a psychotherapy applied to nursing students (Munif et al., 2019).

5. Implications and limitations

This study provides the empirical evidence on emotion regulation and self-injury status in nursing students. The results of this study implicate the importance of health promotion on self-injury's prevention and treatment. It is important to conduct assessments and treatments related to risk factors in the maladaptive behavior within the university to prevent and handle the phenomenon of self-injury in college students by identifying emotion regulation among student and how they manage their emotions. After that, promoting the importance of emotion regulation and how to use emotion regulation at the right moment is necessary.

The researchers realize that this study also has a limitation. Self-injury has several types and each type of self-injury requires different treatments, but this study only identified self-injury in general.

6. Conclusion

This study reveals the relationship between emotion regulation and self-injury status in nursing students. This study proves the importance of nursing implication in terms of health promotion and education that it is necessary for nursing students regarding emotion regulation as a prevention and treatment of self-injury in general. Further study is recommended to identify the types of self-injury committed by nursing students and the factors related to each type of self-injury to be more specific in the prevention and treatment efforts.

Acknowledgment

Author contribution

All the authors have each substantial contribution to drafting the manuscript. All authors (DANS, NOH, CWMS) were involved in the conception of the study, design of the study, data collection, analysis, and manuscript writing.

Conflict of interest

The authors have no conflict of interest

References

Allen, M. (2017). *The sage encyclopedia of communication research methods* (Vols. 1-4). SAGE Publications, Inc. https://doi.org/10.4135/9781483381411

Davis, T. S., Mauss, I. B., Lumian, D., Troy, A. S., Shallcross, A. J., Zarolia, P., Ford, B. Q., & McRae, K. (2014). Emotional reactivity and emotion regulation among adults with a history of self-harm: Laboratory self-report and MRI evidence. *Journal of Abnormal Psychology, 123*(3), 499–509. https://doi.org/10.1037/a0036962

Donoso, L. M. B., Demerouti, E., Garrosa Hernández, E., Moreno-Jiménez, B., & Carmona Cobo, I. (2015). Positive benefits of caring on nurses' motivation and well-being: A diary study about the role of emotional regulation abilities at work. *International Journal of Nursing Studies, 52*(4), 804–816. https://doi.org/10.1016/j.ijnurstu.2015.01.002

Dubert, C. J., Schumacher, A. M., Locker, L., Gutierrez, A. P., & Barnes, V. A. (2016). Mindfulness and emotion regulation among nursing students: Investigating the mediation effect of working memory capacity. *Mindfulness, 7*(5), 1061–1070. https://doi.org/10.1007/s12671-016-0544-6

Ewing, L., Hamza, C. A., & Willoughby, T. (2019). Stressful experiences, emotion dysregulation, and nonsuicidal self-injury among university students. *Journal of Youth and Adolescence, 48*(7), 1379–1389. https://doi.org/10.1007/s10964-019-01025-y

Gratz, K. L. (2001). Measurement of deliberate self-harm: Preliminary data on the deliberate self-harm inventory. *Journal of Psychopathology and Behavioral Assessment, 23*(4), 253–263. https://doi.org/10.1023/A:1012779403943

Gratz, K. L. (2007). Targeting emotion dysregulation in the treatment of self-injury. *Journal of Clinical Psychology, 63*(11), 1091–1103. https://doi.org/10.1002/jclp

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41–54. https://doi.org/10.1023/B:JOBA.0000007455.08539.94

Hamdan-Mansour, A. M., Alzayyat, A. A., Hamaideh, S. H., Rafaiah, M.-Q. B., Jammal, O. L. A., & Hamdan-Mansour, L. A. (2021). Predictors of deliberate self-harm among university students. *International Journal of Mental Health and Addiction.* https://doi.org/10.1007/s11469-021-00561-8

Hamza, C. A., & Willoughby, T. (2016). Nonsuicidal self-injury and suicidal risk among emerging adults. *Journal of Adolescent Health, 59*(4), 411–415. https://doi.org/10.1016/j.jadohealth.2016.05.019

Hasking, P., & Claes, L. (2019). Transdiagnostic mechanisms involved in nonsuicidal self-injury, risky drinking and disordered eating: Impulsivity, emotion regulation and alexithymia. *Journal of American College Health, 68*(6), 603–609. https://doi.org/10.1080/07448481.2019.1583661

Heath, N. L., Ross, S., Toste, J. R., Charlebois, A., & Nedecheva, T. (2009). Retrospective analysis of social factors and nonsuicidal self-injury among young adults. *Canadian Journal of Behavioural Science, 41*(3), 180–186. https://doi.org/10.1037/a0015732

Kiekens, G., Hasking, P., Boyes, M., Claes, L., Mortier, P., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Kessler, R. C., Myin-Germeys, I., Nock, M. K., & Bruffaerts, R. (2018). The associations between non-suicidal self-injury and first onset suicidal thoughts and behaviors. *Journal of Affective Disorders, 239*, 171–179. https://doi.org/10.1016/j.jad.2018.06.033

Kiekens, G., Hasking, P., Claes, L., Boyes, M., Mortier, P., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Kessler, R. C., Myin-Germeys, I., Nock, M. K., & Bruffaerts, R. (2019). Predicting the incidence of non-suicidal self-injury in college students. *European Psychiatry, 59*, 44–51. https://doi.org/10.1016/j.eurpsy.2019.04.002

Klonsky, E. D., May, A. M., & Glenn, C. R. (2013). The relationship between nonsuicidal self-injury and attempted suicide: Converging evidence from four samples. *Journal of Abnormal Psychology, 122*(1), 231–237. https://doi.org/10.1037/a0030278

Klonsky, E. D., Muehlenkamp, J. J., Lewis, S. P., & Walsh, B. (2011). *Advances in psychotherapy: Nonsuicidal self-injury*. Hogrefe Publishing.

Koole, S. L., & Aldao, A. (2016). The self-regulation of emotion: Theoretical and empirical advances. In K. D. Vohs, & R. F. Baumeister (Eds.), *Handbook of self-regulation* (3rd ed., pp. 101-112). Guilford.

Lear, M. K., Wilkowski, B. M., & Pepper, C. M. (2019). A daily diary investigation of the defective self model among college students with recent self-injury. *Behavior Therapy*, *50*(5), 1002–1012. https://doi.org/10.1016/j.beth.2019.03.005

McRae, K., & Gross, J. J. (2020). Emotion regulation. *Emotion*, *20*(1), 1–9. https://doi.org/10.1037/emo0000703.supp

Miller, A. E., & Racine, S. E. (2020). Emotion regulation difficulties as common and unique predictors of impulsive behaviors in university students. *Journal of American College Health*, *0*(0), 1–9. https://doi.org/10.1080/07448481.2020.1799804

Mortier, P., Demyttenaere, K., Auerbach, R. P., Cuijpers, P., Green, J. G., Kiekens, G., Kessler, R. C., Nock, M. K., Zaslavsky, A. M., & Bruffaerts, R. (2017). First onset of suicidal thoughts and behaviours in college. *Journal of Affective Disorders*, *207*, 291–299. https://doi.org/10.1016/j.jad.2016.09.033

Muehlenkamp, J. J., & Cauley, B. (2016). Self-injury (non-suicidal). *Encyclopedia of mental health, 4*, 115–119. https://doi.org/10.1016/B978-0-12-397045-9.00250-0

Munif, B., Poeranto, S., & Utami, Y. W. (2019). Effects of islamic spiritual mindfulness on stress among nursing students. *Nurse Media Journal of Nursing*, *9*(1), 69-77. https://doi.org/10.14710/nmjn.v9i1.22253

Nurhalimah. (2016). *Keperawatan jiwa [Psychiatric Nursing]*. Kementerian Kesehatan Republik Indonesia.

Peterson, A. L., Chen, J. I., Karver, M. S., & Labouliere, C. D. (2019). Frustration with feeling: Latent classes of non-suicidal self-injury and emotion regulation difficulties. *Psychiatry Research*, *275*(August 2018), 61–70. https://doi.org/10.1016/j.psychres.2019.03.014

Rahayu, D. P., & Fauziah, N. (2019). Hubungan antara regulasi emosi dengan burnout pada perawat rawat inap Rumah Sakit Jiwa Daerah (RSJD) Dr Amino Gondohutomo Semarang [The relationship between emotional regulation and burnout in inpatient nurses at the Regional Psychiatric Hospital (RSJD) of Dr Amino Gondohutomo Semarang]. *Empati*, *8*(2), 19–25.

Silva, E. C., Benjet, C., García, F. J., Cárdenas, S. J., Gómez-Maqueo, M. E. L., & Cruz, A. V. (2017). Non-suicidal self-injuries in a sample of Mexican university students. *Salud Mental*, *40*(5), 191–199. https://doi.org/10.17711/SM.0185-3325.2017.025

Tan, S. C., Tam, C. L., & Bonn, G. (2018). Feeling better or worse? The lived experience of non-suicidal self-injury among Malaysian university students. *Asia Pacific Journal of Counselling and Psychotherapy*, *10*(1), 3–20. https://doi.org/10.1080/21507686.2018.1541912

Tresno, F., Ito, Y., & Mearns, J. (2012). Self-injurious behavior and suicide attempts among Indonesian college students. *Death Studies*, *36*(7), 627–639. https://doi.org/10.1080/07481187.2011.604464

Turner, B. J., Austin, S. B., & Chapman, A. L. (2014). Treating nonsuicidal self-injury: A systematic review of psychological and pharmacological interventions. *Canadian Journal of Psychiatry*, *59*(11), 576–585. https://doi.org/10.1177/070674371405901103

Van Orden, K. A., Witte, T. K., Cukrowicz, K. C., Braithwaite, S., & Selby, E. A. (2010). *The Interpersonal Theory of Suicide*. *117*(2), 575–600. https://doi.org/10.1037/a0018697.The

Wolff, J. C., Thompson, E., Thomas, S. A., Nesi, J., Bettis, A. H., Ransford, B., Scopelliti, K., Frazier, E. A., & Liu, R. T. (2019). Emotion dysregulation and non-suicidal self-injury: A systematic review and meta-analysis. *European Psychiatry*, *59*, 25–36. https://doi.org/10.1016/j.eurpsy.2019.03.004

Yates, T. M. (2009). Developmental pathways from child maltreatment to nonsuicidal self-injury. In M. K. Nock (Ed.), *Understanding nonsuicidal self-injury: Origins, assessment, and treatment* (pp. 117–137). American Psychological Association. https://doi.org/10.1037/11875-007

Young, K. S., Sandman, C. F., & Craske, M. G. (2019). Positive and negative emotion regulation in adolescence: Links to anxiety and depression. *Brain Sciences*, *9*(4). https://doi.org/10.3390/brainsci9040076

Yurkowski, K., Martin, J., Levesque, C., Bureau, J. F., Lafontaine, M. F., & Cloutier, P. (2015). Emotion dysregulation mediates the influence of relationship difficulties on non-suicidal self-injury behavior in young adults. *Psychiatry Research*, *228*(3), 871–878. https://doi.org/10.1016/j.psychres.2015.05.006

Zelkowitz, R. L., Cole, D. A., Han, G. T., & Tomarken, A. J. (2016). The incremental utility of emotion regulation but not emotion reactivity in non-suicidal self-injury. *Suicide Life Threat Behavior, 46,* 545-562. https://doi.org/10.1111/sltb.12236

Zelkowitz, R. L., Porter, A. C., Heiman, E. R., & Cole, D. A. (2017). Social exposure and emotion dysregulation: Main effects in relation to nonsuicidal self-injury. *Journal of Adolescence*, *60(1)*, 94–103. https://doi.org/10.1016/j.adolescence.2017.07.015

NurseMedia
JOURNAL OF NURSING

ORIGINAL RESEARCH

Health Literacy-Related Knowledge and Experience among Nurses Practicing in Medical-Surgical Wards

Sadeq Al-Fayyadh[1], Mohammed Baqer Al-Jubouri[1], Hayder Al-Hadrawi[2], Sabah Abdullah Jaafar[3], Shaymaa Mohammed Hussein[1]

[1]University of Baghdad, College of Nursing, Iraq
[2]University of Kufa, College of Nursing, Iraq
[3]Al-Muthanna University, College of Nursing, Iraq

Article Info	Abstract
  Corresponding Author: Mohammed Baqer Al-Jubouri Adult Nursing Department, College of Nursing, University of Baghdad, Iraq Email: maaljubouri@conursing.uobaghdad.edu.iq	**Background:** Medical-surgical nurses are responsible of providing competent care to clients with a wide-array of acute and chronic health problems. This challenging task requires arming nurses with advanced competencies of health literacy to effectively educate their clients. However, evidence about medical-surgical nurse's health literacy-related knowledge and experience is limited. **Purposes:** This study aimed to determine the level of the health literacy-related knowledge and experience among medical-surgical nurses. **Design:** A descriptive-cross-sectional study was conducted among a total sample of 177 nurses who were practicing in medical-surgical wards in teaching hospitals in Iraq. A convenience sampling method was used to select the participants. Data were collected using the Health Literacy Knowledge and Experiences Survey-2 (HLKES-2). Descriptive statistics and Chi-square test were used for data analysis. **Results:** The majority of nurses (92.3%) had a low level of knowledge regarding health literacy and more than half of the participants (58.7%) had an acceptable level of experience. **Conclusion:** Nurses' information about health literacy needs to be updated via continuous education to enhance their knowledge and practice regarding this aspect.

1. Introduction

Health literacy defines persons' capacities to accessing, understanding, using health information, and maintaining health through effective self-management and collaborating with health care providers (Berkman et al., 2010; Liu et al., 2020). The scientific literature has confirmed the fact that low health literacy level is linked with poor health outcomes (Rademakers & Heijmans, 2018). Lower health literacy negatively impacts the efficiency of a wide-array of therapeutic interventions, particularly when providing care to vulnerable segments of population; such as senior citizens, patients with a single or multiple chronic diseases, and those who were less fortunate to get higher levels of education (Brooks et al., 2020; Rademakers & Heijmans, 2018).

Both in developed and developing countries, health literacy was found to be limited (Matthews, 2018; Seng et al., 2020). For example, two out of three Canadian adults, and nine out of ten senior persons stand in need of obtaining, understanding and acting on health-related information to make suitable and independent health decisions (Vamos et al., 2020). Correspondingly, in the United Arab Emirates (UAE), Matthews (2018) reported that approximately half of the study sample did not have the necessary health-related knowledge or skills to effectively steer the healthcare system or follow intricate directives from their health care providers. Despite the fact that sociopolitical, environmental, cultural, and professional factors are major variables in determining the level of target society's health literacy, it can be boosted by inclusive health-focused education at both persons and public levels (Huhta et al., 2018).

