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Transitional care programs to improve outcomes in patients with traumatic brain injury and their caregivers: A systematic review and meta-analysis

Amelia Ganefianty[1*], Praneed Songwathana[2], and Kittikorn Nilmanat[2]

Abstract

Background: Effective nursing interventions for caring for patients with moderate to severe traumatic brain injury are still challenging during a transition from hospital to home. Since traumatic brain injury has deep-rooted sequelae, patients and their caregivers require better arrangement and information on the condition to achieve improved outcomes after discharge.

Objective: This study aimed to assess transitional care programs to improve outcomes of patients with traumatic brain injury and their caregivers.

Methods: A systematic review and meta-analysis were performed on studies retrieved from ProQuest, PubMed, Science Direct, CINAHL, and Google Scholar from January 2010 to July 2021. RevMan 5.4.1 software was used for meta-analysis.

Results: Nine studies were systematically selected from 1,137 studies. The standard approaches of interventions used in patients with traumatic brain injury and their caregivers were education, mentored problem-solving, home- and community-based rehabilitation, counseling, skill-building, and psychological support. We observed that there was significant evidence indicating beneficial effects of intervention in increasing the physical functioning of patients with traumatic brain injury (*SMD* = -0.44, 95% *CI* -0.60 to -0.28, p <0.001), reducing the psychological symptoms among caregivers (*SMD* = -0.42, 95% *CI* -0.59 to -0.24, p <0.001), and increasing the satisfaction (*SMD* = -0.35, 95% *CI* -0.60 to -0.11, p = 0.005).

Conclusion: Education, skill-building, and psychological support should be the main components in transitional care nursing programs for patients with traumatic brain injury and their caregivers.

Keywords

hospitals; patient discharge; transitional care; traumatic brain injury; caregivers; nursing; meta-analysis

Traumatic brain injury (TBI) is a critical problem worldwide that causes disability (Roozenbeek et al., 2013). Approximately 69 million individuals experience TBI from various causes (Dewan et al., 2019). Also, TBI is more common in low-middle income countries (LMIC), where it has a more considerable impact than in high-income countries (Iaccarino et al., 2018), partly due to the differences in health services. The previous study clarifies that one of the elements that can cause early mortality in TBI patients in LMIC is the deferred time from being admitted to the emergency unit to accepting appropriate treatment (Gupta et al., 2020).

Patients with TBI can encounter a wide assortment of neurological deficiencies. The neurological shortfalls experienced by patients depend on the components of the injury, the seriousness of the injury, and the degree of brain damage brought about by the injury (Blennow et al., 2016). Patients can experience headaches, vision loss, loss of

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ability to walk, cognitive impairment, memory loss, and other conditions that result from damage to parts of the brain due to TBI. In addition, recent research focused on TBI suggests that a considerable number of patients have a long-term disabling physical function, neurocognitive and neurobehavioral sequelae (Pavlovic et al., 2019).

The first month home is a transitional and vulnerable period for patients and their caregivers. Previous studies have highlighted that shortly before discharge from the hospital, patients' quality of life is low because of physical limitation, pain, immobility, and anxiety (McAllister et al., 2018). These impacts continue after discharge from the hospital and are associated with significant limitations in daily living activities (Alghnam et al., 2017). Therefore, assistance from their caregivers with activities of daily living (ADLs), such as dressing, bathing, feeding, and managing medications, is required. However, the high demands of care after hospital discharge can affect caregivers' physical and psychosocial conditions because of the loss of time for their own activities such as travel, leisure, social activities, and retirement.

Caregivers of patients with TBI are required to understand the cost of treatment in managing TBI patients. However, in reality, they tend to experience difficulties managing and caring for TBI patients because of difficulty obtaining access to health services and treatment (Lefebvre & Levert, 2012). Consequently, hospital readmission is common among patients with TBI. Of the 15,277 patients with a listed diagnosis of TBI, 35% of them needed at least one-time readmission (Brito et al., 2019). Caring for someone with TBI has been shown to negatively impact caregivers in so many ways that they require interventions designed by health workers (Arango-Lasprilla et al., 2010). A previous study explained that caregivers described the resulting transitional experience as fraught with risks and distress because they felt inadequate, unwilling, or inadequately trained to carry out intervention plans on patients (Mitchell et al., 2018). On the other hand, life satisfaction is based on criteria most relevant to the individual. Still, it has been well documented that TBI-impacted caregivers have highlighted a diminished life satisfaction, high level of caregiver burden, anxiety, social isolation, depression, and emotional difficulties (Manskow et al., 2017). Hence, it is necessary to provide continuity of care to the patients with TBI and their caregivers after being discharged from the hospital (Caro, 2011).

The transitional care intervention is well recommended to ensure coordination and continuity, based on a comprehensive care plan as patients transfer between different locations (Naylor et al., 2011). Nurses have an essential role in caring for patients with TBI and their caregivers (Oyesanya et al., 2017). However, there are several recommendations for nurses in supporting TBI care after discharge but still insufficient information regarding nursing outcomes. Seeking best interventions in improving TBI nursing outcomes of both patients and caregivers during transition is challenging for nurses. This manuscript aimed to review, analyze, and synthesize the existing transitional care programs between hospital and home, systematically focusing on the improvement of the outcomes after discharge among patients with TBI and their caregivers. One paper that discussed the transition from hospital to home for patients with acquired brain injury was published in 2008 (Turner et al., 2008). That article used the literature review method to evaluate existing studies without systematic search methods. A systematic review in the current study is essential for nurses to have a useful and reliable resource with evidence-based nursing recommendations on nursing intervention to help achieve the best outcomes. Additionally, a meta-analysis was performed to assess the strength of evidence for the outcomes for the patients with TBI and their caregivers. Meta-analyses can assist in setting up statistical significance among studies that could seem to have conflicting results. That is crucial due to the fact that statistical importance increases the validity of any discovered differences and improves the reliability of the records.

Methods

Literature Search Strategies and Databases

We used "The framework for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)" to report the findings (Shamseer et al., 2015). We searched electronic databases: Proquest, PubMed, Science Direct, CINAHL, and Google Scholar. This strategy comes from the PICO format (**Table 1**). Keyword and inclusion criteria used for searching in each database are shown in **Table 2**. We developed the search terms based on MESH terms: 'transitional care,' 'hospital to home intervention,' 'traumatic brain injury," 'nursing care,' 'patient outcome,' 'brain injury outcome,' and 'hospital discharge.'

Table 1 PICO Format

PICO	
Population	Patients with TBI and their caregivers
Intervention	Transitional care program between hospital and home
Comparison	Usual care
Outcomes	Physical functioning, psychological distress reduction, satisfaction

Eligibility Criteria

All interventions that focused on increasing favorite outcomes of patients with TBI and their caregivers were included. The inclusion criteria were: (1) types of participants: patients with moderate or severe TBI after discharge from the hospital ≥ 18 years old, while the caregivers were the person who cared for the patients after discharge at home; (2) types of outcome measures: physical functioning, psychological distress reduction, and satisfaction; (3) publication language and date of publication: published in English between January 2010–July 2021, to be current with the most recent literature; (4) study design: intervention study, including randomized

controlled trials and (quasi) experimental research; (5) types of interventions: interventions (both caregiver and patients) relevant to transitional nursing care practice after discharge; and (6) timing: one to the three-month duration of intervention regarding intermediate care.

Table 2 Keywords and inclusion criteria used for searching in each database

Databases	Main search	Limits	*N* (Total articles)	*N* (Articles after exclusion)	Reasons for exclusion
PubMed	('transitional care') AND ('traumatic brain injury patient' OR 'caregiver') AND 'intervention' AND 'discharge' AND ('outcome' OR 'patient' OR 'caregiver')	• English • Full-text • Year 2010-2021 • Human	117	7	Not intervention studies, pediatric, long-term program, inpatient rehabilitation
ProQuest	('transitional care') AND ('traumatic brain injury patient' OR 'caregiver') AND 'nursing intervention' AND 'hospital discharge' AND ('outcome' OR 'patient' OR 'caregiver')	• English • Full-text • Year 2010-2020 • Nursing& allied health database, scholarly journal, full text, peer-reviewed • Exclude commentary, conference proceeding, undefined, and book	336	17	Pediatric, not intervention studies, not TBI patient, systematic review article, a transition between ICU and ward, the population was health care, articles discuss patient perception, the population was spinal cord injury, hip fracture, long-term intervention
Science Direct	'transitional care' AND 'traumatic brain injury', 'nursing care' AND 'brain injury outcome'	• English • Year 2010-2021 • Full-text • Research article	330	4	Not intervention studies, pediatric, long-term program, inpatient rehabilitation
Google Scholar	"transitional care", "traumatic brain injury", "nursing care", "outcome", and "hospital discharge"	Year 2010-2020	87	8	Not intervention studies, not in the adult population, discuss spinal cord injury and stroke patients
CINAHL	'transitional care' AND 'traumatic brain injury' OR 'brain injury' AND ('patient' OR 'caregiver') AND 'outcome'	English 2010-2020 Full-text Academic journal Major headings: brain injuries Age: all adults	267	4	Population: nursing staff, discuss non-TBI patients, not intervention studies

Study Selection

The studies obtained by searching were divided into two parts, with each having been carried out by a pair of authors (AG with PS and AF with KN, respectively). Each team conducted research selection separately and independently. A consensus meeting with a third author was arranged (PS or KN, respectively). The studies selected were initially assessed on the relevance of the topic to the title and abstract. Then a more in-depth search was conducted based on the inclusion criteria of the review. These studies were included if they met the inclusion criteria. The records of the rejected studies and the reasons for refusal were documented. We used Mendeley software to manage duplicate results.

Quality Appraisal of the Studies

The quality of the selected articles was critically analyzed using the Checklist for Randomized Controlled Trial Study (Joanna Briggs Institute (JBI), 2020). The possible score range was 0 to 13.

Data Extraction

Data were extracted from the nine articles following the PRISMA guidelines (Shamseer et al., 2015), including authors, year of publication, tools, provider of intervention, effect size, intervention method, duration of intervention, outcome measures, and study results. All the items were included in data extraction (**Table 3**).