Many studies have confirmed that enhancing patients' knowledge, understanding, and preparedness for self-management are core pillars of nurses' educational responsibility toward their clients (Bergh et al., 2015). Nurses are the principal and the largest group of health care professionals. They are the front position of client care, spending a significant portion of their time with patients and members of their patient's families. This inclusive interaction offers exceptional opportunities for patient and family education to be provided (Al-Fayyadh & Mohammed, 2010; Grønning et al., 2017; Karimi Moonaghi et al., 2016). Thus, nurses must be armed with the required educational competencies to execute this pivotal health promotion role (Al-Fayyadh, 2020).

Nurses should be trained to appropriately engage with all patients, using health literacy strategies based on the prior expertise and education (Walker et al., 2019). According to the Academy of Medical-Surgical Nurses (as cited in Overbaugh, 2020), the medical-surgical nurses are in charge of organizing and providing nursing care across various health care settings covering all stages of illness. Such role can be challenging for nurses practicing in medical-surgical ward, considering their diverse tasks, scarce resources, limited care time, increasing client's health problem acuity. This justifies conducting this study, whereas no similar studies were conducted in Iraq or Middle East.

Both globally and locally, across all professional disciplines, at all planes, health care industry is becoming more complex (Kannampallil et al., 2011). Examples of such complexity are, however not limited to, strong competition, severe financial crises, increase demand and expectations of customers (Manion, 2009). Therefore, providing quality care to clients is becoming challenging. It is expected that all health care providers, particularly nurses, to be armed with all the essential competencies to effectively manage all the previous challenges. This would enable them to enhance their organization survival and optimize their client's wellness in such locally and globally rapidly changing environment. Nurses have an ethical, professional obligation to advocate the good of their clients in health and sickness.

According to Healthy People 2030, health literacy is transforming from the personal to organizational focus, which reflects a holistic emphasis of the concept (Office of Disease Prevention and Health Promotion, n.d.). Therefore, it is becoming mandatory for all the stakeholders, particularly nurses, to enhance their health literacy competencies aiming for providing quality care in a timely manner. Nurses in general, medical-surgical nurses in particular, are the frontline health care providers who are in charge of achieving improvement in patients' health conditions. Therefore, they must be well-trained and continuously educated on how to provide competent patient education to improve their health literacy (Loew, 2015). Success in achieving this goal, however cannot be reached, unless assessing medical-surgical nurse's health literacy-related knowledge and experience as a preliminary step. Therefore, this study was basically conducted to answer this question: What is the level of medical-surgical nurse's health literacy-related knowledge and experience? Answering the aforementioned research question would better inform the tailored on-service, educational intervention for medical-surgical nurses who may have low health literacy-related knowledge and experience.

This research endeavor was principally developed and conducted to fill the existed scientific literature gap both at the national and regional levels. We could not find enough evidence about "health literacy", "Knowledge" and "Experience" of "Medical-Surgical Nurses". Conducting this study was both justified and highly recommended. Therefore, this study aimed basically at assessing medical-surgical nurse's health literacy-related knowledge and experience.

2. Methods
2.1 Research design
A descriptive, cross-sectional study design was used to answer the current research questions regarding the knowledge and experience of nurses concerning health literacy.

2.2 Setting and participants
The study targeted nurses who were practicing in medical-surgical wards in teaching hospitals in Baghdad, Iraq. All the official agreements to collect the data through direct interview with the nurses were issued. However, Covid-19 pandemic had imposed itself and prevented the data collection team from moving forward following the planned approach. Therefore, Google form was used to collect the data of the target setting and subjects. A

convenience sampling method was used to select the participants. The electronic form of the questionnaire was sent to nurses. Nurses who work in the medical and surgical units with at least one year of experience at the time of data collection were included in this study. Nurses who are graduated from a two academic years' program offered at technical institutes were also included in this study. A total of 155 male and female nurses participated as the study samples.

2.3 Measurement and data collection

Nurses' knowledge and practice regarding patients' health literacy was assessed using "Health Literacy Knowledge and Experiences Survey-2" (HLKES-2) with the written permission from the authors (Walker et al., 2019) to translate and use the scale. The instrument is a total of 14 items that are divided into two domains: 10 items for the knowledge domain and 4 items for the experience domain (Walker et al., 2019). Since there is no previous studies or formal records that have determined the prevalence of health literacy in Iraq and to avoid bias results regarding nurses' knowledge, questions number one "low health literacy is most prevalent among which age group?" and question number three "What is the likelihood that a nurse will encounter a patient with low health literacy?" were moved from the original scale to be assessed in separated part after the demographics in the questionnaire. This step did not influence the validity of the score regarding the knowledge domain. Each question has three distractors and one correct answer; for example, question one "a patient with enough health literacy is able to", and nurses who selected the choice (c) "read, understand, and participate effectively in healthcare decisions" was given (1), and nurses who selected other distractors were give (0). The levels of knowledge domain were determined based on the total items mean scores, the mean scores ranged between 0-1. Accordingly, the levels are identified as follow: ≤0.33 "low level of knowledge"; 0.34-0.66 "acceptable level"; 0.67-1 "high level of knowledge". The experience domain is scored on four levels Likert scale (1=never, 2=sometimes, 3=most of the time, and 4=always). The total scores that nurses achieve range between 4 to 16. A score of 4-8 indicates low level of experience, 9-12 moderate level, and a score 13-16 indicates a higher level of experience.

The HLKES-2 was originally developed in English by Walker et al. (2019), and it was forward translated to Arabic by three independent bilingual content experts. The Arabic versions were translated back to English independently by the same content experts. The researchers chose the Arabic version that was closest to the original version after it was translated back to English. The content validity was measured through inviting a panel of nine experts in the specific field of the study to rate the level of items relevance. The calculated Content Validity Index (CVI) is 0.94, signifying that the tested tool measures what it intends to measure (Yusoff, 2019). Test-retest reliability was run using data from 40 nurses to measure the stability of the scale "the health literacy knowledge and experience of Iraqi nurses" over time. The time between first test and the second test was 10 days. Reliability was analyzed using test-retest reliability coefficients method. The result in the correlation between test 1 and test 2 showed the r-value of 0.86.

The questionnaire also included demographics data; age, gender, level of education, and years of experience. The data were collected by distributing the questionnaire through social media platforms including Facebook, Telegram, and WhatsApp. The link was sent to the participants, and 155 completed the survey in the proposed time.

2.4 Data analysis

Data were analyzed using the Statistical Package for Social Sciences for statistical analysis (SPSS version 24). The sample characteristics, knowledge, and experience were described using descriptive statistics. Relationships between dependent and independent variables were explored using non-parametric test (Chi-square test). The significant level was set at 0.05.

2.5 Ethical considerations

All nurses who completed the survey participated voluntarily. The cover letter of the instrument included information regarding study purpose(s) and the confidentiality of nurse' responses. Participants were also informed that survey is anonymous, and their responses and identity would be confidential, and would be use for the research purpose only. The Institutional Review Board (IRB) at the University of Baghdad, College of Nursing has reviewed the study

proposal and issued the required official agreement (Reference number: A-N-D-2020). Of equal importance, the research team had contacted the corresponding author of the article which contained HLKES-2, to seek permission to both translating the HLKES-2 into Arabic language and to use it to investigate health literacy-related knowledge and experience among nurses practicing in medical-surgical wards. All the official agreement to use the HLKES-2 was sent directly through e-mail to the research team.

3. Results

3.1 *Sociodemographic, clinical setting, curriculum, and other related characteristics of the participants*

In Table 1, descriptive statistics of nurse' sociodemographic information represents that about 2/3 of the study subjects were male (69.6%).

Table 1. The sociodemographic, clinical setting, curriculum, and other related characteristics of the participants

Characteristics	f	%
Gender		
Male	108	69.7
Female	47	30.3
Age		
19 - 25 years old	59	38.1
26 - 32 years old	54	34.8
33 - 39 years old	28	18.1
40 and older	14	9.0
Education		
High School of Nursing	8	5.2
Diploma in Nursing	19	12.3
BScN	104	67.1
Post-Graduate	24	15.5
Years of Experience		
1-5	96	61.9
6-10	25	16.1
11-15	21	13.5
16 and more	13	8.4
Nurse-Patient Ratio		
1/5	92	59.4
1/10	38	24.5
1/15	13	8.4
1/20 and more	12	7.7
How Likely you face a client with low health literacy		
1 every 3 patients	27	17.4
1 every 6 patients	66	42.6
1 every 9 patients	39	25.2
1 every 12 patients	23	14.8
Focus times of health literacy in the curriculum		
Never	8	5.2
Sometimes	61	39.4
Most of the time	60	38.7
Always	26	16.8
Have you heard about health literacy concept?		
No	9	5.8
Yes	146	94.2
How you rate your knowledge about the concept		
I have no information	1	0.6
Low level	23	14.8
Moderate Level	68	43.9
Good level	63	40.6

3.2 Level of knowledge and experience regarding health literacy
The levels of knowledge and experience regarding health literacy are shown in Table 2. The results revealed that the majority of nurses (92.3%) had low level of knowledge regarding health literacy and about 58.7% had acceptable level of experience.

Table 2. Health literacy-related knowledge and experience levels (n=155)

Variables	Levels	f	%
Health-literacy related knowledge	Low level of knowledge	143	92.3
	Acceptable level of knowledge	12	7.7
	High level of knowledge	0	0
Health-literacy related experience	Low level of experience	43	27.7
	Acceptable level of experience	91	58.7
	High level of experience	21	13.5

In Tables 3, the Chi-Square test was run to determine the association between nurses' years of experience, focus time of health literacy in nursing curriculum, and nurse-patient ratio and nurses' knowledge and experience related to health literacy. Focus time of health literacy in nursing curriculum was the only variable that show statistically significant association with nurses' knowledge (X^2=11.030, *p*=0.012) and experience (X^2=14.015, *p*=0.029).

Table 3. Association between nurses' years of experience, focus time of health literacy in nursing curriculum, and nurse-patient ratio, and nurses' knowledge and experience (n=155)

Domain	Years of Experience			Focus Time			Nurse-Patient Ratio		
	X^2	df	*p*	X^2	df	*p*	X^2	df	*p*
Knowledge	2.379	3	0.497	11.030	3	0.012	4.113	3	0.249
Experience	9.906	6	0.129	14.015	6	0.029	6.047	6	0.418

4. Discussion

This study was aimed at assessing medical-surgical nurse's health literacy regarding their knowledge and experience. According to the results, about 92.3% of the participants had low knowledge regarding health literacy. In Iraq or any other country around the globe, knowledge about health literacy is crucial among medical-surgical nurses to provide high quality care to patients (Al-Jubouri & Abd Ali, 2021). Nesari et al. (2019) stated that nurses in Iran do not have adequate knowledge and experience about health literacy. Chang et al. (2020) conducted a study in Taiwan to explore nurses' knowledge regarding health literacy. They found that only 51% of their study sample had correct responses toward health literacy. In the United States, Kennard (2017) stated that nurses answered 62% of the knowledge questions regarding health literacy correctly. Cafiero (2013), in another study in the United States, mentioned that most of the nurses answered all the questions regarding knowledge of health literacy correctly. All these results indicate that nurses in Western countries have more knowledge regarding health literacy than Eastern countries. This can be related to the differences in nursing education, curricula, and licensure system in Western and Arab countries (Al-Jubouri & Abd Ali, 2021). Since there is no Arabic version of the HLKES-2 that assess nurses' health literacy, articles about health literacy in Arab countries were limited.

Regarding the nurses' experience toward health literacy, the results showed that more than half of the study sample had good experience. Despite the low knowledge of the study sample which represent 92.3%, they scored much better (58.7%) in their experience. This means that medical-surgical nurses in Iraq act based on their experience not based on their knowledge regarding health literacy. Chang et al. (2020) encountered almost similar results, as they found that 58.8% of nurses scored a good experience in health literacy.

Most of the nurses in this study mentioned that health literacy was a part in the curriculum in their undergraduate program. However, they scored low health literacy related to knowledge. This indicates that they forgot what they have learned, or they were not getting benefits from the course that was presented in the curriculum. Chang et al. (2020) and Nantsupawat et al. (2020)

declared that health literacy among nurses is significantly related to their education. Also, in some studies (Cafiero, 2013; Coleman, 2011; Coleman & Appy, 2012; Nantsupawat et al., 2020), nurses stated that health literacy was overlooked in their curricula. Although, this result is not similar to the current study results, both results highlighted the importance of focusing on health literacy in nursing curricula. Indeed, understanding health literacy during academic study course may improve nurses' knowledge regarding this concept.

The results of this study indicated that there is no significant relationship between nurses' years of experience and their levels of knowledge and experience regarding health literacy. This was surprising for the researchers as most of the study sample (78%) had less than 10 years of experience. This can be related to the communication and interaction between nurses and other health care providers. Nesari et al. (2019) declared that nurses who interact often with health care professionals had higher scores on knowledge regarding health literacy. On the other hand, Wittenberg et al. (2018) found that nurses with less than 10 years of experience are more comfortable with health literacy than nurses with more than 10 years of experience.

The results in this study showed a significant association between curriculum focus on health literacy and nurses' levels of knowledge and experience. Results of many studies (Ayaz-Alkaya & Terzi, 2019; Nesari et al., 2019; Wittenberg et al., 2018) support our findings. Focusing on health literacy in nursing curriculum can increase nurses' knowledge and experience because improving health literacy can start from integrating this concept into nursing curriculum (Ayaz-Alkaya & Terzi, 2019; Mosley & Taylor, 2017) or by assessing health literacy in a competence exam before graduation (Al-Jubouri & Abd Ali, 2021).

5. Implications and limitations

This research endeavor could help other researchers conduct more studies in Arabic-speaking countries to assess nurse's health literacy-related knowledge and experience. On the other hand, integrating the concept of health literacy into the nursing curriculum can improve nursing students' health literacy and the result is future nurses with enhanced health literacy. It also will be helpful to determine the factors that are associated with health literacy-related knowledge deficit in the targeted health care settings. This would equip the health care policymakers with essential research-based facts that enables them to make informed decision to address any issues that are related to the health literacy among medical-surgical nurse.

This study has limitations. Limited access to the internet services was one of the major obstacles that have limited the participation rate. Of equal importance, a significant percentage of medical-surgical nurses were affected by the Covid-19 pandemic during data collection phase, which also limited the participation rate in the study. On the other hand, the convenience sampling may impact on generalization of results.

6. Conclusion

This study showed that majority of nurses had a low level of knowledge regarding health literacy but with an acceptable level of experience. To enhance nurses' knowledge regarding health literacy, it is important to start from the curriculum by focusing on health literacy in the undergraduate program. This will anchor the concept of health literacy in nursing students' perceptions and will be reflected on their practice after graduation. During practicing the profession of nursing, it is also important to update nurses' information about health literacy via continuous education. This will help them to be in touch with health literacy and apply its basic pillars based on the scientific knowledge. Further research into health literacy with a larger and multi-country sample is needed to better understand the examined phenomena.

Author contribution

The principal author of this research paper (SAF) has envisioned the main research idea, designed the study proposal, executed and delegated research-related tasks to other research team. He also wrote the introduction section and participated in data collection, reviewing, and

editing the study for publication. The second author (MBAJ) has contributed in data collection, writing the discussion section, and editing the study for publication. The third author (HAH) has contributed in data collection, writing the methods and results sections, data analysis, and editing the study for publication. The fourth (SAJ) and the fifth (SMH) authors have contributed in data collection. All authors read and approved the final version of the manuscript.

Conflict of interest
    None to be declared.

References
Al-Fayyadh, S. (2020). Whose life is it anyway? A reflective dialogue between religious and secular bioethical perspectives. *Ethics, Medicine & Public Health*, *14*, 100429. https://doi.org/10.1016/j.jemep.2019.100429

Al-Fayyadh, S. & Mohammed, W. (2010). Patients' knowledge about chronic diseases towards risk factors and warning signs of stroke. *Iraqi Scientific Journal of Nursing (ISJN), 23 (special issue),* 1-14. http://www.iasj.net/iasj?func=fulltext&aId=33694

Al-Jubouri, M. B., & Abd Ali, M. B. (2021). Adoption the competence exam as an innovation approach to improve nurses' quality. *American Journal of Nursing*, *10*(3), 182-184. https://doi.org/10.11648/j.ajns.20211003.18

Ayaz-Alkaya, S., & Terzi, H. (2019). Investigation of health literacy and affecting factors of nursing students. *Nurse Education in Practice*, *34*, 31-35. https://doi.org/10.1016/j.nepr.2018.10.009

Bergh, A. L., Friberg, F., Persson, E., & Dahlborg-Lyckhage, E. (2015). Registered nurses' patient education in everyday primary care practice: Managers' discourses. *Global Qualitative Nursing Research, 2*, e1-12 https://doi.org/10.1177/2333393615599168

Berkman, N. D., Davis, T. C., & McCormack, L. (2010). Health literacy: What is it? *Journal of Health Communication*, *15*(S2), 9-19. https://doi.org/10.1080/10810730.2010.499985

Brooks, C., Ballinger, C., Nutbeam, D., Mander, C., & Adams, J. (2020). Nursing and allied health professionals' views about using health literacy screening tools and a universal precautions approach to communication with older adults: A qualitative study. *Disability and Rehabilitation, 42*(13), 1819-1825. https://doi.org/10.1080/09638288.2018.1538392

Cafiero, M. (2013). Nurse practitioners' knowledge, experience, and intention to use health literacy strategies in clinical practice. *Journal of Health Communication*, *18*(sup1), 70-81. https://doi.org/10.1080/10810730.2013.825665

Chang, Y. W., Li, T. C., Chen, Y. C., Lee, J. H., Chang, M. C., & Huang, L. C. (2020). Exploring knowledge and experience of health literacy for Chinese-speaking nurses in Taiwan: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *17*(20), 7609. https://doi.org/10.3390/ijerph17207609

Coleman, C. (2011). Teaching health care professionals about health literacy: A review of the literature. *Nursing Outlook*, *59*(2), 70-78. https://doi.org/10.1016/j.outlook.2010.12.004

Coleman, C. A., & Appy, S. (2012). Health literacy teaching in US medical schools, 2010. *Family Medicine, 44*(7), 504-507. https://pubmed.ncbi.nlm.nih.gov/22791536/

Grønning, K., Bratås, O., & Steinsbekk, A. (2017). Patients' perceptions of having a good life one year after arthritis patient education: A qualitative study nested within a randomized controlled trial. *Nurse Media Journal of Nursing, 7*(1), 1-14. https://doi.org/10.14710/nmjn.v7i1.15123

Huhta, A. M., Hirvonen, N., & Huotari, M. L. (2018). Health literacy in web-based health information environments: Systematic review of concepts, definitions, and operationalization for measurement. *Journal of Medical Internet Research*, *20*(12), e10273. https://doi.org/10.2196/10273

Kannampallil, T. G., Schauer, G. F., Cohen, T., & Patel, V. L. (2011). Considering complexity in healthcare systems. *Journal of Biomedical Iinformatics, 44*(6), 943-947. https://doi.org/10.1016/j.jbi.2011.06.006

Karimi Moonaghi, H., Emami Zeydi, A., & Mirhaghi, A. (2016). Patient education among nurses: bringing evidence into clinical applicability in Iran. *Investigación y Educación en Enfermería, 34*(1), 137-151. https://doi.org/10.17533/udea.iee.v34n1a16

Kennard, D. (2017). *Emergency room nurses knowledge of and experience with health literacy and their patient teaching methods.* Seton Hall University Dissertations and Theses (ETDs). 2270. https://scholarship.shu.edu/dissertations/2270

Liu, C., Wang, D., Liu, C., Jiang, J., Wang, X., Chen, H., Ju, X., & Zhang, X. (2020). What is the meaning of health literacy? A systematic review and qualitative synthesis. *Family Medicine and Community Health*, 8(2), e000351. https://doi.org/10.1136/fmch-2020-000351

Loew, J. T. (2015). *Educating medical-surgical/staff nurses to improve nursing knowledge of patient education, focusing on health literacy* (Doctoral dissertation, Walden University). https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=3007&context=dissertations

Manion, J. (2009). *The engaged workforce: Proven strategies to build a positive health care.* (1st ed., p. 36). AHA press.

Matthews, J. D. (2018). Health literacy among female university students in the United Arab Emirates. *International Journal of Health Promotion and Education*, *56*(6), 298-308. https://doi.org/10.1080/14635240.2018.1536524

Mosley, C. M., & Taylor, B. J. (2017). Integration of health literacy content into nursing curriculum utilizing the health literacy expanded model. *Teaching and Learning in Nursing*, *12*(2), 109-116. https://doi.org/10.1016/j.teln.2016.12.005

Nantsupawat, A., Wichaikhum, O. A., Abhicharttibutra, K., Kunaviktikul, W., Nurumal, M. S. B., & Poghosyan, L. (2020). Nurses' knowledge of health literacy, communication techniques, and barriers to the implementation of health literacy programs: A cross-sectional study. *Nursing & Health Sciences, 22*(3), 577-585. https://doi.org/10.1111/nhs.12698

Nesari, M., Olson, J. K., Nasrabadi, A. N., & Norris, C. (2019). Registered nurses' knowledge of and experience with health literacy. *HLRP: Health Literacy Research and Practice*, *3*(4), e268-e279. https://doi.org/10.3928/24748307-20191021-01

Office of Disease Prevention and Health Promotion. (n.d.). Increase the health literacy of the population — HC/HIT-R01. *Healthy People 2030*. U.S. Department of Health and Human Services. https://health.gov/healthypeople/objectives-and-data/browse-objectives/health-communication/increase-health-literacy-population-hchit-r01

Overbaugh, K. J. (2020). Advance Care planning: An update for the medical-surgical nurse in the age of COVID-19. *Medsurg Nursing, 29*(5), 299-307.

Rademakers, J., & Heijmans, M. (2018). Beyond Reading and understanding: Health literacy as the capacity to act. *International Journal of Environmental Research and Public Health, 15*(8), 1676. https://doi.org/10.3390/ijerph15081676

Seng, J. J. B., Yeam, C. T., Huang, W. C., Tan, N. C., & Low, L. L. (2020). Pandemic related health literacy-A systematic review of literature in COVID-19, SARS and MERS pandemics. *Medrxiv*. https://doi.org/10.1101/2020.05.07.20094227

Vamos, S., Okan, O., Sentell, T., & Rootman, I. (2020). Making a case for "education for health literacy": An international perspective. *International Journal of Environmental Research and Public Health, 17*(4), 1436. https://doi.org/10.3390/ijerph17041436

Walker, D., Howe, C., Dunkerley, M., Deupree, J., & Cormier, C. (2019). The HLKES-2: Revision and evaluation of the health literacy knowledge and experiences survey. *Journal of Nursing Education, 58*(2), 86-92. https://doi.org/10.3928/01484834-20190122-05

Wittenberg, E., Ferrell, B., Kanter, E., & Buller, H. (2018). Health literacy: Exploring nursing challenges to providing support and understanding. *Clinical Journal of Oncology Nursing*, *22*(1), 53-61. https://doi.org/10.1188/18.CJON.53-61

Yusoff, M. S. B. (2019). ABC of content validation and content validity index calculation. *Resource, 11*(2), 49-54. https://doi.org/10.21315/eimj2019.11.2.6

ORIGINAL RESEARCH

Coronaphobia and Coping among the Bereaved: The Mediating Role of Gardening during the Covid-19 Pandemic

Janet Alexis A. De los Santos[1], Bryan G. Daiz[1], Ezequiel L. Rosales[1]

[1]College of Nursing, Visayas State University, Baybay City, Philippines

Article Info	Abstract
	Background: There are growing reports on the benefits of gardening on physical and mental health especially during lockdowns, but very limited studies presented how this affects a person's fear of COVID-19 and coping from grief and loss. **Purpose:** This study aimed to assess the mediating effects of gardening on coronaphobia and bereavement coping. **Methods:** This study utilised a cross-sectional design using self-report scales. A total of 200 participants were selected through referral sampling following a set of criteria. Both researcher-made and standardized questionnaires were utilized in the collection of data. Multiple linear regression was utilized to analyse association between the study variables **Results:** Results revealed that gardening has significant partial mediating effects in the relationship between fear of COVID-19 and coping (B=-0.078, z=-3.55, p=0.001). Fear of COVID-19 negatively affects gardening (β=-0.157, p=0.001), while gardening positively affects coping (β=0.497, p=0.001). Nevertheless, the results also indicate that even accounting for the mediating role of gardening, fear of COVID-19 still has a negative impact to coping (β=0.148, p=0.001). **Conclusion:** Gardening is an adaptive practice in ameliorating stress and improving a person's resilience and bereavement coping. This study adds to the body of knowledge on the benefits of gardening particularly on its mediating role between fear of COVID-19 and bereavement coping. Gardening activities as a complementary intervention may be recommended to bereaved individuals to help them improve coping and grief.

1. Introduction

The unprecedented impact of COVID-19 cuts across all aspects of human life and has caused palpable physical and psychological distress to all people. The pandemic created a horrendous picture of the world we live in today due to the increasing number of deaths, pain, and grief of family members left behind. As of September 1, 2021, the record logs 218,205,951 confirmed cases of COVID-19, including 4,526,583 deaths (WHO, 2021).

The perilous impact of the pandemic on the physical, mental and psychological health is insurmountable and extraordinary. Economic shutdowns, local lockdowns, home quarantine, and social isolation became common in the new normal. The virulence and high transmissibility of the virus have caused humans to extreme feelings of fear and anxiety of their safety and their loved ones, isolation, depression, and for some, even mental challenges have started to manifest (Usher et al., 2020). For instance, coronaphobia otherwise known as a dysfunctional fear of COVID-19 (Labrague & De los Santos, 2020) is a palpable experience especially during the first few months of the pandemic where uncertainty on the management, and imminent threat to life was at hand. This was especially true among those who cared for the inflicted of the virus in the frontline. Nevertheless, fear and anxiety, and psychological distress is a universal experience globally across life span (Sarfika et al., 2021).

Bereavement is a profound and challenging process that comes in many forms but is ultimately sourced and brought about from a loss of a loved one. For instance, the literature presents pet bereavement, a natural grieving experienced by pet owners who have lost their companion and friend (Park et al., 2021). Losing a child is another example that is a significant

life-changer among parents. A series of coping interventions and strategies may be needed towards healing and acceptance from a traumatic loss of a child (Currie et al., 2018). Reports of behavioural changes such as poor self-esteem, anxiety and depression, and poor outlook in life were among the psychological changes observed among young adults who have lost their parents (Lundberg et al., 2018).

In the time of pandemic, the increasing death toll from those who have succumbed to the disease was a horrendous reality felt across the globe. Grieving and bereavement were difficult and distressingly altered from how it was in the norm (Carr et al., 2020). The bereaved kin grieves in isolation and lack emotional support due to imposed health and social restrictions. Undoubtedly, the pandemic has amplified the feeling of anguish and contributed to physical and psychological distress, prolonging the agony among those still grieving due to the loss of a loved one. The trauma from bereavement may even lead to the development of psychopathological manifestations such as depression, hallucinations, and other adverse psychological outcomes needing professional help, particularly among those who have unexpected peer, parental, or spousal loss (Johnson et al., 2017; Kamp et al., 2017).

People who have experienced loss does different coping strategies. The literature discussed extensive styles on how people cope through the grieving process. Generally, coping can be classified as (1) Problem-oriented coping where the person performs active involvement in creating solutions to resolve the situation, (2) Emotion-oriented coping, on the other hand, pertains to expressing feelings and active rationalisation about the situation, and lastly, the (3) Avoidant coping which involves repressive and maladaptive behavioural responses (Fisher et al., 2020; Huh et al., 2017).

One interesting study on coping is the diversion of orientation whereby the person diverts towards restoration instead of the experience of loss. This makes them more adept at managing well and adjusting to the experience of loss (Lundorff et al., 2019). By conscious effort of removing the self from despair such as those that fosters physical diversion of energy and attention, a person experiencing grief and loss restores emotional healing. Restorative coping may involve physical activities, which has been shown to improve coping during times of adversaries and loss (Wicker & Orlowski, 2021). Being physically active is a form of expressive distraction and a conscious way of diverting from thoughts of grief and despair. Engaging in gardening, for example, is an assistive therapeutic approach that helps the bereaved go through the grieving process. Likewise, the literature suggests that persons who engage in gardening activities are more likely to be relieved of stress and find meaningful acceptance of their lost relationships (Lin et al., 2014; Machado & Swank, 2017). Engaging in green activities such as gardening have been found to produce therapeutic effects and reduced reports of emotional trauma and stress while enhances self-awareness and sense of well-being and grief reduction (Thieleman et al., 2021; Cacciatore et al., 2019).

The literature presented recent studies on the practice of gardening in the time of COVID-19, where it has been identified as one of the positive coping behaviours and produced affective benefits (Daiz et al., 2022; Lades et al., 2020; Moore & Lucas, 2020; Serino & Ratilla, 2021). Likewise, there are growing reports on how it has helped reduced coronaphobia and improved mental health, especially during lockdowns (Theodorou et al., 2021; Weerakoon et al., 2021). However, most of the literature presented theoretically based interventions but has not clearly shown their effectiveness (Kocken et al., 2020).