Risk of Bias

We used the free software (RevMan version 5.4.1) to assess the risk of bias. High risk consisted of blinding participants and personnel (performance bias). However, the risk of bias in our review was similar and low in the majority of the studies. The results of bias were assessed and presented in **Figure 1** and **Figure 2**.

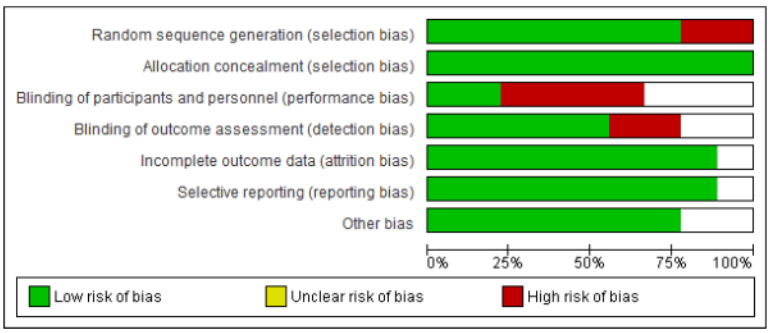

Figure 1 Risk of bias graph: review authors' decisions about each risk of bias item used RevMan 5.4.1

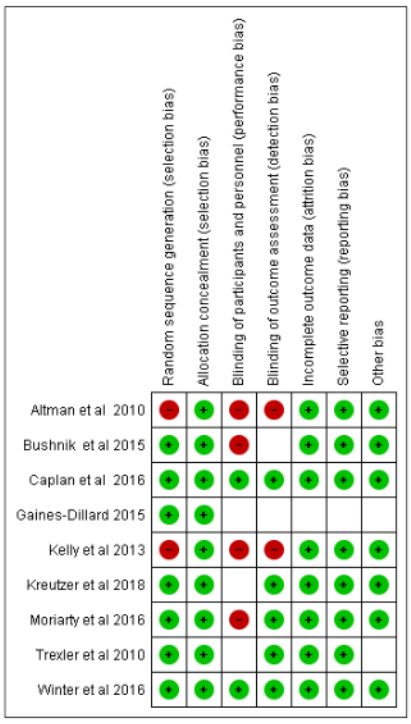

Figure 2 Risk of bias summary used RevMan 5.4.1

Data Synthesis

We used a model of meta-analyses of similar outcomes reported by several studies (Schmidt et al., 2009). For this meta-analysis, the physical functioning of patients with TBI, the psychological distress symptoms of caregivers, and the satisfaction were used as indicators of follow-up received from the research. We analyzed the model of meta-analyses in RevMan V 5.4.1 software using the inverse variance method, a model of fixed effect, and continuous data. The heterogeneity taken into consideration to guarantee measurable investigation consistency was I^2 < 50% and Chi^2 < 0.10, with confidence intervals of 95% (Higgins et al., 2003).

Results

With the search strategies, we identified 1,137 articles. We removed one hundred and seventy-one duplicated articles and then selected 966 papers. After the title and abstract reading, we decided on 41 articles for full reading (**Figure 3**). Of those articles, nine studies fulfilled the inclusion standards in the analysis, while 32 were excluded. Keywords and inclusion criteria used for searching in each database and the reasons for excluding these articles are shown in **Table 2**. We categorized the intervention types, module items used in the intervention, strengths, and limitations of each study in **Table 3**.

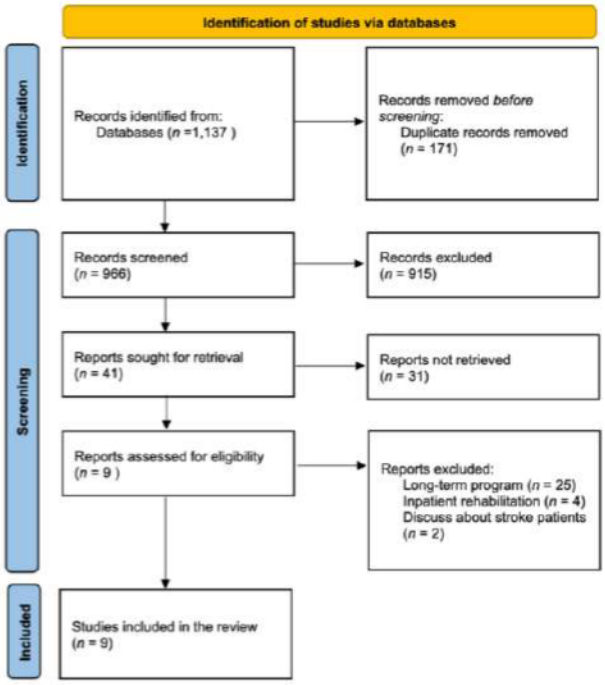

Figure 3 PRISMA Flow Diagram

None of the included studies scored the maximum JBI quality score of 13 points. Among the nine reviewed studies, three articles had a methodological quality score of 11 (Bushnik et al., 2015; Winter et al., 2016; Kreutzer et al., 2018) and have a score of 10 (Trexler et al., 2010; Caplan et al., 2016; Moriarty et al., 2016). Additionally, two studies had a methodological quality score of 7 (Altman et al., 2010; Gaines-Dillard, 2015), and one had a score of 6 (Kelly et al., 2013), as presented in **Table 3**.

Descriptive characteristics for nine included studies are presented in **Table 3**. Of the nine studies, eight studies were conducted in various places in the USA (Altman et al., 2010; Trexler et al., 2010; Bushnik et al., 2015; Gaines-Dillard, 2015; Caplan et al., 2016; Moriarty et al., 2016; Winter et al., 2016; Kreutzer et al., 2018) but only one study in Australia (Kelly et al., 2013). The studies varied in patients' demography, duration of the intervention (from one to three months), type of procedures used, and the intervention sample size (23 to 489). One thousand three hundred seventy-two participants (both of intervention and control group) in the samples were included in the nine studies.

Intervention Characteristics

A wide range of interventions was used in improving the outcomes among patients with TBI and their caregivers. We categorized the transitional care program for patients with TBI, including primary interventions and the other components. The primary interventions were education (Trexler et al., 2010; Kelly et al., 2013; Bushnik et al., 2015; Gaines-Dillard, 2015; Caplan et al., 2016; Moriarty et al., 2016; Kreutzer et al., 2018) and home/community-based rehabilitation (Altman et al., 2010; Winter et al., 2016). Patient education was delivered after discharge by various personnel or methods: telephone, face-to-face visits, group-education, and in-person education (both patient and caregiver) education (Trexler et al., 2010; Kelly et al., 2013; Bushnik et al., 2015; Gaines-Dillard, 2015; Caplan et al., 2016; Moriarty et al., 2016; Kreutzer et al., 2018), while home/community-based rehabilitation refers to home visits by a healthcare provider, such as a nurse, doctor, or occupational therapist, who educated and gave the self-care instructions, undertook the physical examination, or provided other care rehabilitation (Altman et al., 2010; Winter et al., 2016).

In addition, there were the other components of transitional care program, including mentored problem solving (Kelly et al., 2013; Caplan et al., 2016), counseling (Moriarty et al., 2016; Winter et al., 2016), skill-building and psychological support (Bushnik et al., 2015; Kreutzer et al., 2018). The interventionist guided the patients and their caregivers in problem-solving such as physiological problems and memory difficulties (Caplan et al., 2016). Counseling was wider, taken at-home visits by a licensed healthcare provider and two telephone contacts with the patient and caregivers together to obtain their concerns and discuss intervention objectives (Moriarty et al., 2016). On the other hand, both programs were designed to resolve the most common problems identified by patients with TBI and included emotion and stress management and good communication (Bushnik et al., 2015; Kreutzer et al., 2018).

Materials used in delivering intervention included a booklet and handbook on various aspects of TBI patient and caregiver management. The duration of the transitional care program was between one and three months. We assessed the effect size of each study regarding Cohen's guide categorization (Cohen, 1992). The effect is considered small if the effect size is <0.1, medium if between 0.3 and 0.5, and large if above 0.5. Three studies in this systematic review indicated a large effect of the intervention (Altman et al., 2010; Winter et al., 2016; Kreutzer et al., 2018).

Outcome Measures

Types of outcome measures in this article include the physical functioning, psychological distress reduction, and satisfaction of caregivers or patients with TBI. The decision to classify outcomes into three groups, namely physical functioning, psychological distress, and service satisfaction, made it easier for the authors to synthesize data through meta-analysis. Studies that contain physical functioning as outcomes include physical and cognitive abilities, physical problem severity, physical signs and symptoms in patients with TBI. Meanwhile, those with outcomes of anxiety, stress, burden, and depression are classified as studies with psychological distress as outcomes. Also, studies containing patient satisfaction with TBI and their caregivers are grouped as having satisfaction with the services as an outcome. Some studies assessed the improvement of caregiver outcomes, such as coping responses and emotional symptomatology (Trexler et al., 2010; Caplan et al., 2016; Moriarty et al., 2016). Other studies assessed the caregiver burden reduction and satisfaction improvement (Bushnik et al., 2015; Moriarty et al., 2016). For the patients' outcomes, one study measured self-management improvement (Kelly et al., 2013), while other studies measured the increase the physical functioning, reduction in psychological symptoms, and improvement in cognitive abilities (Altman et al., 2010; Gaines-Dillard, 2015; Winter et al., 2016), physicological well-being (Trexler et al., 2010; Kelly et al., 2013; Kreutzer et al., 2018), and community or work participation (Altman et al., 2010;Trexler et al., 2010; Winter et al., 2016). In summary, most studies in this systematic review measured the physical functioning among patients with TBI and the psychological symptoms of their caregivers.

Intervention Effects on Patients with TBI and Their Caregivers

From the nine eligible studies in this review, only five (Altman et al., 2010; Trexler et al., 2010; Caplan et al., 2016; Moriarty et al., 2016; Kreutzer et al., 2018) provided statistical data of standard deviation of physical functioning of patients with TBI, and six studies (Trexler et al., 2010; Bushnik et al., 2015; Caplan et al., 2016; Moriarty et al., 2016; Winter et al., 2016; Kreutzer et al., 2018) provided statistical data of standard deviation of psychological distress symptoms of caregivers to be included in this meta-analysis.