There was an increased practices observed among people fascinated towards plants and gardening especially during the lockdown, yet there is seemingly lack studies on gardening as a therapeutic approach. This prompted the researchers to conduct this study. Moreover, it was aimed to bridge this gap and add the context of gardening as a means of coping during the COVID-19 pandemic. It was hypothesised that coronaphobia affects a person's coping, and gardening activities can mediate this. Specifically, this study aims to determine the effect of gardening activities to a person's coping in grieving and loss, and fear of COVID-19.

2. Methods

2.1 Research design

This study utilised a quantitative cross-sectional design using survey questionnaires. Cross-sectional design was ideal in this study as it aimed to observe the participants through a single data collection between first half of the year 2021.

2.2 Setting and participants

The researchers utilized an online calculator (Soper, 2022) to achieve an anticipated effect size of 0.15 in the multiple regression analysis of five predictors. The researchers set the desired statistical power level to 0.8, with a probability level of 0.01 which revealed that the study can proceed with 127 minimum required sample. For this study, 200 participants were recruited to ensure that the data were suitable for the analysis.

The participants included residents from one province in Central Philippines. The researchers initially identified twenty possible participants who is fit based on a criterion set. The selected participants were then asked for referrals who share the same characteristics. Email addresses and social media messenger were asked by the researchers from the participants for the distribution of online questionnaire and data retrieval. Specifically, included were those of legal age, self-declared gardeners who own a garden or are tending plant collections at home and have experienced a loss of a loved one within the last four years. Literature suggests that bereavement may last up to four years post-loss (Kamp et al., 2017). Excluded in the study were farmers who do farming and gardening roles as their primary source of living.

2.3 Measurement and data collection

To answer the objectives of the study, self-report questionnaires were utilized in the gathering of the needed data. Considering movement restrictions such as lockdowns and quarantine protocols, the researchers resorted to an online mode of data collection. These questionnaires were prepared using Google Form and were later sent to email addresses or social media messengers. Necessary follow-ups and reminders to the participants was done to get the desired number of samples.

Because of the lack of standardised stool that measures assess perceptions to gardening, the researchers devised a tool where items were lifted from literature and experiences among people who do gardening. The items were finalised after the subject matter expert validation test for face and content validity. It revealed that the item content validity index (I-CVI) ranges between 0.8-0.9. This suggests that the items in the scale are relevant and valid to measure the intended construct the scale intends to measure. Meanwhile, the scale validity index (S-CVI) score obtained 0.92 suggesting that the scale has high validity. Pilot testing of the instrument was done with thirty people of the same characteristics as the participants in this study. The score revealed a high internal consistency and reliability of $\alpha=0.90$. The scale has 23 items and utilizes a five-point Likert scale scored between 1-5 described as 'strongly disagree', 'disagree', 'neutral', 'agree' and 'strongly agree' respectively.

There were five other standardised scales we used to assess for Fear of COVID-19, Stress, Health, Resilience and Coping. The English version of the instrument was used for the participants to answer. Guidance and assistance were made by the researchers whenever clarification and translation to vernacular was necessary.

The Fear of COVID-19 Scale (Ahorsu et al., 2020) was used to assess the participants' feelings of fear of the currently experienced pandemic or coronaphobia. The scale has a total of seven items with 5 point options described from 'strongly disagree' equivalent to 1 point, and 'strongly agree', which is equivalent to 5 points. The scale originally has an excellent internal consistency with a value of $\alpha=0.82$. As for the present study, the scale likewise showed excellent internal consistency based on the Cronbach's alpha value of $\alpha=0.86$.

Stress was measured using the Perceived Stress Scale (Cohen et al., 1983). The scale is composed of ten items and is scored using a 5-point Likert, where one refers to "never". The highest possible score for the scale is 5, which means "very often". The scale has an acceptable internal consistency value of $\alpha=0.78$. The scale showed an excellent internal consistency based on the Cronbach's alpha value score of $\alpha=0.94$ on this present study.

The Health Orientation Scale was utilised to measure the participants' health (Snell et al., 1991), particularly on the perceived health status subscale. The participants scored the items using a 5-point Likert scale where one is "not at all characteristic to me", and five is "very characteristic of me". The subscale has an acceptable internal consistency value at $\alpha=0.79$. Reliability score of the scale in this present study revealed a Cronbach's alpha value of $\alpha=0.72$

The Brief Resilience Scale (Smith et al., 2008) assessed the participant's resilience. The scale is composed of six items and is scored using a 5-point Likert scale. The scale is scored from

1 to 5 where one is "strongly disagree", two is "disagree", three is "neutral", four is "agree", and five is "strongly agree". Originally, the scale shows a consistent reliability score of 0.69. In the current study, the scale showed excellent reliability based on the Cronbach's alpha value of α=0.98.

Coping was assessed using the Coping Assessment for Bereavement and Loss Experiences (Crunk, 2004). Eleven items comprise the scale, which is answerable using a 5-point Likert scale. The lowest possible score is 1, which indicates "never", and five as the highest possible score means "daily". The scale presents a good reliability score of 0.80. For the current study the scale showed excellent reliability score of α=0.98.

2.4 Data analysis

Data were organised using a spreadsheet. Analysis was done using SPSS version 22 software. The Spearman rho correlation analysis was utilised to assess the correlation between the variables in the study. Multiple regression analyses were done to assess the predictors of gardening its effects on fear of COVID-19, health, stress, resilience, and bereavement coping. The direct and indirect effect of gardening on the relationship between fear of COVID-19 and bereavement coping was analysed using multiple linear regression and was interpreted following Baron and Kenny's (1986) four-step approach namely: (1) establishing an effect variable that can be mediated; (2) identifying the mediator variable as an outcome variable; (3) controlling the causal variable while establishing relationship between the mediator on the outcome variables, and; (4) establishing the mediating effect.

2.5 Ethical considerations

This study underwent technical and ethical review by the Visayas State University College of Nursing Research Review Committee and was given a code number RES-CON-S2020.08. The introductory page on the forwarded link contained the informed consent where the participants' agreement to partake in the survey voluntarily is indicated by clicking on the proceed button.

3. Results

3.1 Characteristics of the participants

Table 1 presents the characteristics of the participants in the study. Results show that majority are in their productive years of 21-40 years old (53%). Most of the participants were female (65%) and are married (47%). Most of the participants have finished college (34.5%) and are currently self-employed (33%).

Table 1. Characteristics of the participants

Variables	*f*	%
Age		
20 and below	11	5.5
21-40	106	53
41-60	63	31.5
61 and above	20	10
Sex		
Female	130	65
Male	70	35
Marital Status		
Single	85	42.5
Married	94	47
Separated/Divorce	8	4.0
Widow	13	6.5
Education		
Elementary	28	14.0
High-School	35	17.5
College	69	34.5
Post-graduate	68	34.0

Table 1. Continued

Variables	f	%
Employment		
Employed full-time	32	16.0
Employed part-time	12	6.0
Retired	21	10.5
Seeking opportunities/unemployed	14	7.0
Self-employed	66	33.0
Student	55	22.5

3.2 Correlations between gardening, fear of COVID-19, health, stress, resilience and coping

Table 2 presents the correlation of the study variables. The results suggest that gardening has shown significant relationships with Fear of COVID-19, Stress, Resilience and Coping among the study variables. More specifically, gardening showed an inverse relationship with Fear of COVID-19 (r=-0.327, *p*=0.001), and Stress (r=-0.173, *p*=0.014). Positive correlations were observed between gardening and resilience (r=0.221, *p*=0.002), and coping (r=0.399, *p*=<0.001). Health was not found to have any significance with gardening.

Table 2. Correlations between gardening, fear of COVID-19, health, stress, resilience and coping (n=200)

Variables	M (SD)	Coefficient	*p*-value
Fear	2.67 (0.82)	-0.327	0.000
Health	3.40 (0.48)	0.013	0.853
Stress	3.14 (0.48)	-0.173	0.014
Resilience	3.82 (0.51)	0.221	0.002
Coping	3.82 (0.56)	0.399	0.000

This study was conducted to determine if gardening influences Fear of COVID-19, Health, Stress, Resilience and Coping. Presented in Table 3 are the results of the regression analysis between gardening and the other key variables of the study. Results show that 19.7% of the variance in gardening can be explained by the five predictors, F(5,194)=9.504, *p*=<0.001. The results further suggest that only fear and coping is associated with gardening. Specifically, we found a negative association between gardening and fear of COVID-19 (β=-0.217, *p*=0.008). Meanwhile, it showed a significantly positive association with bereavement coping (β=0.319, *p*=<0.001).

Table 3. Regression analysis on gardening perceptions and key study variables

Variables	B	Std. Error	β	t	P	95% CI Lower Bound	Upper Bound
Constant	78.648	16.951		4.640	0.000	45.217	112.080
Fear of COVID-19	-0.217	0.080	-0.217	-2.701	0.008	-0.376	-0.059
Health	0.025	0.067	0.024	0.369	0.713	-0.107	0.156
Stress	0.055	0.076	0.055	0.718	0.474	-0.096	0.206
Resilience	0.036	0.075	0.036	0.480	0.632	-0.112	0.184
Coping	0.319	0.073	0.319	4.357	0.000	0.175	0.464

R2=0.197; F=9.504; *p*=<0.001

3.3 Mediating effects of gardening on the relationship between fear of COVID-19 and coping

Mediation analysis was done to examine the impact of Fear of COVID-19 on Coping as mediated by Gardening (Table 3, Figure 1). It was hypothesised that being fearful of COVID-19 will negatively affect the coping of a person. Additionally, it was hypothesised that gardening

would mediate this relationship. A series of regression analyses were carried out to test these hypotheses.

Table 3. Mediating effects of gardening on the relationship between fear of COVID-19 and coping

Model	SE	β	Z	p	% Mediation	95% CI Lower bound	95% CI Upper bound
Indirect Effect	0.0220	-0.0780	-3.55	< .001	34.6	-0.121	-0.0350
Direct Effect	0.0438	-0.1476	-3.37	< .001	65.4	-0.233	-0.0618
Total Effect	0.0454	-0.2256	-4.97	< .001	100	-0.314	-0.1367

The findings revealed that Fear of COVID-19 negatively affects Coping (B=-0.2256, z=-4.97, p=<0.001). Analysing the indirect effects, the results indicate that gardening has significant partial mediating effects in the relationship between Fear of COVID-19 and Coping (B=-0.078, z=-3.55, p=<0.001). Fear of COVID-19 negatively affects gardening (β=-0.157, p=<0.001), while gardening positively affects coping (β=0.497, p=<0.001). Nevertheless, the results also indicate that even accounting for the mediating role of gardening, Fear of COVID-19 still negatively impacts Coping (β=-0.148, p=<0.001). Gardening accounts for 34.6% of the total effect.
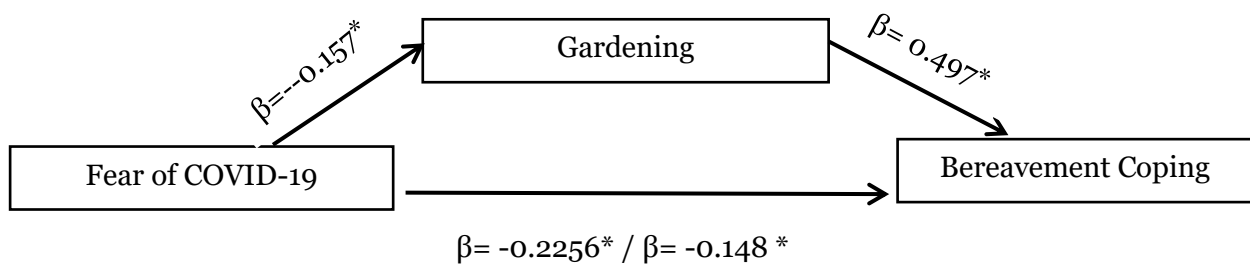

Figure 1. Hypothesized model

4. Discussion

This study was performed to assess the relationship between gardening and key variables, including coronaphobia, health, stress, resilience, and coping. Based on the result, there is an inverse relationship between gardening and coronaphobia and stress. This suggests that the participants who are into gardening display less coronaphobia and stress. To our knowledge, this is the first study to present the negative correlation between coronaphobia and gardening.

The negative correlation suggests that when a person engages in greener activities such as gardening, the less likely is his fear of COVID-19. Moreover, the correlation results of our study support the growing literature on the potential benefits of gardening to people's well-being. One plausible explanation to this phenomenon is the numerous restrictions, lockdowns has made people socially isolated within the safe boundaries of their homes. Green activities served as their diversion to release stress and boredom by doing something creative and fulfilling, and at the same time encourages physical activity. This study is similar to the findings in Italy and Scotland, which found how gardening reduced distress and improves subjective well-being among those on lockdown (Corley et al., 2021; Theodorou et al., 2021). This is also similar to a recent finding which found how gardening improves psychological well-being and reduced the adverse effects of COVID-19 on people's mental health (Kou et al., 2021).

Meanwhile, our findings also revealed a positive correlation between gardening, resilience and bereavement coping. This suggests that participants who are more inclined to gardening appear to be more resilient and positively coping. Our findings are in consonance with other literature, which found how resilience and coping correlates with gardening (Koay & Dillion, 2020). Notably, our results have not seen any significant correlation of gardening to health, which is in contrast to other conducted studies which found the physical benefits of gardening in improving patients with cardiac problems as displayed on their improved hemodynamic

response (Ogura et al., 2021). This can be explained since subjective health was the focus of this study rather than clinical and in vivo measures of health. Regardless, other studies support the health benefits, which is not found in this study (Howarth et al., 2020). Other researchers may take an interest in investigating these conflicting findings in their future research.

The regression analysis revealed that among the key variables of the study, only fear of COVID-19 and bereavement coping shows direct association with gardening. The variables, health, stress, and resilience, were not found to be associated with gardening. Perhaps this is because most literature advocated doing community gardening rather than individual or home gardening, as the former is proven to be more beneficial in increasing resilience and a sense of well-being (Koay & Dillion, 2020). However, the present participants cannot do this because of COVID-19, where social distancing, home quarantine, lockdowns, and other restrictions are observed. To our knowledge, this is the first study to examine the effect of gardening on the participants fear of COVID-19 and bereavement coping. The negative association between the variables fear of COVID-19 and gardening means that feelings of fear of COVID-19 reduces when one is engaged in gardening. Although there is no specific article that presented the exact same variables in this study, the breadth of literature is thorough in discussing the benefits of gardening in improving a person's subjective well-being and anxiety reduction (Corley et al., 2020; Howarth et al., 2020; Kou et al., 2021).

This study also hypothesised a mediation effect of gardening on the participants coronaphobia and bereavement coping. The results found a partial mediating effect of gardening on the participants fear of COVID-19 and their bereavement coping. Further, based on our results, there is a significant total effect of fear of COVID-19 on bereavement coping. This indicates that participants who are more fearful of COVID-19 tend to have lesser coping of their loss. This finding can be supported by a multitude of literature discussing the exponential fear of COVID-19 across all peoples, underscoring the gravity of the pandemic and its impact on man (De los Santos & Labrague 2021; Saricali et al., 2020). People who are in distress tend to be more fearful of COVID-19 (Rahman et al., 2020). Scholars have suggested that moving towards restorative coping activities is essential to reach the stage of acceptance (Lundorff et al., 2018). However, with the current state of the pandemic, achieving this may be difficult. The bereaved may find it hard to go through the restoration process when certain stressors such as the health threat of COVID-19 and social isolation add as another psychological blow in their already distressed dispositions.

Finally, this paper presents the role of gardening between the relationship of coronaphobia and bereavement coping. Based on our search of available literature, this is the first study to explore the mediating effects of gardening to fear of COVID-19 and bereavement coping. Nevertheless, gardening is well discussed to positively impact a person's general sense of well-being. For instance, Theodorou et al. (2021) presented the mediating effect of gardening on persons in psychological distress due to COVID-19. Additionally, the finding supports that of the posits of Cacciatore et al. (2019) on the benefits of green activities such as farming towards the recovery of traumatic grief. Based on our results, the same is true that gardening positively affects the participants' bereavement coping in time of the pandemic.

5. Implications and limitations

The findings of this study add to the growing body of knowledge on the contribution of practising green spaces in improving a personal sense of well-being. Green activities, horticultural therapy or basic home gardening, are synonymous but is solidified on the interrelationships between nature, man and wellness.

As found in this study, the mediating role of gardening highlights another way of boosting a person bereavement coping, especially in the present time. Given the detrimental effects of COVID-19 on a person's mental health and psychological well-being, it is essential to integrate gardening as a supportive and therapeutic intervention. Of equal importance is embedding green spaces in health facilities especially in hospitals, treatment and rehabilitation centers in order to provide therapeutic and healing spaces among sick patients, provide comfort to worried family members, and bring forth consolation to the weary. Health institutions and practitioners may consider this as another paradigm they can implement when providing supportive care to bereaved clients. Gardening may be regarded as a complementary intervention that can be

incorporated with the more conventional therapies in overcoming concerns on the psychological effects of COVID-19 and towards the recovery of grief and loss.

This study is not without limitations. First, the participants included in this study were taken from one province in the Philippines. Hence generalizability of the results cannot be claimed. Second, the use of a cross-sectional design cannot establish a causal link between the study's variables. It is therefore recommended for future researchers to utilise randomisation of participant samples to establish causality. Third, the partial mediating effect of gardening on the participants' bereavement coping means that some other variables or factors can explain which were not accounted for in this study. Fourth, the developed gardening scale was pilot tested to thirty individuals only, it is recommended for other researchers to utilize bigger number of samples to determine changes in the scales' internal validity. Fifth, the use of a self-report questionnaire may pose possible bias and errors to the participants' answers. It would be best for future researchers to combine qualitative aspects to understand further these variables that may not have been captured using self-report scales.

6. Conclusion

Based on the findings of this study, it is concluded that gardening is an adaptive practice in ameliorating stress and improving a person's resilience and bereavement coping. This study adds to the body of knowledge on the benefits of gardening, particularly on its mediating role between fear of COVID-19 and bereavement coping. Gardening activities as a complementary intervention may be recommended to bereaved individuals to help them improve coping and grief.

Acknowledgment

Author contribution

JAAD: Conceptualization, design, analysis, interpretation of results, manuscript preparation and approval; BD: conceptualization, design, data collection, manuscript preparation and approval; ER: conceptualization, design, data collection, manuscript preparation and approval.

Conflict of interest

The authors report no actual and potential conflicts of interest

Funding information

Declaration of interest statements

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

References

Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., & Pakpour, A. H. (2020). The fear of COVID-19 scale: Development and initial validation. *International Journal of Mental Health and Addiction*, 1–9. Advance online publication. https://doi.org/10.1007/s11469-020-00270-8

Baron, R.M., Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6),1173-1182.

Cacciatore, J., Gorman, R., & Thieleman, K. (2019). Evaluating care farming as a means to care for those in trauma and grief. *Health & Place, 62*, e102281. http://doi.org/10.1016/j.healthplace.2019.102281

Carr, D., Boerner, K., & Moorman, S. (2020). Bereavement in the time of Coronavirus: unprecedented challenges demand novel interventions. *Journal of Aging & Social Policy*, *32*(4-5), 425–431. https://doi.org/10.1080/08959420.2020.1764320

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior,* 24, 385- 396.

Corley, J., Okley, J. A., Taylor, A. M., Page, D., Welstead, M., Skrabela, B., Redmond, P., Cox, S.R. & Russ, T. C. (2021). Home garden use during COVID-19: Associations with physical and mental well-being in older adults. *Journal of Environmental Psychology, 73*, 101545. https://doi.org/10.1016/j.jenvp.2020.101545

Crunk, A. (2004). The coping assessment for bereavement and loss experiences (CABLE): development and validation (Publication No. 5658) [Doctoral dissertation, University of Central Florida]. https://stars.library.ucf.edu/etd/5658

Currie, E.R., Christian, B.J., Hinds, P.S., Perna, S.J., Robinson C., Day, S., Bakitas, M. & Meneses K. (2018). Life after loss: Parent bereavement and coping experiences after infant death in the neonatal intensive care unit. *Death Studies, 43*(5). https://doi.org/10.1080/07481187.2018.1474285

Daiz, B.G., Rosales, E.L, Diago, P., & De los Santos, J.A.A. (2022). Health and well-being benefits of gardening: A comparative study among gardeners and non-gardeners in the Philippines. *The Malaysian Journal of Nursing, 13*(4). https://ejournal.lucp.net/index.php/mjn/article/view/1582

De los Santos, J. A. A., & Labrague, L. J. (2021). The impact of fear of COVID-19 on job stress, and turnover intentions of frontline nurses in the community: A cross-sectional study in the Philippines. *Traumatology, 27*(1), 52–59. https://doi.org/10.1037/trm0000294

Fisher, J. E., Zhou, J., Zuleta, R. F., Fullerton, C. S., Ursano, R. J., & Cozza, S. J. (2020). Coping strategies and considering the possibility of death in those bereaved by sudden and violent deaths: Grief severity, depression, and posttraumatic growth. *Frontiers in Psychiatry, 11*, 749. https://doi.org/10.3389/fpsyt.2020.00749

Howarth, M., Brettle, A., Hardman, M., & Maden, M. (2020). What is the evidence for the impact of gardens and gardening on health and well-being: A scoping review and evidence-based logic model to guide healthcare strategy decision making on the use of gardening approacges as a social prescription. *BMJ Open, 10*(7). http://dx.doi.org/10.1136/bmjopen-2020-036923

Huh, H. J., Kim, K. H., Lee, H. K., & Chae, J. H. (2018). Attachment styles, grief responses, and the moderating role of coping strategies in parents bereaved by the Sewol ferry accident. *European Journal of Psychotraumatology, 8*(sup6), 1424446. https://doi.org/10.1080/20008198.2018.1424446

Johnson, L.M., Torres, C., Sykes, A., Gibson, D.V. & Baker, J.N. (2017). The bereavement experience of adolescents and early young adults with cancer: Peer and parental loss due to death is associated with increased risk of adverse psychological outcomes. *PLOS ONE,*12(8): e0181024. https://doi.org/10.1371/journal.pone.0181024

Kamp, K. S., O'Connor, M., Spindler, H., & Moskowitz, A. (2019). Bereavement hallucinations after the loss of a spouse: Associations with psychopathological measures, personality and coping style. *Death Studies, 43*(4). https://doi.org/10.1080/07481187.2018.1458759

Koay, W.I. & Dillion, D. (2020). Community gardening: Stress, well-being and resilience potentials. *International Journal of Environmental Research and Public Health, 17*(18), 6740; https://doi.org/10.3390/ijerph17186740

Kochen, E. M., Jenken, F., Boelen, P.A., Deben, L. M. A., Fahner, J.C. van den Hoogen, A., Teunissem S.C.C.M. Geleijns, K. & Kars, M.C. (2020). When a child dies: A systematic review of well-defined parent-focused bereavement interventions and their alignment with grief and loss theories. *BMC Palliative Care, 19, 28.* https://doi.org/10.1186/s12904-020-0529-z

Kou, H., Zhang, S., Li, W. & Liu, Y. (2021). Participatory action research on the impact of community hardening in the context of COVID-19 pandemic: Investigating the seeding plan in Shanghai, China. *International Journal of Environmental Research and Public Health 18*(2), 6243; https://doi.org/10.3390/ijerph18126243

Labrague, L. J., & De los Santos, J. A. A. (2020). Prevalence and predictors of coronaphobia among frontline hospital and public health nurses. *Public Health Nursing, 38*(3), 382-389. http://doi.org/10.1111/phn.12841

Lades, L. K., Laffan, K., Daly, M. & Delaney, L. (2020). Daily emotional well-being during the COVID-19 pandemic. *British Journal of Health Psychology, 25*(4), https://doi.org/10.1111/bjhp.12450

Lin, Y. J., Lin, C. Y. & Li, Y. C. (2014). Planting hope in loss and grief: Self-care applications of horticultural therapy for grief caregivers in Taiwan. *Death Studies, 38*(9). https://doi.org/10.1080/07481187.2013.820231

Lundberg, T., Forinder, U., Olsson, M., Furst, C.J., Arestedt, K., & Alvarizza, A. (2018). Bereavement stressors and psychological well-being of young adults following the loss of a parent-a cross sectional survey. *European Journal of Oncology Nursing, 35,* 33-38. https://doi.org/10.1016/j.ejon.2018.05.004

Lundorff, M., Thomsen, D. K., Damkier, A., & O'connor M. (2018). How do loss-and restoration-oriented coping change across time? A prospeective study on adjustment following spousal bereavement. *Anxiety, Stress & Coping, 32*(3). https://doi.org/10.1080/10615806.2019.1587751

Machado, M. M. & Swank, J. M. (2017). Therapeutic gardening: A counseling approach for bereavement from suicide. *Death Studies, 43*(10). https://doi.org/10.1080/07481187.2018.1509908

Moore, K. A. & Lucas, J. J. (2020). COVID-10 distress and worries: The role of attitudes, social support and positive coping during social isolation. *Psychology and Psychotherapy: Theory, Research and Practice, 94*(2), 365-370. https://doi.org/10.1111/papt.12308

Orgura, A., Izawa, K.P., Tawa, H., Kureha, F., Wada, M., Harada, N., Ikeda, Y. Kimura, K., Kondo, N., Kanai, M., Kubo, I., Yoshikawa, R. & Matsuda, Y. (2021). Older phase 2 cardiac rehabilitation patients engaged in gardening maintained physical function during the COVIC-19 pandemic. *Heart and Vessels, 37,* 77-82. https://doi.org/10.1007/s00380-021-01892-1

Park, R.M., Royal, K.D. & Gruen, M.E. (2021). A Literature review: Pet bereavement and coping mechanisms. *Journal of Applied Animal Welfare Science, 6,* 1-15 Advance Online. http://doi.org/10.1080/10888705.2021.1934839

Rahman, M., Hoque, N., Alif, S.M., Salehin, M., Islam, S.M.S., Banik, B., Sharif, A., Nazim, N.B. Sultana, F. & Cross, W. (2020). Factors associated with psychological distress, fear and coping strategies during the COVID-19 pandemic in Australia. *Global Health,* 16, 95. https://doi.org/10.1186/s12992-020-00624-w

Sarfika, R., Malini, H., Putri, D.E., Buanasari, A., Abdullahm K.L. & Freska, W. (2021) Factors influencing depression among Indonesians during the COVID-19 outbreak. Nurse Media Journal of Nursing, 11(3), 380-388. http://doi.org/10.14710/nmjn.v11i3.36783

Saricali, M., Satici, S. A., Satici, B., Gocet-Tekin, E., & Griffiths, M. D. (2020). Fear of COVID-19, mindfulness, humor, and hopelessness: A multiple mediation analysis. *International Journal of Mental Health and Addiction*, 1–14. Advance online publication. https://doi.org/10.1007/s11469-020-00419-5

Serino, M.N. & Ratilla, M.T. (2021). Local response and coping mechanisms adopted to disruptions associated with the COVID-19 pandemic at a Filipino State University. *Human Behavior, Development and Society, 22*(1), 42-52. https://soo1.tci-thaijo.org/index.php/hbds/article/view/244575

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine, 15*(3), 194–200. https://doi.org/10.1080/10705500802222972

Snell, W. E., Jr., Johnson, G., Lloyd, P. J., & Hoover, W. (1991). The development and validation of the Health Orientation Scale: A measure of psychological tendencies associated with health. *European Journal of Personality,* 5, 169-183.