We did not find significant heterogeneity among studies that mentioned the physical functioning of patients with TBI as the outcomes (p = 0.24, I^2 27%). Then, we used the fixed-effects model to conclude the mean effect size and found that transitional care program intervention can lead

to a significant increase in patient physical functioning (*SMD (Standard Mean Difference)* = -0.44, 95% *CI* -0.60 to -0.28, *p* <0.00001) (**Figure 4**). Finally, we used sensitivity analysis using different pooled models and indicated a significant difference between the two groups (*MD* = -0.21 95% *CI* -0.49, *p* <0.00001), indicating that the summary effect size is robust.

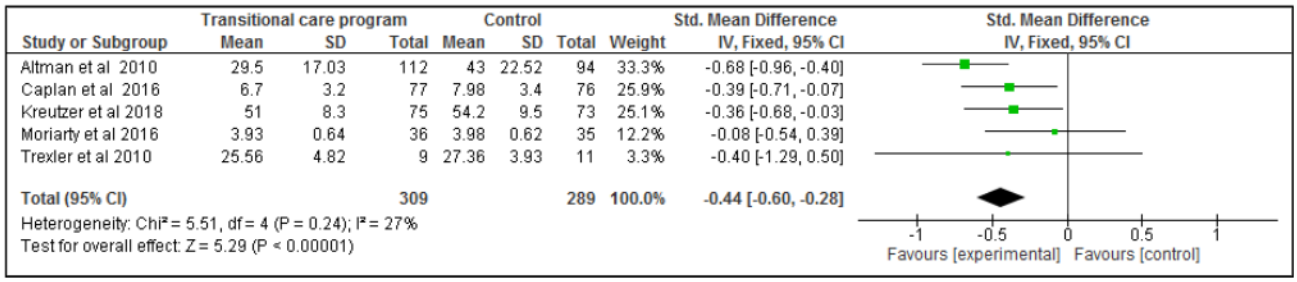

Figure 4 Forest plot: Evaluation of physical functioning improvement after transitional care program in patients with TBI versus control group

We also found no significant heterogeneity between studies that mentioned the psychological symptoms of caregivers as the outcomes (*p* = 0.28, I^2 21%). We used the fixed-effects model to calculate the mean effect size. We found that transitional care program intervention leads to a significant reduction in caregiver's psychological distress symptoms (*SMD*= -0.42, 95% *CI* -0.59 to -0.24, *p* <0.00001) (**Figure 5**). In addition, we used sensitivity analysis using other pooled models and indicated a significant difference between the two groups (*MD*= -0.40, 95% *CI* -0.60, *p* <0.00001), meaning that the summary effect size is robust.

For the third outcome, we found no significant heterogeneity among those studies that measured satisfaction as the outcomes (*p* = 0.26, I^2 26%). Then, we used the fixed-effects model to conclude the mean effect size and found that transitional care program intervention can significantly increase satisfaction (*SMD*= -0.35, 95% *CI* -0.60 to -0.11, *p* = 0.005) (**Figure 6**). According to the result of critical methodology appraisal, risk of bias assessment, effect size assessment, and meta-analysis, we assumed that education combined with skill-building and psychological support to be the best transitional care program between hospital and home, which can improve the outcomes of traumatic brain injury patients after discharge (Kreutzer et al., 2018).

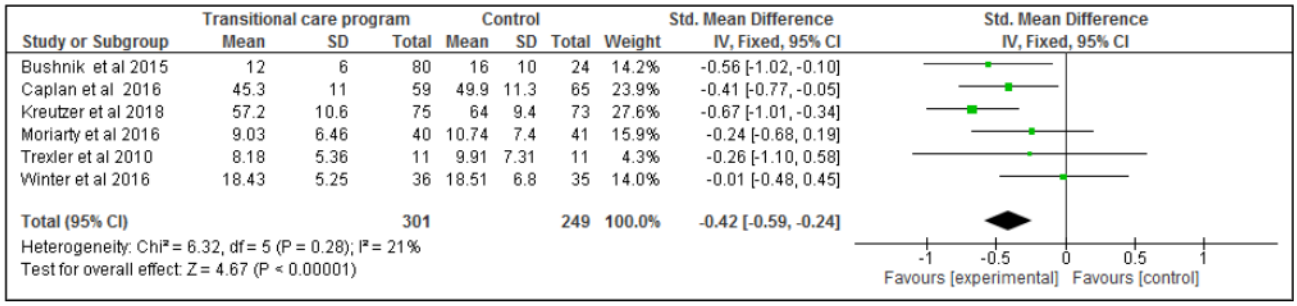

Figure 5 Forest plot: Evaluation of the psychological distress reduction after transitional care program in caregivers for patients with TBI versus control group

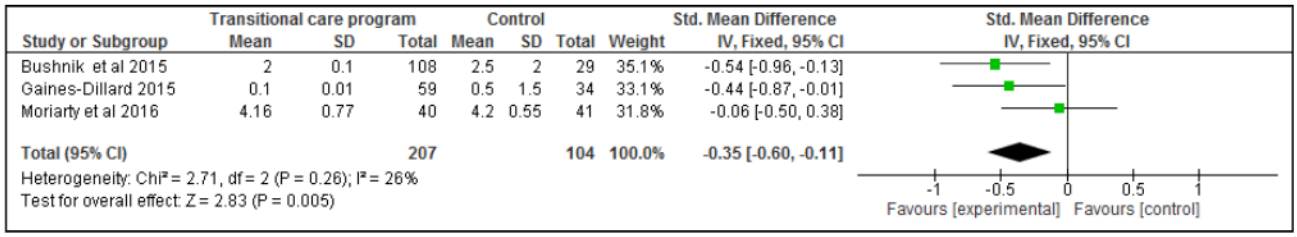

Figure 6 Forest plot: Evaluation of the satisfaction after transitional care program versus control group

Discussion

The transition period from hospital to home is the crucial phase in patients with TBI and their caregivers. Patients with TBI are discharged home with several deficits, creating considerable difficulties for caregivers regarding readiness and preparation (Imanigoghary et al., 2017). Thus, during the transition between hospital and home, these patients' outcomes and their caregivers need close attention. Based on the theory of Meleis (2010), nurses can

help patients, families, and networks adapt to advance care by envisioning reactions, giving expectant direction, reducing side effects, upgrading well-being and prosperity, and supporting the improvement of self-care activities (Meleis, 2010). Also, a systematic review mentioned that it requires magnificent correspondence during the transition to home and has suggestions for coordination and association of care across settings and nursing ability (Coffey et al., 2017). Using the systematic review and meta-analysis, the current study confirms the effect of transitional care programs and suggests a continuation of care coordination across settings and nursing capability.

This is the first systematic review of transitional care intervention in patients with TBI and their caregivers. The results of our study indicated that transitional care program between hospital and home compared with usual care was helpful regarding improvement of caregiver outcomes, such as coping responses, emotional symptomatology, and reducing the burden. Also, the intervention can improve caregiver satisfaction, patients' self-management and functional status, psychological, cognitive, physiological well-being, and community or work participation. According to the meta-analysis result, there was a significant difference in psychological distress symptoms score in caregivers between the intervention and control groups. These positive post-discharge results are presumably connected to a superior progression of care, with correspondence between various medical care experts and caregivers being a remembered segment for some intercessions (Chen et al., 2020).

Education, mentored problem-solving, home-and community-based rehabilitation, counseling, skill-building, and psychological support can be applied in the transitional care program between hospital and home for caregivers and patients with TBI. A telephone-based intervention combining individualized education and mentored problem-solving can extend the interventions to people with transportation or other access hindrances. It could be more practical than giving face-to-face benefits (Caplan et al., 2016). In LMIC, because of distance and transportation troubles, follow-up and patient recovery measures experience challenges and encounter difficulties. This result is in line with the study in Indonesia as an LMIC showing that direct subsequent phone conferences and meetings with TBI patients after release from a neurosurgery ward at 1, 2, and 3 months were valued by patients (Sutiono et al., 2018).

On the other hand, skill-building and psychological support effectively improved the outcomes of traumatic brain injury patients after discharge (Bushnik et al., 2015; Kreutzer et al., 2018). Neurobehavioral sequelae of TBI are commonly shown, leaving numerous survivors jobless and dependent on relatives for help (Oyesanya et al., 2021). Psychological strategies were utilized to assist patients with TBI in perceiving their sentiments and improve their emotion or passionate prosperity. At the same time, the ability to manage care was fused to enhance correspondence, critical thinking, and enthusiastic control (Kreutzer et al., 2018). A couple of studies have shown that enhanced energetic prosperity is connected with better utilitarian outcomes post-injury, including social joining and return to work (Iverson, 2010; Hart et al., 2014; Fann et al., 2017).

A prospective cohort study led to quantifying rates of adverse mental events in caregivers of patients with TBI at post-discharge and three months after discharge. In addition, the results showed caregiver dissatisfaction at one-month post-discharge, and a further reduction after three months showed that injury time elapsed was inversely related to caregiver burden (Turner et al., 2010).

This meta-analysis aimed to improve understanding of how transitional care could help patients with TBI and their caregivers during discharge and transition from hospital to home, increase physical functioning and satisfaction, and reduce the caregivers' psychological distress. It also showed that studies have homogeneity and found that transitional care program intervention led to a significant increase in physical functioning among patients with TBI (Altman et al., 2010)(Trexler et al., 2010; Caplan et al., 2016; Moriarty et al., 2016; Kreutzer et al., 2018) and reduction in caregiver's psychological distress symptoms (Trexler et al., 2010; Bushnik et al., 2015; Caplan et al., 2016; Moriarty et al., 2016; Winter et al., 2016; Kreutzer et al., 2018). This result is in line with the previous study that the most commonly utilized intervention component of the caregiver of the patients with TBI was illness education, including skills training, social support, and therapy (Shepherd-Banigan et al., 2018).

Study Limitations

This paper aims to synthesize the existing transitional care program between hospital and home, which can improve the outcomes of traumatic brain injury patients after discharge. Although the review presents strong evidence with study target tests, plan, and result estimation to advise future examination, some potential limitations in this review were found. These include small studies; searches were limited to articles published in English and various outcome measures. Also, we did not have sufficient studies to conduct robust assessments of publication bias. A common criticism of meta-analysis is that analysts join multiple types of study in a similar investigation so that the overall impact may disregard conceivably significant contrasts across studies. The publication bias of the study could be found when using various measurements and outcomes in the meta-analysis.

Table 3 Transitional program for patients with TBI and their caregivers

Author (year), Location	Type of studies	Population & Sample	Tools	Provider	Effect size	Intervention	Duration of Intervention	Outcome measures	Results
(Caplan et al., 2016) Washington, USA	Randomized Controlled Trial	153 caregivers of persons with moderate to severe TBI Two groups	Brief Symptom Inventory (BSI-18)	A master's level social worker with experience in TBI and problem-solving studies	0.20 to 0.41 (small to medium)	Individualized training and mentored trouble-solving intervention via up to ten phone calls at 2-week durations.	One month	Emotional symptomatology	Emotional symptomatology discharge of the patients with TBI resulted in better caregiver outcomes
(Kelly et al., 2013) Victoria, Australia	Pre-post-test design	41 adults with TBI Two groups	The Self-Concept Scale: Second Edition (TSCS: 2), the Family Assessment Device (FAD), the Rosenberg Self-Esteem Scale (RSE) and the Hospital Anxiety and Depression Scale (HADS)	A clinical psychologist with 15 years of experience and training and a medical neuropsychologist with clinical revel in brain injury rehabilitation	0.046 to 0.158 (small)	Family inclusive intervention on the multidimensional self-concept of individuals TBI	Three months	Self-concept, self-esteem, anxiety and depression, family functioning	Temper and circle of relatives functioning was not enhanced for the TBI pattern
(Altman et al., 2010) Indianapolis, USA	Retrospective analysis of program evaluation data for treatment	489 adults with TBI Two groups	Mayo-Portland Adaptability Inventory and Injury Severity	Licensed or certified clinicians and/or assistants	0.52 to 0.58 (large)	Home- and community-based post-acute brain injury rehabilitation (PABIR)	Three months	Physical and cognitive abilities, adjustment, and community participation	Results provided evidence of the effectiveness of home-and community-based care
(Trexler et al., 2010) Midwest of the USA	Randomized Controlled Trial	23 people with TBI (and their caregivers) Two groups	O-Log, C-Log, the Participation Index of the Mayo-Portland Adaptability Inventory (M2PI), Patient Health Questionnaire-9 (PHQ-9)	Resource facilitators	0.04 to 0.05 (small)	Resource Facilitation (RF): resource facilitator to assist TBI patients in returning to work and community activities	Three months	Return to work, participation in home and community activities, and depression	Participation increased significantly for the intervention group
(Moriarty et al., 2016) Pennsylvania, USA	Randomized Controlled Trial	81 adults with TBI and their family member Two groups	The Center for Epidemiologic Studies Depression Scale, The Modified Caregiver Appraisal Scale (CAS), Caregiver	A licensed occupational therapist with clinical experience	0.01 to 0.311 (small to medium)	Veteran's In-Home Program (VIP) by phone: compensatory strategies to enhance cognitive functioning; emotion-	Three months	Depressive symptomatology, caregiver burden, and caregiver satisfaction	Own family contributors in the VIP confirmed an appreciable decrease in depressive symptom

Author (year), Location	Type of studies	Population & Sample	Tools	Provider	Effect size	Intervention	Duration of Intervention	Outcome measures	Results
			burden, and the Caregiver Relationship Satisfaction	in patient and family interventions		regulation strategies to manage behavioral and interpersonal disturbances.			rankings, lower burden scores, and better caregiver pleasure when compared to controls at follow-up.
(Bushnik et al., 2015) Virginia, USA	Randomized Controlled Trial	108 family caregivers after TBI Two groups	The Service Obstacles Scale (SOS), the Family Needs Questionnaire (FNQ, and Zarit Burden Inventory (ZBI)	Therapists included family therapists and clinical psychologists with doctoral degrees	0.3 to 0.37 (medium)	The Brain Injury Family Intervention: psychological support, addressing needs, skill-building, and emphasizing education	Three months	Family members' perceived needs, satisfaction, and quantified caregiving burden	Treatment group caregivers showed an increase in met desires, greater satisfaction with services, and decreased burden relative to pretesting.
(Kreutzer et al., 2018) Virginia, US	Randomized Controlled Trial	160 adults with TBI Two groups	The Connor-Davidson Resilience Scale (CD-RISC), Brief Symptom Inventory-18 (BSI-18), Mayo-Portland Adaptability Inventory-4 (MPAI-4), and the 13 Item Stress Test	Doctoral-level psychologists who received training from the first author	−0.54 to 0.60 (small to large)	The Resilience and Adjustment Intervention (RAI) objectives adjustment demanding situations: emphasizes education, skill-building, and mental help.	Three months	Resilience measurement scales, problem severity, and stress symptoms	A resilience-focused intervention improved psychological health and adjustment after TBI
(Winter et al., 2016) Philadelphia, USA	Randomized Controlled Trial	81 veterans with TBI and a key family member Two groups	The Centre for Epidemiologic Studies Depression Scale (CES-D), The Patient Competency Rating Scale, and The Community Re-integration for Service Members scale (CRIS),	Health professional	0.01 to 0.68 (small to large)	Veterans' In-home Programme (VIP), applied in veterans' houses, regarding a family member and focused on the environment, carried out in homes or by smartphone.	Three months	Community re-integration, mitigation of trouble with the maximum troubling TBI signs, and facilitation of day-by-day functioning	VIP participants had significantly higher community re-integration scores and less difficulty managing targeted outcomes.
(Gaines-Dillard, 2015) Newark, USA	Pre-post-test design	93 adults with TBI Two groups	Trauma Follow-up Tracking Tool (TFTT)	Nurses	0.34 to 0.37 (medium)	Education and follow-up by phone (TFU)	Three months	Patient satisfaction, communication, and knowledge deficit	TFU can improve patient satisfaction in patients with TBI.

Conclusion

This systematic review supports the transitional care programs for improving the outcomes, particularly in physical functioning, psychological distress reduction, and satisfaction among patients with TBI and their caregivers. Nurses' role is highly prominent in transitional care as they are involved in education, mentored problem solving, supporting home-and community-based rehabilitation, counseling, skill-building, and psychological support for patients with TBI and their caregivers. This review concludes that education combined with skill-building and psychological support is the main component in transitional care programs between hospitals and homes for improving the outcomes of traumatic brain injury patients and their caregivers. For the clinical implication, nurses should give efforts to education along with skill-building and psychological support to improve the physical functioning of patients with TBI, increase satisfaction and reduce the psychological distress of TBI caregivers. Future research is necessary to test its effectiveness in different contexts of care in LMIC.

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Authors' Contributions
AG designed the study, wrote and revised the manuscript. AG and PS analyzed the data, wrote and revised the manuscript. KN designed the study, wrote and revised the manuscript. All authors agreed with the final version of the article to be published.

Data Availability Statement
The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Correlates of evidence-based nursing practice among nurses in Saudi Arabia: A structural equation model

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Abstract

Background: Consideration needs to be given to variables that impact the application of evidence-based nursing practice.

Objective: This study aimed to generate and validate a structural model of factors predictive of evidence-based nursing practice.

Methods: A cross-sectional descriptive design was used, with 612 registered nurses in the southern area of Saudi Arabia selected using a convenience sampling procedure. Data were collected during the period from November 2019 to January 2020 using valid and reliable questionnaires, including the novel Registered Nurses' Competencies, Beliefs, Facilitators, Barriers, and Implementation of the Evidence-based Practice Questionnaire. A structural equation modeling technique was used for data analysis.

Results: Evidence-based nursing practice was significantly influenced by nurses' competency, beliefs, barriers, and facilitators. 38.75% of the variance was explained by all factors. Specifically, nurses' beliefs partially mediated the relationship between nurses' competency and the evidence-based application of nursing practice. In addition, the relationship between nurses' beliefs and evidence-based application of nursing practice was partially mediated by organizational facilitators. Nurses' competency and beliefs were significantly influenced by attending the workshop, education level, years of experience, and previous research work.

Conclusion: The current study highlights the significant effect of personal and organizational variables toward the application of evidence-based nursing practice.

Keywords

latent class analysis; evidence-based nursing; self-report; structural models; nurses; Saudi Arabia

Over the past three decades, evidence-based application of nursing practice has come into sight as a significant matter to clinical nursing practice and the health care system (Alqahtani et al., 2020; Pierce, 2020). Evidence-based nursing practice has been defined as an ideal problem-solving approach and practice of the best evidence derived from well-designed research projects concerning nursing inquires of the patients, their preferences, and values (Jolley, 2020). The importance and cost-effectiveness of evidence-based practice have been extensively discussed in the nursing literature since it has an immediate impact on patients, nurses, and the health care system (Squires et al., 2011; Williams et al., 2015; Cheng, Feng, et al., 2017). Evidence-based practice is necessary because it can reduce cost, save time and result in better patient outcomes (Cheng, Feng, et al., 2017; Jolley, 2020).

In today's healthcare environment, the urgent call to provide high-quality nursing care has been growing worldwide. The profession of nursing is one of the major health professions that could significantly impact healthcare quality (Pierce, 2020). Therefore, governmental and private agencies in the Kingdom of Saudi Arabia (KSA) recommend improving evidence-based competencies for

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nurses to guarantee superior nursing care (Hasheesh & AbuRuz, 2017). Evidence-based nursing competencies have been praised and mandated as the heart of evidence-based nursing (EBNP) (Pierce, 2020). The recent emphasis in the KSA is for a health care system that is up to date, trustworthy, and offers quality-guaranteed services (Hasheesh & AbuRuz, 2017). The dynamics for high-quality nursing care have begun to be increasingly substantial in the Saudi Health Care System (SHCS) (Hasheesh & AbuRuz, 2017; Mohammed Hamdan et al., 2020). Considering nursing paradigms shift to evidence-based care, Saudi nursing professionals have launched significant efforts to establish their own existence in the evidence-based world (Hasheesh & AbuRuz, 2017).