Theodorou, A.., Panno, A., Carrus, G., Carbone, G.A., Massulo, C., & Imperatori, C. (2021). Stay home, stay safe, stay green: The role of gardening activities on mental health during the COVID-19 home confinement. *Urban Forestry & Urban Greening, 61,* 127091. https://doi.org/10.1016/j.ufug.2021.127091

Thieleman, K., Cacciatore, J. & Gorman, R. (2021). "Perhaps something of beauty can grow:" Experiences of care farming for grief. *Death Studies.* Advance Online Publication. http://doi.org/10.1080/07481187.2021.1964108

Usher, K., Durkin, J., & Bhullar, N. (2020). The COVID-19 pandemic and mental health impacts. *International Journal of Mental Health Nursing,* *29*(3), 315–318. https://doi.org/10.1111/inm.12726

Weerakoon, R., Wehigaldeniya, D. S. & Charikawickramarathne. (2021). The effect of home gardening towards the mental well-being of men and women during the COVID-19 pandemic. *Asian Journal of Advances in Research, 10*(2), 1-8. http://mbimph.com/index.php/AJOAIR/article/view/2395

WHO. (2021, September 2). *WHO Coronavirus (COVID-19) dashboard.* https://covid19.who.int/

Wicker, P. & Orlowski, J. (2020). Coping with adversity: Physical activity as a moderator in adaption to bereavement. *Journal of Public Health, 43*(2), e196-e203. http://doi.org/10.1093/pubmed/fdaa059

ORIGINAL RESEARCH

Blood Pressure Control and Its Determinants among Patients with Non-Dialysis Chronic Kidney Disease in Myanmar

Ei Su Mon[1], Aurawamon Sriyuktasuth[2], Warunee Phligbua[2]

[1]Master of Nursing Science Program (International Program), Faculty of Nursing, Mahidol University, Bangkok, Thailand
[2]Department of Medical Nursing, Faculty of Nursing, Mahidol University, Bangkok, Thailand

Article Info	Abstract
	Background: Controlling blood pressure is critical for patients with non-dialysis chronic kidney disease to prevent the rapid progression to end-stage renal disease and sudden cardiac death. However, only a limited number of these patients achieve the blood pressure target. No previous study has been observed to evaluate the status of blood pressure control and its determinants among Myanmar patients with non-dialysis chronic kidney disease. **Purpose:** This study aimed to identify the rate of blood pressure control and its determinants among patients with non-dialysis chronic kidney disease in Myanmar. **Methods:** A total of 150 patients with non-dialysis chronic kidney disease attending the clinics at a tertiary hospital in Myanmar participated in this cross-sectional, correlational predictive study. They were recruited by a convenience sampling method. Data were collected by using Sodium Consumption Behavior Questionnaire, Family-Friends Support Subscale and Doctor-Health Care Team Support Subscale of Chronic Illness Resources Survey, demographic and clinical characteristics data form, and by measuring blood pressure against the target level of less than 130/80 mmHg. Descriptive statistics, Chi-square, Fisher's exact test, and binary logistic regression analysis were performed. **Results:** Only 44% of the participants had their blood pressure controlled. Overweight (OR=0.170, 95% CI: 0.058-0.495), obese (OR=0.071, 95% CI: 0.017-0.305), and chronic kidney disease stage 5 (OR=0.070, 95% CI: 0.020-0.244) were the determinants associated with poorly controlled blood pressure. Low sodium consumption behavior (OR=9.065, 95% CI: 3.251-25.277) and high family support (OR=7.799, 95% CI: 2.738-22.215) were the determinants associated with well-controlled blood pressure. **Conclusion:** The blood pressure control rate in Myanmar patients with non-dialysis chronic kidney disease was suboptimal. Determinant findings serve as an input to endorse family-based lifestyle modification interventions such as weight control and low sodium dietary for optimizing blood pressure control. Further investigation of other determinants and of lifestyle intervention programs is warranted.

1. Introduction

Chronic kidney disease (CKD) is a global leading health problem. The global number of adults with CKD has increased to be more than double, from 276 million in 2016 to 698 million in 2017 (GBD Chronic Kidney Disease Collaboration, 2020; Xie et al., 2018). Meanwhile, Myanmar, which is a low-income country, has encountered a significant rise in the prevalence of CKD. These trends towards CKD are estimated to be higher due to a dramatically growing number of non-communicable diseases (World Health Organization [WHO], 2020).

As the prevalence of CKD grows, there is more burden of CKD to be suffered. According to recent data, CKD caused 1.2 million deaths and 35.8 million years of healthy life lost (GBD Chronic Kidney Disease Collaboration, 2020). Moreover, CKD resulted in other physical illnesses and psychosocial disabilities (Ahlawat et al., 2018; Almutary et al., 2016).

Blood pressure (BP) control is the backbone of CKD management and the main means to hinder the undesirable consequences of CKD. Numerous trials have already proved the merits of

controlling BP in patients with CKD. Intensive BP control decreased the risk of kidney failure (Lv et al., 2013), as well as the incidence of cardiovascular events and mortality (Cheung et al., 2017). In spite of its benefits, BP control is not adequately practiced in this population. Previous studies have reported the poor rates of BP control at the recommended level (<130/80 mmHg) in patients with Non-Dialysis CKD (NDCKD) (Whelton et al., 2018), accounting for 10%-40% (Kuryata et al., 2019; Zhang et al., 2019; Zheng et al., 2020). Poor BP control can damage kidney function rapidly and eventually, lead to end-stage renal disease (ESRD). Patients reaching the end-stage require dialysis treatment to survive, which induces massive health care costs and poor quality of life (Dąbrowska-Bender et al., 2018; Kusuma et al., 2018). Therefore, the problem of BP control in these NDCKD patients deserves greater attention. However, no previous research has examined the level of BP control in Myanmar patients with NDCKD.

Besides addressing poor BP control, identifying its determinants is also essential so that interventions can focus on such specific factors. Frazier (2000) proposed the Hypertension Development and Assessment (HDA) model to distinguish the risk factors for high BP. This model encompasses four domains affecting BP: lifestyle, response to the environment, physiology, and genetics.

Lifestyle is the critical and dynamic domain. Lifestyle factors, including body mass index (BMI) and sodium consumption behavior, have been observed to be associated with BP control. In a study conducted by Hossain et al. (2019), hypertensive patients who were overweight and obese were less likely to control BP than those who had normal weight. Moreover, Cho et al. (2016) found that salt usage behavior of Myanmar adults was significantly higher and, this was associated with high BP. Nevertheless, these studies were conducted in healthy or hypertensive adults. No study has identified the association between these factors and BP control among Myanmar patients with NDCKD.

The second domain is response to the environment. The HDA model has explained that one's reaction and perception towards social support can affect BP (Frazier, 2000). Perceived family support and health professional support have also been noticed to be linked with BP control. Ojo et al. (2016) revealed that patients who perceived good support from family members had well-controlled BP. Besides, Khadoura et al. (2021) mentioned that patients perceiving high health professional support had better medication adherence and improved health outcome. While these studies were investigated among hypertensive subjects, no study was found in patients with NDCKD in Myanmar.

For the physiological domain, including age, comorbidity, diabetes mellitus (DM), and CKD stage, there have been inconsistent findings. Some studies found older age (Schneider et al., 2018), presence of comorbidity (Abegaz et al., 2018), DM, and advanced CKD stage (Yan et al., 2018), significantly influence BP control, while some found no association between age (Yan et al., 2018), comorbidity, DM, CKD stage (Schneider et al., 2018), and BP control. Hence, previous studies could not provide an exact explanation of the relationship between these determinants and BP control.

Similarly, in the genetic domain, gender has not yet been clearly identified as a determinant of BP control. Researchers found that gender disparity had a significant impact on BP control (Lee et al., 2017; Schneider et al., 2018). By contrast, another study from China found that being male or female had no association with controlling BP (Yan et al., 2018). Thus, the role of gender on BP control is also ambiguous.

In conclusion, BP control is the cornerstone for NDCKD patients to prevent disease progression. Adequate BP control reserves renal function and delays advanced renal impairment requiring renal replacement therapy (RRT). Myanmar is a resource-constrained country and is facing challenges related to the cost of renal care and the availability of RRT modalities. Thus, BP control is the optimal care to prevent Myanmar patients with NDCKD from disease progression and premature death. Many previous studies have investigated BP control and its determinants in Western and other developed countries like Australia and China, and the results were mixed. Moreover, little is known about which factors contribute to poor BP control. No study has been found to assess the status of BP control among Myanmar patients with NDCKD. The existing findings may not apply to patients living in Myanmar where exists different contexts. The differences in religion, culture, lifestyle, and health care system may have different impacts on BP control. Accordingly, this study aimed to identify the rate of BP control and its determinants among patients with NDCKD in Myanmar.

2. Methods

2.1 Research design

This study employed a cross-sectional, correlational predictive design to explore the rate of BP control and its determinants among patients with NDCKD in Myanmar.

2.2 Setting and participants

This study was conducted among NDCKD patients at the out-patient clinics in a tertiary hospital, Myanmar, from February to May 2020. The samples were recruited using a convenience sampling method with the following inclusion criteria: diagnosed with CKD at least 3 months earlier, estimated glomerular filtration rate (eGFR) <60ml/min/1.73m2, never underwent renal replacement therapy, and able to communicate in Burmese. The exclusion criteria were patients who suffered from psychiatric illnesses or severe physical conditions, had changes in an antihypertensive drug regimen in the past three months, were taking medications that affect BP (i.e., cold medicines, analgesics, immune-suppressants, antacids, oral contraceptives), or who were recognized as cognitively impaired by the General Practitioner Assessment of Cognitive (GPCOG) Patients Examination test.

The potential participants who met the inclusion criteria were identified by staff nurses at the clinics. Next, they were introduced to the researcher and explained the details of the study including objectives, data collection process, risks, and benefits with the participant information sheet. Those who gave written informed consent were recruited into the study.

The sample size was computed based on the odds ratios of study variables. The maximum calculation was obtained from a previous similar study which found a predictive power of family support on controlled BP (OR=4.51) (Ojo et al., 2016). Then, G Power software 3.1.9.4 was used to calculate the prescribed sample size assuming α=0.05, power=0.90, OR=4.51 and x parm π=0.2. A sample size of 150 patients was prescribed for the current study.

2.3 Measurement and data collection

The Sodium Consumption Behavior Questionnaire was used to measure the sodium consumption behavior of participants. It was developed in 2009 and revised in 2020 (Piaseu et al., 2020). The revised version's content validity has been checked by nutritionists and experts. Its reliability coefficient value was 0.78 (Piaseu et al., 2020). In the present study, the questionnaire was translated into the Burmese language by using the back-translation method proposed by Maneesriwongul and Dixon (2004). Then, the content validity index (CVI) of the Burmese version was tested by linguists and nursing experts. It was valid with a CVI value of 0.95. The reliability test was carried out among 30 patients who had similar characteristics to the sample. The result showed a Cronbach's alpha value of 0.82 in this study. The questionnaire consists of 13 items with 3 subscales, including use of nutrition labels, consumption of food containing sodium, and use of seasonings. The answers were rated on a 5-point Likert scale, ranging from "never" (1) to "regularly" (5). A total score was classified into three levels based on the percentage: high (≥80%: 52-65 points), moderate (50-79.9%: 33-51 points), and low (<50%: 13-32 points).

The Family-Friends Support Subscale (FFSS) and Doctor-Health Care Team Support Subscale (DHSS) of Chronic Illness Resources Survey (CIRS) were used to assess the two variables, family support and health professional support. The original CIRS scale was developed by Glasgow et al. (2000). The internal consistency (Cronbach's alpha value) was 0.90, and test-retest reliability was 0.83 (Glasgow et al., 2000). Additionally, the validation and reliability of CIRS have been tested across various cultures, including Spain, China, and Thailand. In this study, the original versions of FFSS and DHSS were translated into Burmese versions by following the back-translation method (Maneesriwongul & Dixon, 2004). The Burmese versions of FFSS and DHSS were valid (FFSS CVI=0.95, DHSS CVI=0.94). The reliability coefficient values were also excellent; 0.87 for the FFSS and 0.83 for the DHSS. There are eight items in the FFSS and seven items in the DHSS. The items have been constructed to assess the level of perceived support in terms of informational, emotional, and tangible support. Responses were scored on a 5-point scale from "not at all" (1) to "a great deal" (5). A total score was formed by computing the mean scores and it was dichotomized at the median of the distribution into high (≥ median distribution) and low (< median distribution).

The demographic and clinical characteristics data form developed by the researcher was applied to collect the participant's demographic characteristics (age, gender, marital status, education, occupation, monthly income, household status) and clinical characteristics (BMI, comorbidity, DM, CKD stage). The CKD stage was classified according to the updated eGFR as follows: stage 3 CKD with eGFR of 30-59 ml/min/1.73m²; stage 4 CKD with eGFR of 15-29 ml/min/1.73m²; and stage 5 CKD with eGFR of < 15 ml/ min/1.73m².

A calibrated scale was applied to measure participant's body weight and height. Then, body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. BMI was classified into three groups: normal weight (< 23 kg/m²), overweight (23-27.4 kg/m²), and obese (BMI ≥ 27.5 kg/m²), based on the WHO BMI classification for Asian population (WHO Expert Consultation, 2004).

An automated Upper Arm BP Monitor (OMRON HEM 7130-L) was used to measure BP. In addition, the 2017 ACC/AHA BP measurement procedure was followed (Whelton et al., 2018). All participants were asked to avoid alcohol, tea, or coffee, smoking, and exercise for at least 30 minutes before measurement. Then, their BP was measured in a sitting position after 3-5 minutes of rest, with legs uncrossed and back supported. Two times measurements in both arms (i.e., a measurement in one arm followed by the other arm) were performed at 1-minute interval. Third time measurement was done when the former two systolic or diastolic BP readings were different from ≥10 mmHg. After two or three measurements, all systolic and diastolic BP values were averaged. Based on the criteria from the 2017 ACC/AHA BP management guideline (Whelton et al., 2018), a BP target <130/80 mmHg was adopted. However, only systolic blood pressure (SBP) was considered to categorize participants into two groups; controlled (SBP <130 mmHg) and uncontrolled (SBP ≥130 mmHg) since SBP is the best indicator for cardiovascular risk and is widely emphasized by physicians.

Data were collected at one time by the principal investigator. All participants' BP, body weight, and height were measured at the time of routine BP measurement. After that, participants were asked to fill in the self-administered questionnaires during their waiting time. If they were not able to read and/or write or had visual impairment, they were interviewed face-to-face. The clinical characteristics, including eGFR, were collected from their medical records with permission. The data collection process took approximately 20 minutes per participant. No data were missing from the current study. Data collection flowchart was presented at Figure 1.
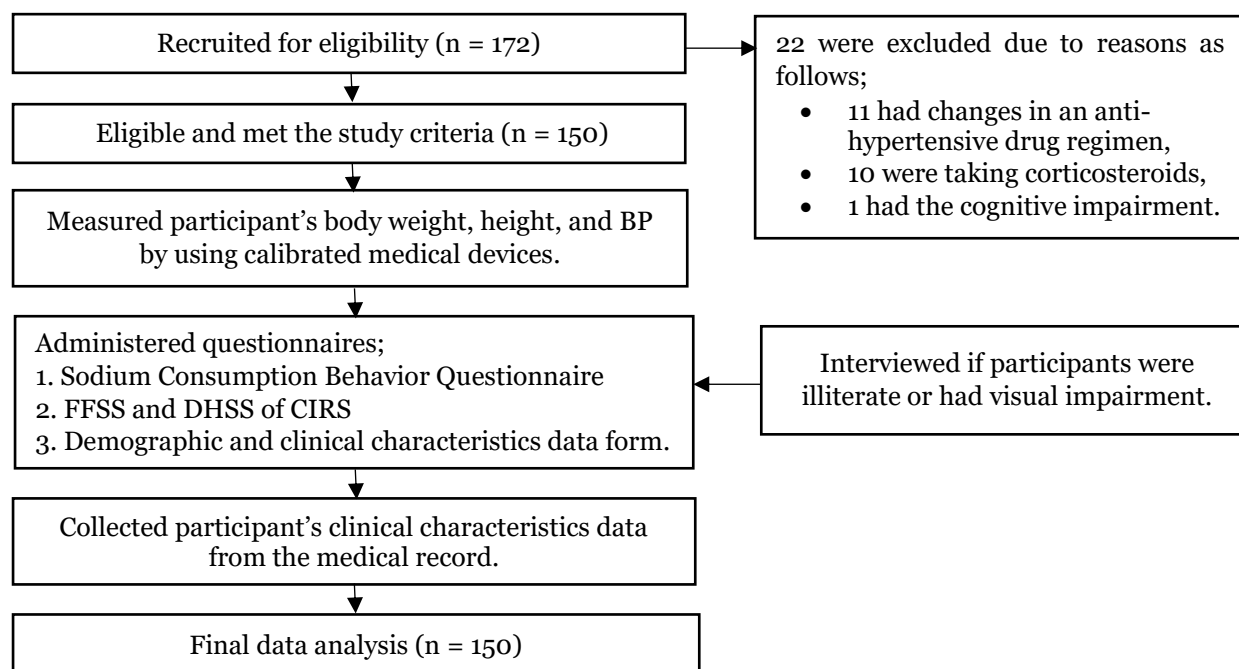
Figure 1. Data collection flowchart

2.4 Data analysis

The obtained data were analyzed by using Statistical Package for the Social Science (SPSS) software (version 18.0, SPSS, Inc., Chicago, IL) licensed by Mahidol University. Descriptive statistics were expressed as means for continuous variables, and frequencies and percentages for categorical variables. The Chi-square and Fisher's exact tests were used to analyze the association between BMI, sodium consumption behavior, family support, health professional support, age, comorbidity, DM, CKD stage, gender, and BP control. Then, the significant variables were entered into binary logistic regression analysis using the enter method to determine the determinants of BP control by odd ratios (ORs) and 95% confidence intervals (CIs). P-values were 2-sided, and α=0.05 was considered statistical significance. Assumptions were checked for each statistical test.