However, despite widespread demands to incorporate evidence-based principles in clinical practice, evidence-based implementation has been slow and inconsistent (Cheng, Feng, et al., 2017; Ellis, 2019; Alqahtani et al., 2020). Worldwide, several studies conducted in a variety of countries showed that the application of the evidence-based approach is a complex activity (Al-Momani et al., 2016; Ellis, 2019; Abuejheisheh et al., 2020; Alqahtani et al., 2020). Therefore, to understand the multifaceted evidence-based practice implementation process, it is necessary to investigate factors that enable successful evidence-based implementation (Ellis, 2019).

Previous studies have tackled the multitude of influencing personal and organizational factors on evidence-based practice implementation (Leung et al., 2016; Cheng, Broome, et al., 2017). Cheng, Broome, et al. (2017) and Leung et al. (2016) found that lack evidence-based knowledge and skills, such as the skills of clinical question identification and formulation, relevant evidence searching, critical literature appraisal, and evidence integration and implementation. However, other researchers found that knowledge and skills are not necessarily enough to engage nurses in the process of evidence-based nursing application (Hasheesh & AbuRuz, 2017; Alqahtani et al., 2020). Pierce (2020) highlighted the importance of attitudes in changing nursing practice.

Building on the work of previous researchers, there have been numerous studies conducted to examine the impact of personal factors such as evidence-based competencies, attitudes, and beliefs related to the evidence-based application (Farokhzadian et al., 2015; Leung et al., 2016; Cheng, Broome, et al., 2017).

Recently, literature has gradually shifted from personal factors to organizational factors (Williams et al., 2015; Ellis, 2019; Lizarondo et al., 2019; Boltz et al., 2020). The literature identified potential organizational barriers that impact nurses' ability to promote and maintain evidence-based approach, that is, (a) lack of time, (b) lack of staff/ administrative support, (c) resources deficiency, (d) absence of autonomy and power to change practice and (e) resistance to change (Williams et al., 2015; Al-Momani et al., 2016; Johnston et al., 2016; Cheng, Broome, et al., 2017).

On the other hand, Duncombe (2018) identified potential organizational facilitators that enhance nurses' ability to promote and maintain evidence-based approach, that is, (a) managerial support, (b) accessibility to articles, (c) comprehension of scientific research, (d) availability of time to read and utilize research results, and (e) adequate authority over practice (Duncombe, 2018). Bearing in mind the sophisticated nature of the evidence-based nursing practice, manipulating only personal factors might not be adequate to promote the evidence-based application.

Hence, the assessment of personal and organizational factors on several levels simultaneously is essential to study their complex interactions (Cheng, Broome, et al., 2017). A large body of literature has discussed a wide range of factors that have a great influence on EBNP; these include as perceived by registered nurses : (a) evidence-based practice competencies (Connor et al., 2017; Hasheesh & AbuRuz, 2017), (b) evidence-based practice beliefs (Cruz et al., 2016; Laske & Kurz, 2019), and (c) evidence-based practice facilitators and barriers (Johnston et al., 2016; Spooner et al., 2018; Lizarondo et al., 2019). Although considerable literature examining factors influencing the implementation of EBNP in clinical practice is widely present internationally (Barako et al., 2012; Bostrom et al., 2013; Farokhzadian et al., 2015; Kim et al., 2015; Park et al., 2015; Cheng, Broome, et al., 2017; Connor et al., 2017), only a few studies had been conducted in Saudi Arabia to address those factors (Cruz et al., 2016; Hasheesh & AbuRuz, 2017; Alqahtani et al., 2020). In addition, the majority of these studies focused on either personal or organizational factors without considering their complex interaction (Cruz et al., 2016; Hasheesh & AbuRuz, 2017; Alqahtani et al., 2020).

Moreover, there is still a huge gap between nurses' evidence-based knowledge and what is truly done in recent nursing practice (Cheng, Broome, et al., 2017). Therefore, it is essential to identify all potential factors that could interfere with evidence-based practice implementation (Johnston et al., 2016; Kang & Yang, 2016; Connor et al., 2017). To date, only one study has used a conceptual model to explain the predictive effect of a limited set of organizational and personal factors (De Pedro Gomez et al., 2012). Comprehensive assessment of these factors using a valid conceptual model can help develop appropriate interventions to promote evidence-based practice in clinical practice. To our best knowledge, a valid conceptual model that adequately explains a set of factors associated with the application of evidence-based practice has not been available. Therefore, the aims of the current study were to generate and validate a model of factors significant to and predictive of the application of evidence-based practice.

Conceptual Model Development

The current study used a hypothetical conceptual model that was derived from previous literature (Park et al., 2015; Al-Momani et al., 2016; Hellier & Cline, 2016; Cheng, Broome, et al., 2017) and a concept analysis study that

investigated the hypothetical relationships between the antecedents, attributes, and the consequences of evidence-based practice implementation (Chiwaula et al., 2018).

According to the literature, five essential domains were recognized to influence the evidence-based implementation. The review identified nurses' competencies, beliefs, facilitators, barriers, and contextual attributes as important domains. These five domains create the conceptual model structure. In the Oxford dictionary, competence is described as "the ability to do something well"; beliefs as "a strong feeling that something is true"; facilitator is defined as "person or (factor) who (which) helps somebody do something more easily by discussing problems, giving advice, etc. rather than telling them what to do"; barrier is described as "problem, rule or situation that prevents somebody from doing something, or that makes something impossible"; and implementation as "the process of putting a decision or plan into effect; execution" (Stevenson, 2010).

These definitions relate to the conceptual model as follows: competence reveals a nurse's cognitive ability to perform a task, incorporating attributes of knowledge and skill related to EBNP (Leung et al., 2016); beliefs as to endorse the idea that EBNP improves patient outcomes and being confident in one's knowledge or skills about EBNP (Laske & Kurz, 2019); barriers, as all elements that inhibit the nurses' ability to use research evidence in their practice (Johnston et al., 2016); facilitators, as all elements that help the nurses' ability to use research evidence in their practice (Johnston et al., 2016); and implementation, as the application of evidence-based process steps (Connor et al., 2017). These factors are related to each other and may work together to affect the application of evidence-based practice (Hellier & Cline, 2016). In addition, some factors contain several interrelated sub-factors (contextual factors) that must be considered (Chiwaula et al., 2018). The current study used a researcher-constructed structural model (See **Figure 1**).

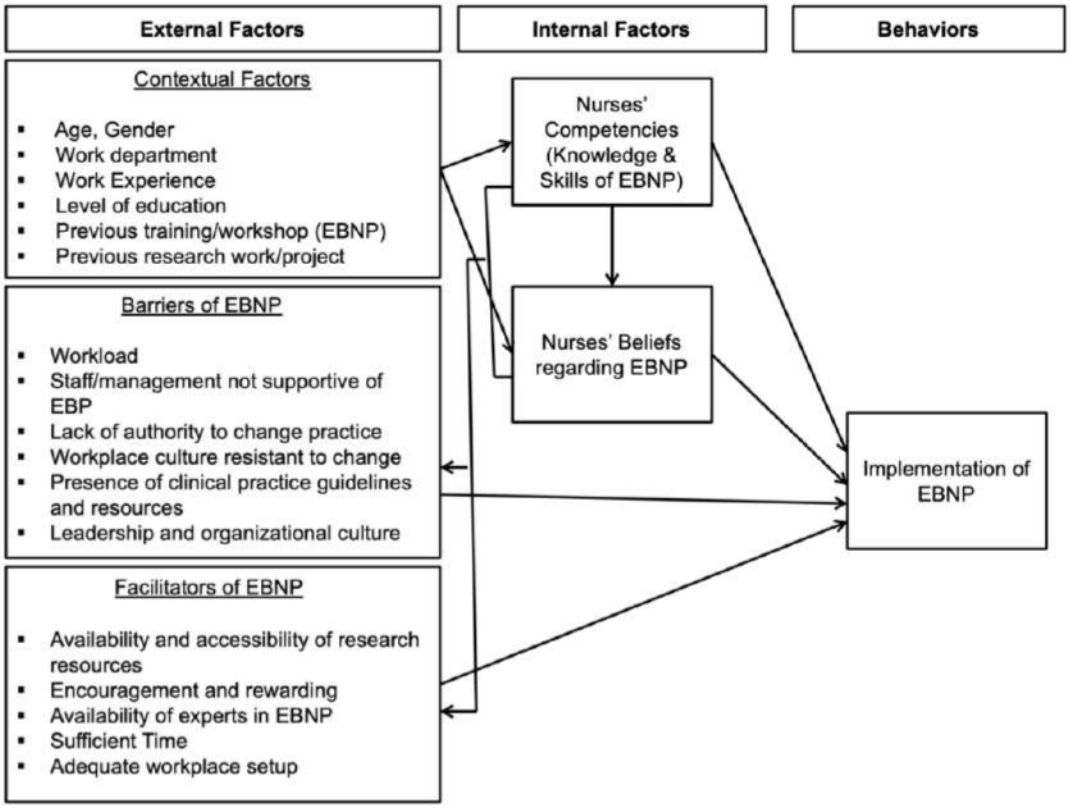

Figure 1 Structural model of personal and organizational variables related to evidence-based practice implementation

This model is composed of five domains (evidence-based practice barriers, facilitators, competence, beliefs, and contextual variables) that might impact the application of evidence-based practice. Contextual factors are presented in seven variables (age, gender, department, experience, education, previous training/workshop, and previous research work).

Methods

Design

A descriptive (cross-sectional) design was used in the current study. Structural equation modeling (SEM) is used to estimate causality and relationships of multiple independent and dependent variables simultaneously. This

method also aids in identifying direct, indirect, and total effects (Schermelleh-Engel et al., 2003).

Sample and Setting

Six hundred and twelve registered nurses were enrolled using a convenience sampling procedure from four hospitals. The author used an algorithm calculator invented by Westland (2010) to compute the required sample size; assuming (β= .80), (α=.05), medium effect size (f^2 = .3), and five latent factors would require at least two hundred subjects to discover the effect (Westland, 2010). The study sample included registered nurses from the in-patient surgical, medical, and critical care units, having previous clinical experience of more than twelve months, and consenting to join. Contacting representatives with hospitals approached and screened the subjects for eligibility.

Instrument

A two-part self-report questionnaire was used to collect data. The first part of the questionnaire was used to gather information on contextual variables such as level of education, age, gender, experience, department, exposure to previous evidence-based practice training/workshop, and conducting or participating in any previous research project/activity.

Evidence-based competencies, beliefs, facilitators, barriers, and implementation were measured using Registered Nurses' Competencies, Beliefs, Facilitators, Barriers, and Implementation of Evidence-based Practice Questionnaire (EBP-CBFRI Questionnaire) developed by Abuadas et al. (2021). The questionnaire is composed of 55-items distributed within five subscales; perceived competencies (14 items), beliefs (10 items), facilitators (9 items), barriers (10 items), and implementation (12 items). Each item was scored on a 5-point Likert-type format, ranging from 1 (strongly disagree) to 5 (strongly agree). The overall validity of the questionnaire was established based on the S-CVI score, which was .92. As well as, the I-CVI confirmed that all items were scored as acceptable (values ranged from .83-1.00). Cronbach's alpha was .87 for the overall questionnaire and ranged between .92 and .95 for all five subscales. All the corrected item-total correlations were found to be >.30 and ranged from .66 to .78. The EBP-CBFRI questionnaire had good internal reliability and validity since it showed satisfactory evidence of content, construct, convergent, and discriminant validity when used with registered nurses in Saudi Arabia (Abuadas et al., 2021).

Data Collection

Permission was obtained from hospital administrators prior to data collection. Data were collected between November 2019 and January 2020 in the inpatient medical-surgical units and critical care units. After receiving permission, data collectors approached the nurses in their wards. Nurses approved to take part were given the questionnaires enclosed with the consent form. Finally, the data collectors gathered the completed questionnaires after allowing adequate time for subjects. On average, it took about 25 minutes to complete the whole questionnaire.

Data Analysis

Participants' demographic characteristics frequencies, percentages, means, and standard deviations were described using descriptive statistics. Structural equation modeling was used to find the direct, indirect, and total effects of the contributing factors and build a preliminary hypothetical model of evidence-based practice implementation among the nurses. Relationships between the variables/factors were estimated using Pearson's correlation coefficients. Maximum likelihood estimation was used to estimate parameters and test the path validity. The current study used the thresholds of fit recommendations for Schermelleh-Engel et al. (2003) to assess the model fit as follow: (i) a critical ratio (CR) >1.96 of factor loadings, (ii) relative Chi-Square (χ2/df) ≤5, (iii) the normed fit index (NFI) and the comparative fit index (CFI) ≥.85, (iv) adjusted goodness of fit index (AGFI) and the goodness of fit index (GFI) ≥.85, (v) the standardized root mean square residual (RMR) and root mean square error of approximation (RMSEA) ≤.08 (Schermelleh-Engel et al., 2003). Prior to the model development, the author checked for normality, independence, and homoscedasticity. Random missing data were replaced using the case mean imputation approach.

Ethical Considerations

Approval from the Institutional Review Board (IRB) was attained prior to data collection (the approval no. HA-06-B-001 ECM#2019-44). At the beginning of the survey, detailed written information was provided, and the participants were informed that the participation was voluntary and anonymity was maintained. The consent form was enclosed with each questionnaire.

Results

Characteristics of Participants

The current study showed a response rate of (77%); a total of 612 nurses returned completed questionnaires. The mean age was 31.86 years and a standard deviation of 6.79 years. The standard deviation ranged between 24 and 45 years. In addition, the participants consisted of females (57%) and 4males (43%). Nurses' experience mean was 6.73 years with a standard deviation of 2.39 years. The bulk of the sample underwent undergraduate education (84.5%). Being engaged in previous evidence-based workshops or training was reported in more than half of the participants (69.8%). Regarding the engagement in medical or nursing research studies, only a few participants (25.3%) were involved in medical or nursing-related studies throughout the past years (See **Table 1**).

Table 1 Participants' characteristics (*N* = 612)

Variables	*N*	%
Gender		
Male	263	43%
Female	349	57%
Level of education		
Bachelor level	517	84.5%
Master level	95	15.5%
Department		
Medical floors	112	18%
Surgical floors	125	20%
Orthopedic floors	49	8%
Maternity floor	59	10%
Pediatric floors	65	11%
Critical care units	105	17%
Emergency units	97	16%
Engagement in previous EBNP training/workshop		
Yes	427	69.8%
No	185	30.2%
Engagement in previous nursing or health research		
Yes	155	25.3%
No	457	74.7%
Age (years)	Mean ± SD (31.86 ± 6.79)	
Years of experience	Mean ± SD (6.73 ± 2.39)	

†SD, standard deviation, % percentage

Evidence-based implementation showed moderate significant correlation with facilitators, barriers, and competencies variables; having the strongest correlation with facilitators (r = .57, p < .01), followed by competencies (r = .48, p < .01) and barriers (r = - .39, p < .01). Weak significant correlations were found between belief variable and implementation (r = .38, p < .01) (See **Table 2**).

Table 2 Main study variables correlation matrix (*N* = 612)

No.	Variable/ variable	1	2	3	4	5	6	7	8	9	10	11	12
1	Age	1											
2	Gender	.13**	1										
3	Education	.16**	-.02	1									
4	Experience	.46**	-.02	.22**	1								
5	Department	-.11**	-.09*	-.14*	-.12**	1							
6	Workshop	.04	-.12**	.28**	.07	-.13**	1						
7	Research	-.09*	-.12**	.13**	-.07	-.09*	.08*	1					
8	Competency	-.04	.01	.22**	.13**	-.07	.23**	.13**	1				
9	Beliefs	.05	-.06	.18**	.15**	-.01	.23**	.13**	.16*	1			
10	Facilitators	-.04	-.05	.26**	-.02	-.07	.24**	.15**	.48**	.11**	1		
11	Barriers	.02	-.04	.01	.03	.02	-.16*	.03	-.35*	-.17**	-.39*	1	
12	Implementation	-.07	-.06	.15**	-.07	-.04	.37**	.32**	.48**	.38**	.57**	-.39**	1

*p < .05; **p < .001

Testing the preliminarily hypothesized model

Preliminarily hypothesized model fit criteria (See **Figure 2**) showed a poor fit: (χ2/df = 2.892, p < .001, RMSEA = .063, GFI = .772, AGFI = .752, CFI = .871). After evaluating modification indices and parameter estimates, numerous paths were non-significant; subsequently, they were removed in order to make the measurement model more theoretically parsimonious. Likewise, age, gender, and department factors were removed.

Testing the modified stable model

The modified stable model presented in **Figure 3** indicated improved fit indices than the preliminarily model: (χ2/*df* = 2.29, CFI = .94, RMSEA = .05, GFI = .90, AGFI = .88, CFI = .93).

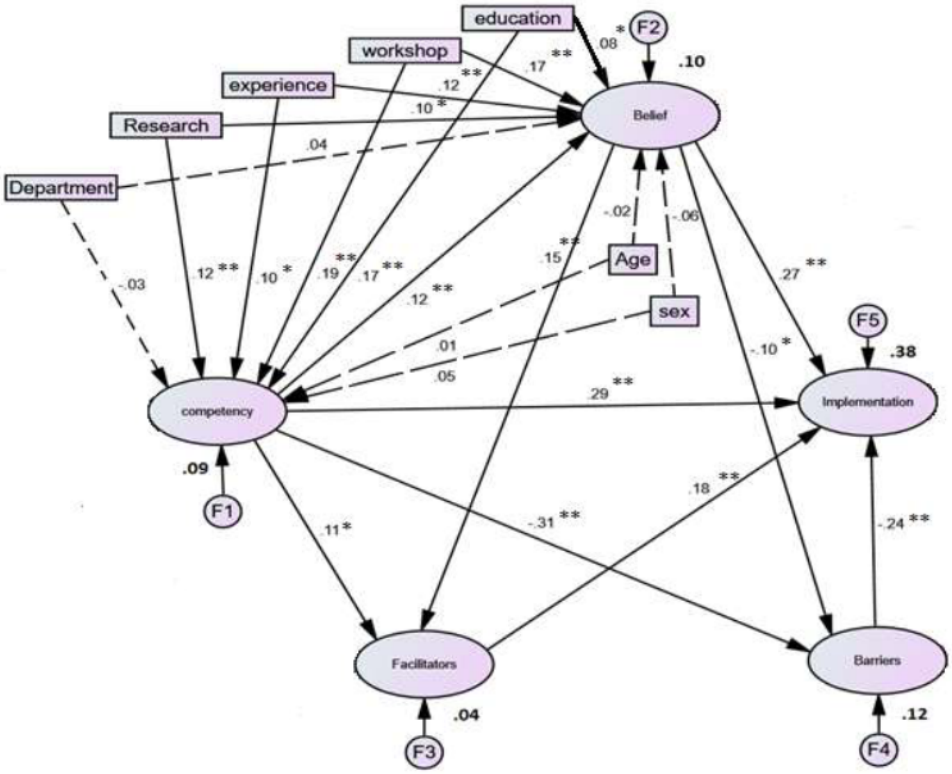

Figure 2 The initial preliminarily model predicting implementation of evidence-based practice; † dotted lines denote insignificant paths. ‡All regression estimates are standardized β coefficients. * $p < .05$, ** $p < .001$.