2.5 Ethical considerations

The study protocol was approved by the Institutional Review Board (IRB), Faculty of Nursing, Mahidol University, Bangkok, Thailand (COA No. IRB-NS2019/524.0912), and the Institutional Review Board (IRB), University of Public Health, Yangon, Myanmar (UPH-IRB. 2020/Research/2). Written informed consent was obtained from each participant who was willing to participate voluntarily in the study.

3. Results

3.1 Demographic and clinical characteristics of participants

In the current study, the participants had an average age of 58.4 years (SD=12.6) with a slight male dominance (58.0%). The majority were married (86.0%), completed primary school (81.3%), were employed (58.7%), and lived with their spouses and children (59.2%). The mean family monthly income was 181.8 USD (SD=125.6). Regarding clinical characteristics, almost half of the participants were overweight (30.0%) and obese (14.7%). About 92.7% of them had comorbidities. More than half were suffering from DM (56.7%). Furthermore, many of them were in CKD stage 4 (28.0%) and 5 (32.0%). Detailed information on participants' demographic and clinical characteristics is described in Table 1.

Table 1. Demographic and clinical characteristics of participants

Characteristics	Frequency	Percentage
Age (years)		
≤40	17	11.3
41-60	59	39.3
>60	74	49.4
(Mean = 58.4, SD = 12.6, Range = 23-90)		
Gender		
Female	63	42.0
Male	87	58.0
Marital status		
Single	21	14.0
Married	129	86.0
Education		
Not completed primary school	28	18.7
Completed primary school	122	81.3
Occupation		
Unemployed	62	41.3
Employed	88	58.7
Monthly income (USD)		
40-259	120	80.0
260-479	24	16.0
≥480	6	4.0
(Mean = 181.8, SD = 125.6, Range = 42-706)		
Household status		
Living alone	6	4.0
Living with spouses/parents/children	38	25.4
Living with spouses and children	89	59.2
Living with relatives and others	17	11.4

Table 1. Continued

Characteristics	Frequency	Percentage
BMI		
Normal weight (< 23 kg/m²)	83	55.3
Overweight (23-27.4 kg/m²)	45	30.0
Obese (≥ 27.5 kg/m²)	22	14.7
(Mean = 22.8, SD = 4.4, Range = 13.3-38.0)		
Comorbidity		
Yes	139	92.7
No	11	7.3
DM		
Yes	85	56.7
No	65	43.3
CKD stages		
Stage 3 (30-59 ml/min/1.73m²)	60	40.0
Stage 4 (15-29 ml/min/1.73m²)	42	28.0
Stage 5 (< 15 ml/min/1.73m²)	48	32.0
(Mean = 26.6, SD = 17.1, Range = 2-59)		

3.2 BP level of participants

As shown in Table 2, only 44.0% of the participants could control their BP at the target level. The overall mean of systolic BP (SBP) was 137.6 mmHg (SD=21.9), suggesting poorly controlled BP. Moreover, more than two-thirds (84.5%) had SBP 140 mmHg or above.

Table 2. BP level of participants

BP level	Mean (SD)	N	%
Overall systolic BP (mmHg)	137.6 (21.9)	150	100.0
Controlled systolic BP (< 130)	117.6 (8.9)	66	44.0
90-119		28	42.4
120-129		38	57.6
Uncontrolled systolic BP (≥ 130)	153.3 (15.2)	84	56.0
130-139		13	15.5
140-210		71	84.5

3.3 Association between independent variables and controlled BP

Findings showed that BMI (χ^2=8.859, p=0.012), sodium consumption behavior (χ^2=24.066, p<0.001), family support (χ^2=19.044, p<0.001), health professional support (χ^2=10.823, p=0.001), and CKD stage (χ^2=8.744, p=0.013), had a significant association with controlled BP (Table 3). Thus, these significant variables were entered binary logistic regression analysis.

Table 3. Association between independent variables and controlled BP

Study variables	Controlled group (N = 66) n (%)	Uncontrolled group (N = 84) n (%)	χ²/Fisher's exact	*P*-value
Age (years)			5.671	0.059
≤ 40	8 (47.1)	9 (52.9)		
41-60	19 (32.2)	40 (67.8)		
> 60	39 (52.7)	35 (47.3)		
Gender			0.182	0.670
Female	29 (46.0)	34 (54.0)		
Male	37 (42.5)	50 (57.5)		
BMI			8.859	0.012
Normal weight	45 (54.2)	38 (45.8)		
Overweight	16 (35.6)	29 (64.4)		
Obese	5 (22.7)	17 (77.3)		

Table 3. Continued

Study variables	Controlled group (N = 66) n (%)	Uncontrolled group (N = 84) n (%)	χ²/Fisher's exact	*P*-value
Sodium consumption behavior			24.066	<0.001
Moderate	13 (20.6)	50 (79.4)		
Low	53 (60.9)	34 (39.1)		
Family support			19.044	<0.001
Low	13 (22.0)	46 (78.0)		
High	53 (58.2)	38 (41.8)		
Health professional support			10.823	0.001
Low	23 (30.7)	52 (69.3)		
High	43 (57.3)	32 (42.7)		
Comorbidity[f]				0.060
Yes	58 (41.7)	81 (58.3)		
No	8 (72.7)	3 (27.3)		
DM			2.133	0.144
Yes	33 (38.8)	52 (61.2)		
No	33 (50.8)	32 (49.2)		
CKD stages			8.744	0.013
Stage 3	33 (55.0)	27 (45.0)		
Stage 4	20 (47.6)	22 (52.4)		
Stage 5	13 (27.1)	35 (72.9)		

[f] Fisher's exact test

3.4 Determinants of controlled BP

According to binary logistic regression analysis, overweight (OR=0.170, 95% CI:0.058-0.495), obese (OR=0.071, 95% CI: 0.017-0.305), and CKD stage 5 (OR=0.070, 95% CI:0.020-0.244) were the determinants of poorly controlled BP. Low sodium consumption behavior (OR=9.065, 95% CI:3.251-25.277) and high family support (OR=7.799, 95% CI:2.738-22.215) were the determinants of well-controlled BP (Table 4).

Table 4. Determinants of controlled BP

Variables	B	S.E.	Wald	95% CI	OR	*P*-value
BMI						
Normal weight	Ref.	-	-	-	-	-
Overweight	-1.773	0.546	10.556	0.058-0.495	0.170	0.001
Obese	-2.640	0.741	12.698	0.017-0.305	0.071	< 0.001
CKD stages						
Stage 3	Ref.	-	-	-	-	-
Stage 4	-0.684	0.549	1.550	0.172-1.481	0.505	0.213
Stage 5	-2.656	0.635	17.482	0.020-0.244	0.070	< 0.001
Sodium consumption behavior						
Moderate	Ref.	-	-	-	-	-
Low	2.204	0.523	17.752	3.251-25.277	9.065	< 0.001
Family support						
Low	Ref.	-	-	-	-	-
High	2.054	0.534	14.792	2.738-22.215	7.799	< 0.001
Health professional support						
Low	Ref.	-	-	-	-	-
High	0.159	0.479	0.110	0.459-2.997	1.172	0.740

Hosmer and Lemeshow Test; χ^2 = 4.715, df = 8, *p* = 0.788, Cox & Snell R^2 = 0.394, Nagelkerke R^2 = 0.528, overall percentage of correct classification = 80%, OR = odds ratios, CI = Confidence Interval

4. Discussion

The present study was designed to assess the BP control status of Myanmar patients with NDCKD. The results showed that the BP control rate was still suboptimal. Some potentially significant determinants of controlled BP were also identified and discussed below.

4. 1 BP control

As shown in the previous section, only 44% of the participants achieved the BP target. No study has been found to examine the rate of BP control in other resource-constrained countries where are similar to Myanmar. However, when compared to studies conducted in high-income countries, e.g., Korea and China, the control rate is apparently lower than that reported in those studies, which were 51.5% and 61.5%, respectively (Lee et al., 2021; Wang et al., 2013). A patient's ability to control BP might differ depending on his or her disease severity. In this study, a majority of participants belonged to CKD stage 5, and 72.9% of them had poorly controlled BP. It is possible that many patients in Myanmar seek health care only at the late stage of disease. Dialysis facilities are also insufficient for Myanmar people. While an estimated number of 10,800 patients with ESRD need RRT, 85%-90% are unable to access treatment (Than, 2018). Furthermore, Hyodo et al. (2020) also stated that in 2017, only 328 hemodialysis (HD) machines could operate normally at 52 nationwide HD centers. In addition, dialysis therapy is impossible for patients living in poverty. The national government subsidized only 40% of the total cost (20 USD) (Hyodo et al., 2020). HD patients needed to pay 30 USD out-of-pocket each time for their dialysis. This estimated HD expense (60 USD/week) was beyond the participant's average income. Accordingly, many Myanmar ESRD patients have difficulties receiving dialysis treatment. This might have caused, in the current study, the larger contribution of ESRD patients and the lower rate of BP control.

According to the study result, BP is not adequately controlled among Myanmar patients with NDCKD. This finding notifies the health care team to pay more attention to the problem of BP control in this population. Physicians and nurses should monitor BP levels and provide persistent health care related to improving BP control.

4. 2 Determinants of controlled BP

Besides classifying the rate of BP control, this study identified significant determinants of controlled BP. Higher BMI (lifestyle factor) and CKD stage 5 (physiological factor) were determinants of poorly controlled BP. Low sodium consumption behavior (lifestyle factor) and high family support (response to the environment factor) were the determinants of well-controlled BP.

As mentioned earlier, higher BMI could significantly predict poorly controlled BP. Patients with overweight and obese were less likely to have controlled BP than those with normal weight. This finding is consistent with a previous study that used the same BMI criteria among a South Asian hypertensive population (Hossain et al., 2019). These days, many patients are reluctant to maintain a healthy weight. The sedentary lifestyle and frequent consumption of unhealthy food can be barriers. Evidence also suggests that an irregularly active lifestyle increases the risks for obesity (Back et al., 2018). Similarly, in a study conducted in Myanmar, frequent fast-food consumption and less physical activity were risk factors of overweight and obesity (Thike et al., 2020). Further, Myanmar inhabitants already have consumption habits of too much carbohydrate and fat in the form of rice and cooking oil. These conditions might lead almost half of the respondents in this study to be overweight or obese, and then to have poorly controlled BP. Multiple mechanisms in obesity, insulin resistance, vascular endothelial dysfunction, sodium reabsorption, and impaired glomerular filtration, significantly cause poorly controlled BP (DeMarco et al., 2014).

Meanwhile, this study found inadequately controlled BP among Myanmar patients in CKD stage 5. The more severe kidney disease they had, the poorer BP control they experienced. This result is similar to a recent study conducted in China which found CKD stage as the factor behind less controlled BP (Yan et al., 2018). In line with the HDA model, increasing severity of kidney disease can notably cause poorly controlled BP by means of vascular stiffness (Frazier, 2000). As swiftly as renal function declines, volume expansion and peripheral vascular resistance are more likely to increase, thereby devastating BP (Banasik, 2016). As a result, patients with end-stage CKD find it more difficult to control their BP and require more therapeutic interventions.

Nevertheless, one study in Germany revealed that the CKD stage did not significantly relate to controlled BP (Schneider et al., 2018). Incongruently, that study enrolled the patients under nephrology specialist care for at least one year. Therefore, those patients might have a higher disease awareness and obtained more intensive therapies to delay disease progression than the patients in this study. This might be the reason why the results were different between studies.

The results of this study also displayed low and moderate levels of sodium consumption behavior among NDCKD participants. No participant reported a high level of sodium consumption behavior. This can be explained by their increasing awareness about the importance of lower sodium consumption. At the initial and every clinic visit, they had received health education about sodium consumption reduction. With good awareness, they might have practiced better compliance with low salt dietary instructions. This study also revealed a positive relationship between low sodium consumption behavior and well-controlled BP. Patients who had low sodium consumption behavior were likely to have better BP control than those who had moderate sodium consumption behavior. This finding is supported by Meuleman et al. (2017) who reported sodium restriction could decrease BP among CKD patients. Humalda and Navis (2014) also stated that low dietary sodium improved controlling BP by adding the effect of antihypertensive drugs. Moreover, low sodium intake assists to maintain normal cellular homeostasis, renin angiotensin aldosterone system (RAAS), sympathetic activity, and BP level.

Similarly, patients with strong family support had increased odds for controlled BP. Patients who perceived high family support had their BP controlled better than those who perceived low family support. Although there are limited data on the CKD population, this report is congruent with that of a former study undertaken in a hypertensive population (Ojo et al., 2016). Generally, Myanmar citizens prefer to be cared for and supported by their significant others, including parents, spouses, and offspring. In this research, most of the respondents lived together with their parents, spouses, and children. As such, they perceived a high level of family support for a healthy diet and medication adherence, as well as active listening about health concerns. It is evident that perceiving good support can augment health care management and reduce negative emotional feelings such as anxiety, stress, and depression (Hill et al., 2014). Thus, these facts probably help the participants with perceived high family support to improve BP control.