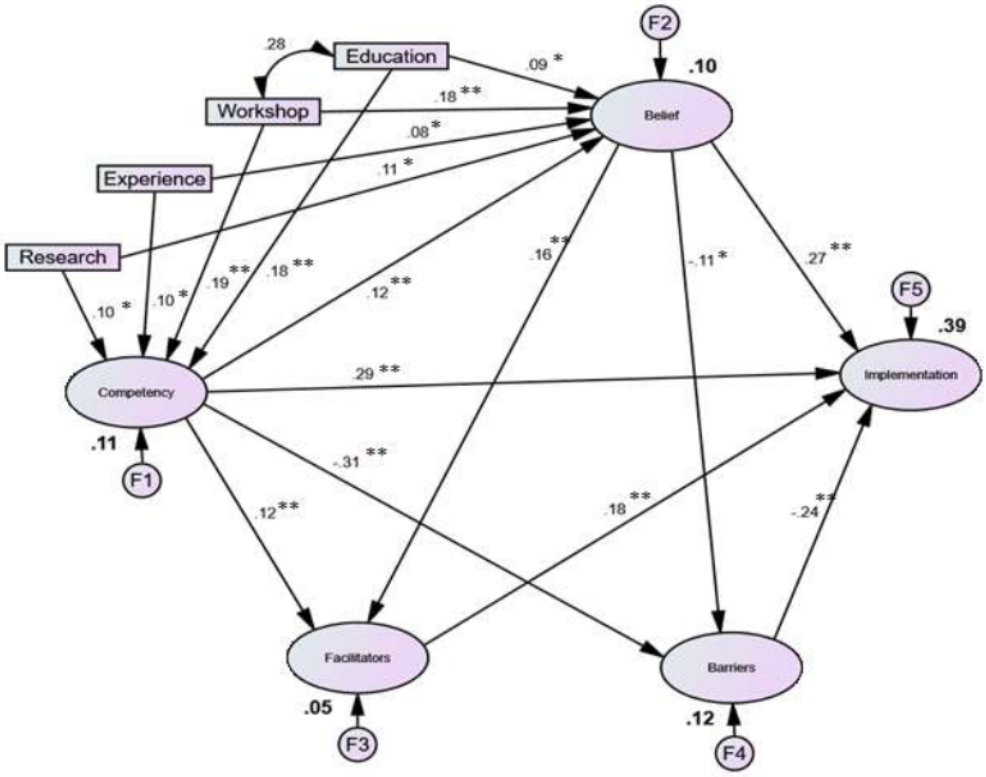

Figure 3 The modified stable model predicting implementation of evidence-based practice; †All regression estimates are standardized β coefficients. * $p < .05$, ** $p < .001$.

Factors influencing implementation of evidence-based practice

The influencing factors on evidence-based practice implementation for nurses were specified (**Table 3** and **Figure 3**). Explicitly, evidence-based practice implementation was significantly influenced by nurses' competency (β = .29, p < .001), beliefs (β = .27, p < .001), EBNP barriers (β = -.24, p < .001), and facilitators (β = .18, p < .001). The nurses' competency was most strongly related to evidence-based practice implementation. In total, the four factors explained 38.75% of the variance in evidence-based practice implementation.

The study findings show that nurses' competency had a direct positive effect and indirect effect via nurses' belief in evidence-based practice implementation. Similarly, beliefs had a direct positive effect and indirect effect via facilitators on evidence-based practice implementation. Greater barriers, in turn, predicted lower evidence-based practice implementation scores. In contrast, higher facilitators predicted higher evidence-based practice implementation scores. Both barriers and facilitators had only a direct effect on evidence-based practice implementation.

In addition, the influence of contextual factors (nurses' educational level, years of experience, attending EBNP workshops, and research conduction) on both nurses' competency and beliefs was examined. Nurses' competency was significantly influenced by attending evidence-based workshop (β = .19, p < .001), education level (β = .18, p < .001), years of experience (β = .10, p < .05), and previous research work (β = .10, p < .05). Attending evidence-based workshop was most strongly related to competency. Altogether, the four factors explained 10.9% of the variance in competency. Likewise, beliefs of the nurses was significantly influenced by attending evidence-based workshop (β = .18, p < .001), competency (β = .12, p < .001), previous research work (β = .11, p < .001), education level (β = .09 p < .05), and years of experience (β = .08, p < .05). Attending evidence-based workshop was most strongly related to beliefs. In total, these five factors explained 10.1% of the variance in competency (See **Table 3**).

Table 3 Summary of the total, direct, and indirect effects of variables in the modified stable model (N = 612)

Outcome variables	Independent variables	β	Standardized effects			Squared multiple correlations
			Direct effect	Indirect effect	Total effect	
Implementation	Competency	.29	.29**	.14	.43**	.39
	Beliefs	.27	.27**	.05	.33**	
	Barriers	-.24	-.24**		-.24**	
	Facilitators	.18	.18**		.18**	
Barriers	Competency	-.31	-.32**	-.01	-.33**	.12
	Beliefs	-.11	-.11*		-.11*	
Facilitators	Beliefs	.16	.16**		.16**	.05
	Competency	.12	.12**	.02	.14**	
Beliefs	Workshop	.18	.18**	.02	.20**	.10
	Competency	.12	.12**		.12**	
	Research	.11	.11*	.02	.13**	
	Education	.09	.09*	.02	.11*	
	Experience	.08	.08*	.02	.10*	
Competency	Workshop	.19	.19**		.19**	.11
	Education	.18	.18**		.18**	
	Research	.10	.10*		.10*	
	Experience	.10	.10*		.10*	

*p < .05; **p < .001

Discussion

The study aimed to generate and validate a structural prediction model with the outcome of nurses' implementation of evidence-based practice. The socio-demographic and personal profiles of the participants in this study were similar to those in previous studies exploring nurses' competencies and beliefs regarding implementing evidence-based nursing practice within health care organizations (Hasheesh & AbuRuz, 2017; Verloo et al., 2017). Developing and validating a new conceptual model to assess multiple essential factors related to evidence-based practice implementation arose from the fact that most previous literature studied single or combinations of two or three factors without considering the sophisticated nature of evidence-based practice implementation (Squires et al., 2011; Cheng, Broome, et al., 2017).

The final model accounted for 39% of the variance of evidence-based practice implementation, which represented a large effect size (Cohen, 1992). However, a significant portion of variance remains undetermined, suggesting there are additional factors unaccounted for. Results of the current study confirm that the proposed model could be appropriate for this extended set of factors, as nurses' competency, beliefs, facilitators, and barriers have a significant impact on nurses' evidence-based practice implementation (See **Figure 3**).

In the modified stable model, competencies and beliefs of the nurses were the main predictors for nurses'

implementation of evidence-based practice. In addition, both factors were influenced by contextual factors, mainly the evidence-based workshops and training programs. Similarly, several researchers found significant positive associations of nurses' competencies and beliefs with evidence-based practice implementation (Barako et al., 2012; Bostrom et al., 2013; Park et al., 2015; Cheng, Broome, et al., 2017; Alqahtani et al., 2020). Moreover, the current study indicated that nurses' beliefs partially mediated the relationship between nurses' competency and evidence-based practice implementation. Similarly, this result was congruent with a recent study conducted in KSA that found the same mediation effect (Alqahtani et al., 2020).

Other investigators found that the contextual factors (educational level, experience EBNP workshops or training program, and conducting research) were positively and significantly associated with the uptake of evidence-based practice (Barako et al., 2012; De Pedro Gomez et al., 2012; Farokhzadian et al., 2015; Hellier & Cline, 2016; Pereira et al., 2018). In addition, Alqahtani et al. (2020) found that both receiving evidence-based training and participation in research activity can influence the nurses' knowledge. Moreover, Heydari et al. (2014) examined nurses' competencies, beliefs, and implementation of evidence-based practice and found a significant positive correlation between educational levels and knowledge levels about evidence-based practice. However, Alqahtani et al. (2020) found that academic level was not associated with evidence-based implementation for Saudi nurses. This finding highlights the need to foster positive competencies and beliefs throughout providing in-hospital evidence-based practice training programs and workshops. Instilling competencies and beliefs in the benefit of evidence-based practice can be strengthened through multifaceted in-hospital evidence-based practice educational programs (van der Goot et al., 2018), which enable nurses to apply evidence-based practice knowledge and skills in practice (van der Goot et al., 2018).

An exciting finding from this study was the non-significant predictive effect of age, gender, and department in the proposed predictive model. This result was consistent with a recent Saudi study (Alqahtani et al., 2020). However, other studies found that increasing age, being female, and magnet status were found to positively and significantly impact evidence-based practice implementation scores (Hellier & Cline, 2016; Kim et al., 2016). This could be attributed to the variations in sample characteristics and settings. Although evidence-based practice competencies and beliefs were the chief predictors for nurses' evidence-based implementation, barriers and facilitators also had a significant and direct impact on the outcome, thus highlighting the importance of the external organizational factors. Consistently, most studies about evidence-based practice discussed the impact of facilitators and barriers on the implementation of evidence-based practice (Johnston et al., 2016; Duncombe, 2018; Spooner et al., 2018; Lizarondo et al., 2019).

The current study presents the following limitations: (i) the results were taken from a convenient sample from various nationalities; there was probably a bias due to cultural diversities. Hence, the generalization of the results must be made carefully. Replication of the study with a larger, randomized sample in various regions and nursing settings is a necessity to increase the generalizability of the findings. (ii) Additional limitation was the use of self-report questionnaires; thus, over-estimation of evidence-based competency, beliefs, and implementation is probable. Further research is recommended to include more factors like self-efficacy and confidence and their relation to nurses' implementation of evidence-based practice.

Implications for Nursing Practice

The findings from the current study can lead the international efforts for nursing professionals to better comprehend the extent to which personal and organizational factors influence the implementation of evidence-based practice among registered nurses worldwide. The developed conceptual model may direct international future nursing research. Furthermore, this study implies that registered nurses need to improve their competencies, beliefs, and implementation of evidence-based practice. Also, the findings will help to lighten the hidden effects of organizational facilitators and barriers. Therefore, medical institutions, nursing front-runners, and policymakers might benefit from building up strategies and policies to promote registered nurses' implementation of evidence-based practice through continuing education and mentoring programs about evidence-based practice.

In addition, national interventional programs should be developed and implemented to overcome the hidden organizational barriers and enhance evidence-based organizational facilitators. Decision-makers must place a high priority on the promotion of evidence-based practice if patients are to receive the best evidence-based care. This requires that evidence-based practice be tackled at the organizational as well as governmental levels if it is to be maintained.

Conclusion

The findings have highlighted the significant influence of nurses' evidence-based competencies, beliefs, facilitators, barriers, and contextual factors toward nurses' implementation of evidence-based practice. The developed model has the potential to support the transition of evidence-based practice competencies and beliefs to actual clinical behaviors; to meet professional necessities toward evidence-based practice; nevertheless, additional model validation is required. Further research is also advised to recognize other discipline-specific, personal, behavioral, and contextual factors that were not captured, as identified by the amount of model variance. Furthermore, this study presents the health authorities and nurses responsible for planning and providing evidence-

based health services with insights into how to enhance evidence-based practice in KSA strategically. Therefore, interventions to increase the nurse's competencies in evidence-based practice are needed. Educative training and in-hospital orientation programs that focus on the enhancement of competencies and health beliefs regarding evidence-based practice are required to promote the practice of evidence-based practice.