5. Implications and limitations

The findings in this study show that controlling BP remains a major challenge among Myanmar patients with NDCKD. Hence, health care providers, including nurses, should monitor BP more closely, and strengthen continuity of care with regard to controlling BP. Furthermore, this study highlights the more important clinical determinants of controlled BP. Higher BMI and advanced CKD stage were determinants of poorly controlled BP. Thus, physicians and nurses should regularly screen patients with these characteristics, and provide effective interventions for optimizing BP control. In addition, low sodium consumption behavior and high family support were found to be associated with well-controlled BP. As such, health care personnel should continue to provide health education about low sodium consumption, and should encourage family members to be involved in the BP management intervention programs.

There are some limitations of this study. First, this study employed a cross-sectional, correlational predictive study design. Therefore, the study findings may not provide causal inferences. Measuring the BP once may not accurately determine BP control since BP potentially alters by days. Second, this study was done in NDCKD patients visiting the clinics at a tertiary hospital in Myanmar. Thus, the study results may not necessarily apply to populations with different backgrounds or in different settings. Third, the study applied a self-administered questionnaire to collect the data on sodium consumption behavior. Hence, there is a need to measure the actual amount of sodium intake. Last, only patient-level factors were focused in this study, other level factors that are essential to controlling BP are not included. Though, these prescribed limitations provide an opportunity for further researchers to conduct longitudinal cohort studies in other health sectors of Myanmar.

6. Conclusion

This correlational predictive study underlines that the BP control rate in Myanmar patients with NDCKD did not reach an optimal level. The study also identified some potentially significant determinants of controlled BP. Higher BMI and advanced CKD stage were determinants of poorly

controlled BP, and low sodium consumption behavior and high family support were predictors of well-controlled BP. Therefore, this study has added to the body of knowledge on BP control and its determinants in Myanmar. Based on the study findings, health care teams should develop strategies and intervention protocols to improve BP control. In addition, further research should address other health care providers and system related determinants, such as treatment intensification pattern, adherence to BP management guidelines, and health insurance status, on BP control. It is also necessary to investigate lifestyle modification trials to promote BP control among patients with NDCKD in Myanmar.

Acknowledgment

Author contribution

ESM developed the research proposal, implemented data collection, data analysis, and data interpretation, drafted the manuscript, and revised it critically for the important intellectual content. AS and WP provided supervisions, essential suggestions, and recommendations throughout the research process. All authors have read and approved the final manuscript.

Conflict of interest

All authors declare no conflict of interest in relation to this paper.

References

Abegaz, T. M., Abdela, O. A., Bhagavathula, A. S., & Teni, F. S. (2018). Magnitude and determinants of uncontrolled blood pressure among hypertensive patients in Ethiopia: Hospital-based observational study. *Pharmacy Practice (Granada), 16*(2), 1-7. https://doi.org/10.18549%2FPharmPract.2018.02.1173

Ahlawat, R., Tiwari, P., & D'Cruz, S. (2018). Prevalence of depression and its associated factors among patients of chronic kidney disease in a public tertiary care hospital in India: A cross-sectional study. *Saudi Journal of Kidney Diseases and Transplantation, 29*(5), 1165-1173. https://doi.org/10.4103/1319-2442.243972

Almutary, H., Bonner, A., & Douglas, C. (2016). Which patients with chronic kidney disease have the greatest symptom burden? A comparative study of advanced CKD stage and dialysis modality. *Journal of Renal Care, 42*(2), 73-82. https://doi.org/10.1111/jorc.12152

Back, I. R., Oliveira, R. R., Silva, E. S., & Marcon, S. S. (2018). Risk factors associated with overweight and obesity in Japanese-Brazilians. *Journal of Nutrition and Metabolism, 2018,* 5756726. https://doi.org/10.1155/2018/5756726

Banasik, J. (2016). *Study guide for pathophysiology* (6th ed.). Elsevier.

Cheung, A. K., Rahman, M., Reboussin, D. M., Craven, T. E., Greene, T., Kimmel, P. L., Cushman, W. C., Hawfield, A. T., Johnson, K. C., Lewis, C. E., Oparil, S., Rocco, M. V., Sink, K. M., Whelton, P. K., Wright, J. T., Basile, J., Beddhu, S., Bhatt, U., Chang, T. I., Chertow, G. M., . . . Yee, J. (2017). Effects of intensive BP control in CKD. *Journal of the American Society of Nephrology, 28*(9), 2812–2823. https://doi.org/10.1681/ASN.2017020148

Cho, H., Kim, S. M., Jeong, S. B., & Kim, S. B. (2016). Comparison of salt taste thresholds and salt usage behaviors between adults in Myanmar and Korea. *Asia Pacific Journal of Clinical Nutrition, 25*(4), 879-884. https://doi.org/10.6133/apjcn.092015.32

Dąbrowska-Bender, M., Dykowska, G., Żuk, W., Milewska, M., & Staniszewska, A. (2018). The impact on quality of life of dialysis patients with renal insufficiency. *Patient Preference and Adherence, 12,* 577-583. https://doi.org/10.2147/PPA.S156356

DeMarco, V. G., Aroor, A. R., & Sowers, J. R. (2014). The pathophysiology of hypertension in patients with obesity. *Nature Reviews. Endocrinology, 10*(6), 364–376. https://doi.org/10.1038/nrendo.2014.44

Frazier, L. (2000). Factors influencing blood pressure: Development of a risk model. *Journal of Cardiovascular Nursing, 15*(1), 62-79. https://doi.org/10.1097/00005082-200010000-00007

GBD Chronic Kidney Disease Collaboration (2020). Global, regional, and national burden of chronic kidney disease, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet (London, England), 395*(10225), 709–733. https://doi.org/10.1016/S0140-6736(20)30045-3

Glasgow, R. E., Strycker, L. A., Toobert, D. J., & Eakin, E. (2000). A social–ecologic approach to assessing support for disease self-management: The chronic illness resources survey. *Journal of Behavioral Medicine, 23*(6), 559-583. https://doi.org/10.1023/a:1005507603901

Hill, P. L., Weston, S. J., & Jackson, J. J. (2014). Connecting social environment variables to the onset of major specific health outcomes [Abstract]. *Psychology & Health, 29*(7), 753-767. https://doi.org/10.1080/08870446.2014.884221

Hossain, F. B., Adhikary, G., Chowdhury, A. B., & Shawon, M. S. R. (2019). Association between body mass index (BMI) and hypertension in South Asian population: Evidence from nationally-representative surveys. *Clinical Hypertension, 25*(1), 1-9. https://doi.org/10.1186/s40885-019-0134-8

Humalda, J. K., & Navis, G. (2014). Dietary sodium restriction: A neglected therapeutic opportunity in chronic kidney disease. *Current Opinion in Nephrology and Hypertension, 23*(6), 533–540. https://doi.org/10.1097/MNH.0000000000000073

Hyodo, T., Fukagawa, M., Hirawa, N., Isaka, Y., Nakamoto, H., Van Bui, P., Thwin, K. T., & Hy, C. (2020). Present status of renal replacement therapy in Asian countries as of 2017: Vietnam, Myanmar, and Cambodia. *Renal Replacement Therapy, 6*(1), 1-14. https://doi.org/10.1186/s41100-020-00312-w

Khadoura, K., Shakibazadeh, E., Mansournia, M. A., Aljeesh, Y., & Fotouhi, A. (2021). Determining the prevalence of and the factors associated with antihypertensive medication non-adherence in the Gaza Strip. *Korean Journal of Family Medicine, 42*(2), 150–158. https://doi.org/10.4082/kjfm.19.0081

Kuryata, O., Yaschenko, T., & Semenov, V. (2019). Analysis of blood pressure control in outpatients with non-dialysis chronic kidney disease referred by primary care physicians: A study from the centre of nephrology care. *Arterial Hypertension, 23*(2), 88-97. https://doi.org/10.5603/AH.a2019.0004

Kusuma, H., Ropyanto, C. B., Widyaningsih, S., & Sujianto, U. (2018). Relating factors of insomnia among haemodialysis patients. *Nurse Media Journal of Nursing, 8*(1), 44-57. https://doi.org/10.14710/nmjn.v8i1.15741

Lee, S., Oh, H. J., Lee, E. K., Lee, O., Ha, E., Kim, S. J., Kang, D. H., Choi, K. B., & Ryu, D. R. (2017). Blood pressure control during chronic kidney disease progression. *American Journal of Hypertension, 30*(6), 610-616. https://doi.org/10.1093/ajh/hpx017

Lee, Y. B., Lee, J. S., Hong, S. H., Kim, J. A., Roh, E., Yoo, H. J., Baik, S. H., & Choi, K. M. (2021). Optimal blood pressure for patients with chronic kidney disease: A nationwide population-based cohort study. *Scientific Reports, 11*(1), 1538. https://doi.org/10.1038/s41598-021-81328-y

Lv, J., Ehteshami, P., Sarnak, M. J., Tighiouart, H., Jun, M., Ninomiya, T., Foote, C., Rodgers, A., Zhang, H., Wang, H., Strippoli, G. F., & Perkovic, V. (2013). Effects of intensive blood pressure lowering on the progression of chronic kidney disease: A systematic review and meta-analysis. *Canadian Medical Association Journal, 185*(11), 949–957. https://doi.org/10.1503/cmaj.121468

Maneesriwongul, W., & Dixon, J. K. (2004). Instrument translation process: A methods review. *Journal of Advanced Nursing, 48*(2), 175-186. https://doi.org/10.1111/j.1365-2648.2004.03185.x

Meuleman, Y., Hoekstra, T., Dekker, F. W., Navis, G., Vogt, L., van der Boog, P., Bos, W., van Montfrans, G. A., & van Dijk, S. (2017). Sodium restriction in patients with CKD: A randomized controlled trial of self-management support. *American Journal of Kidney Diseases, 69*(5), 576–586. https://doi.org/10.1053/j.ajkd.2016.08.042

Ojo, O. S., Malomo, S. O., & Sogunle, P. T. (2016). Blood pressure (BP) control and perceived family support in patients with essential hypertension seen at a primary care clinic in Western

Nigeria. *Journal of Family Medicine and Primary Care, 5*(3), 569-575. https://doi.org/10.4103/2249-4863.197284

Piaseu, N., Boonsiri, C., Panichkul, K., Maruo, S. J., Putwatana, P., & Kantachuvesiri, S. (2020). Effects of program promoting food consumption for sodium reduction on knowledge, sodium consumption behaviors, and urinary sodium in nursing students: A multi-setting study. *Bangkok Medical Journal, 16*(1), 1-6. https://doi.org/10.31524/bkkmedj.2020.11.009

Schneider, M. P., Hilgers, K. F., Schmid, M., Hubner, S., Nadal, J., Seitz, D., Busch, M., Haller, H., Kottgen, A., Kronenberg, F., Baid-Agrawal, S., Schlieper, G., Schultheiss, U., Sitter, T., Sommerer, C., Titze, S., Meiselbach, H., Wanner, C., & Eckardt, K. U. (2018). Blood pressure control in chronic kidney disease: A cross-sectional analysis from the German Chronic Kidney Disease (GCKD) study. *PLoS One, 13*(8), 1-17. https://doi.org/10.1371/journal.pone.0202604

Than, K. M. M. (2018). RRT-M-Renal replacement therapy in Myanmar, a developing country [Abstract]. *Journal of Nephrology and Therapeutics, 8,* 16. https://doi.org/10.4172/2161-0959-C4-060

Thike, T. Z., Saw, Y. M., Lin, H., Chit, K., Tun, A. B., Htet, H., Cho, S. M., Khine, A. T., Saw, T. N., Kariya, T., Yamamoto, E., & Hamajima, N. (2020). Association between body mass index and ready-to-eat food consumption among sedentary staff in Nay Pyi Taw Union Territory, Myanmar. *BioMed Central Public Health, 20*(1), 1-10. https://doi.org/10.1186/s12889-020-8308-6

Wang, L. Y., Yin, D. X., Zhang, D. L., Xu, R., Cui, W. Y., & Liu, W. H. (2013). Improvement and influencing factors of blood pressure control by nephrologist referral in chronic kidney disease patients in China: A cohort study. *International Urology and Nephrology, 45*(5), 1345-1353. https://doi.org/10.1007/s11255-012-0332-8

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., Collins, K. J., Himmelfarb, C. D., Depalma, S. M., Gidding, S., Jamerson, K. A., Jones, D. W., Maclaughlin, E. J., Muntner, P., Ovbiagele, B., Smith, S. C., Spencer, C. C., Stafford, R. S., Taler, S. J., Thomas, R. J., Williams, K. A., . . . Wright, J. T. (2018). 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/ APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Hypertension, 71*(6), e13-e115. https://doi.org/10.1161/HYP.0000000000000065

World Health Organization. (2020). *Noncommunicable diseases: Progress monitor 2020.*

World Health Organization Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet, 363*(9403), 157–163. https://doi.org/10.1016/s0140-6736(03)15268-3

Xie, Y., Bowe, B., Mokdad, A. H., Xian, H., Yan, Y., Li, T., Maddukuri, G., Tsai, C., Floyd, T., & Al-Aly, Z. (2018). Analysis of the global burden of disease study highlights the global, regional, and national trends of chronic kidney disease epidemiology from 1990 to 2016. *Kidney International, 94*(3), 567-581. https://doi.org/10.1016/j.kint.2018.04.011

Yan, Z., Wang, Y., Li, S., Wang, J., Zhang, L., Tan, H., Li, S., Yang, L., Pei, H., Zhang, L., Wang, Y., Duan, J., Jiao, S., Zhao, M., & Fu, S. (2018). Hypertension control in adults with CKD in China: Baseline results from the Chinese cohort study of chronic kidney disease (C-STRIDE). *American Journal of Hypertension, 31*(4), 486-494. https://doi.org/10.1093/ajh/hpx222

Zhang, J., Healy, H. G., Venuthurupalli, S. K., Tan, K. S., Wang, Z., Cameron, A., & Hoy, W. E. (2019). Blood pressure management in hypertensive people with non-dialysis chronic kidney disease in Queensland, Australia. *BioMed Central Nephrology, 20*(1), 1-10. https://doi.org/10.1186/s12882-019-1532-6

Zheng, Y., Tang, L., Zhang, W., Zhao, D., Zhang, D., Zhang, L., Cai, G., & Chen, X. (2020). Applying the new intensive blood pressure categories to a nondialysis chronic kidney disease population: The prevalence, awareness and treatment rates in chronic kidney disease patients with hypertension in China survey. *Nephrology Dialysis Transplantation, 35*(1), 155-161. https://doi.org/10.1093/ndt/gfy301