Declaration of Conflicting Interest
The author declares that they have no conflict of interests.

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Author's Contribution
The author solely contributed to every aspect of the study.

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Data Availability Statement
The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Perceptions of nurse managers and staff nurses regarding Technological Competency as Caring in Nursing theory in general hospitals in Japan

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Abstract

Background: Nurses as primary healthcare providers demonstrate quality nursing care through competencies with healthcare technologies, while nurse managers assume the primacy of managing quality healthcare in their respective care settings. However, little is known about perceptions of the influence of care technologies on their nursing practice.

Objective: This study aimed to determine managers' and staff nurses' perceptions regarding the Technological Competency as Caring in Nursing (TCCN) theory in general hospitals in Japan.

Methods: This study employed a cross-sectional survey design, with 421 participants selected using a stratified sampling method. Technological Competency as Caring in Nursing Instrument–Revised (TCCNI-R) was used for online data collection using Survey Monkey©. Data were analyzed using Welch's t-test and ANOVA.

Results: Nurses with years of experience within the range of 20 to less than 30 years showed the highest TCCNI-R scores among the two groups. Nurses who had received education on caring in nursing showed significant differences for Factor 2 (Technological Competency as Caring), that of expressing Technological Competency as Caring. Three other factors showed no significant difference, namely in Factor 1 (Nursing Expression as Caring), Factor 3 (Technology and Caring), and Factor 4 (Technological Knowing). However, the average scores of these factors were high, which reflect high professional ethics and occupational discipline and increased awareness of caring in nursing. It was also found that the nurse managers were more aware of the TCCN than were the staff nurses. The nurse managers were also more aware of providing care using technology, recognizing the need-to-know patient needs through technology and providing care to the ever-changing patient's condition.

Conclusion: The study discovered that continuing education is needed regarding the practice of nursing based on theory, enabling appropriate and accurate understanding of practicing knowing persons as caring in nursing.

Keywords

advanced technologies; caring in nursing; in-service education; technological competency; nurse administrators; nursing staff; Japan

The rapid development of technology has affected hospitals to improve the quality of healthcare service (Juhana et al., 2015). The theory of Technological Competency as Caring in Nursing (TCCN) developed by Locsin (2005) illuminated the harmonious coexistence between technologies and caring in nursing through

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technological knowing, mutual designing, and participative engaging (Locsin, 2017). The items of the TCCNI were developed through the TCCN theory. The theory of TCCN has been examined among different groups of nurses in several countries, for example, nursing professionals in Spain (Rincón-Álvarez & Chaparro-Díaz, 2017), ICU nurses in Japan (Kato et al., 2017), and ICU nurses in Bangladesh (Biswas, 2016). However, only a limited number of studies were found that specifically examine the extent to which TCCN is recognized by nurse managers (Kato et al., 2017). To measure the nurses' technological competency, the Technological Competency as Caring in Nursing Instrument (TCCNI) was developed by Parcells and Locsin (2011).

The items in the Technological Competency as Caring in Nursing Instrument–Revised (TCCNI-R) were theoretically derived from the understanding of the TCCN theory formulated by Tanioka (2018). The TCCNI-R can be used in both the Japanese and English languages, and it has been confirmed for its reliability and validity (Yokotani et al., 2021). However, in that study, the population consisted of general nurses working in a limited area in Japan. Alternatively, technology-related studies conducted among nurse managers frequently discuss nursing informatics, such as electronic information systems (Lammintakanen et al., 2010) and utilizing informatics (Gunawan et al., 2020).

The coexistence of technology and caring is best exemplified in nursing. Recently, these technologies have become fundamental to the delivery of quality human healthcare now and in the future (Locsin, 2017; Nakano et al., 2019; Locsin, 2020). Complex health problems demand a highly skilled response that mobilizes teams of professionals from various disciplines.

When the engineering lens is expanded to include the practical perspective of nursing, opportunities emerge for greater technology-nurse interface and subsequent innovation. However, important patient care improvement opportunities are missed when nurses are not actively engaged in patient care device innovation and creation (Glasgow et al., 2018). In addition, the quality of nursing care can be valued based on how nurses practice their nursing as caring and on their technological competency in practicing their care (Croke, 2020).

As nurses are at the front liner of care providers in healthcare institutions, the quality of nursing care, including nursing competency in terms of technology, plays a significant role in influencing healthcare service. Nurse managers have an essential role in controlling the quality of nursing services (Tanioka et al., 2011). Also, managers' time spent, engagement, and work can influence the quality and safety of clinical outcomes, processes, and performance (Parand et al., 2014). Excellence in nursing care will not occur without the development of genuine shared working partnerships and collaborations between nurse managers, leaders and educators, and their associated organizations (McSherry et al., 2012). Nurses work with various technologies; however, they may not be aware of them. In addition, as the experience of nurses increases, the experience of caring for patients and their families increases as well, and awareness of caring may increase. Furthermore, the nurse manager influences the staff nurse's view of nursing. Therefore, there is a distinct possibility that nurse managers' awareness of nursing as caring is high.

Caring is the basis of nursing, and in order to gain a deeper understanding of the TCCN among the technologies that are advancing day by day, it is important to educate stakeholders about the TCCN. However, little is known about the differences in terms of the years of nursing experience, the experience of receiving education on TCCN, and their position. Nurse managers' perception of caring in nursing reflects promoting enhanced patient understanding, thereby fostering quality nursing care management focused on patient-centered care and improving quality nursing care services. Thus, their thinking and behavior are thought to influence the thinking and behavior of nursing staff.

This study aims to determine managers' and staff nurses' perceptions regarding the theory of TCCN in general hospitals in Japan.

Methods

Study Design

This is a cross-sectional study with a web-based questionnaire survey using the TCCNI-R.

Settings and Samples

The study settings were 11 general hospitals in Chugoku-Shikoku district, Japan. These hospitals have 200 or more in-patient beds. The sample of the study was selected based on the following inclusion criteria: a) currently employed as nurse managers and staff nurses; b) practicing in a private or public healthcare system or both; c) qualified and registered to practice nursing; d) agreed to participate in the survey; e) nurse managers included the director of nursing, vice director of nursing, head nurse, and chief nurse; and f) nursing staff was registered nurses (RNs) only. Excluded from the study were professionals who were ineligible to participate in the survey, such as nursing students who decided to quit the study at any stage and for any reason.

For sample size estimation, the researcher performed a statistical power analysis. The effect size in this study is considered large using Cohen (1988) 's criteria. With an $\alpha = 0.05$ and power = 0.80, the projected sample size needed with effect sizes (G*Power 3.1.9.7) (Faul et al., 2007) reflected values for the t-test (N = 128), for the one-way analysis of variance (N = 200) and for correlation coefficient (N = 82). Therefore, the sample size was adequate for the main objective of this study. The data were collected using a stratified sampling method in which 20% was allocated to each group who were within the age range of 20 to 60 years old.

Instrument

The TCCNI-R was used to evaluate the participants' perception of TCCN. TCCNI-R utilizes a 5-point Likert scale measurement with values ranging from 1 as "Strongly Disagree" to 5 as "Strongly Agree." Former TCCNI-R has 25 items. In this study, we used the 19 items version with the original numbers of items based on confirmatory factor analysis results of the study by Yokotani et al. (2021). This instrument is available in Japanese and English. The Japanese version was used in this study.

Exploratory factor analysis, confirmatory factor analysis, and Cronbach's alpha coefficient established validity and reliability. The root means square error of approximation (RMSEA) showed less than or equal to about 0.08, indicating the result as having a reasonable approximation error. The covariance structure analysis with a causal model revealed that the structural theory of TCCN had similar causal relationships to the model that has been hypothesized (Yokotani et al., 2021). The authors had obtained permission from its creator to use TCCNI-R in this study.

Data Collection

The 11 general hospitals in Chugoku-Shikoku Island, Japan, introduced a category of general care wards for advanced care, with a higher staffing standard, a patient-to-nurse ratio of 7:1. The "7:1" nursing placement standard is an accurate placement, with one nurse assigned to every seven patients on average over 24 hours. In addition, it is obligatory to display information on the number of nursing staff working during the day, evening, and night in each ward (Morioka et al., 2017; Japanese Nursing Association, n.d.). Those hospitals were contacted to obtain permission from their respective management administrators for their nurse managers and staff to participate in the survey. Survey Monkey© platform was used for this survey. The survey was conducted from October to December 2019. The researcher provided a letter of invitation to participate and disseminated information about the study together with the Survey Monkey URL to the Nurse Managers who agreed to distribute the document containing the URL for participants to access the survey instrument. After permission was obtained, a briefing document containing the URL of the questionnaire was distributed to nurse managers in each hospital. The document package included information for nurses' cooperation in this survey. The nurse managers at each hospital distributed the survey briefing documents to their respective staff.

Data Analysis

This study tested the following hypotheses: a) Nurses with years of nursing experience show a high perception of TCCN, b) Nurses with experience of receiving education on caring in the nursing show a high perception of TCCN, and c) Nurse managers show a high perception of TCCN.

From the Survey Monkey© data, only 421 responses could be used for the study. Excluded were questionnaire responses that had missing data. Statistical analysis was conducted using IBM SPSS Version 21 (IBM Institute, Chicago, USA) and R (version 3.6.2, R Foundation for Statistical Computing, Vienna, Austria).

The mean and standard deviation with a 95% confidence interval (95% CI) was calculated. The ceiling and floor effects for each question item were confirmed with the basic statistics. Descriptive statistics were used to describe the gender, age, the experience of receiving education on caring in nursing (respondents judged whether they experienced receiving education on caring in nursing based on their subjectivity), employment position, length of experience as an RN, and educational background.

The mean for each factor of the TCCNI-R was calculated: Welch's t-test was used to determine differences by the experience of receiving education on caring in nursing, and employment position (nurse manager or staff nurse); Welch's analysis of variance (ANOVA) with posthoc tests of Games-Howell was used to determine the differences by the length of experience as an RN. To identify significant differences between specific groups, a pairwise comparisons post hoc test was performed. Games-Howell's multiple comparison method is appropriate when using Welch's ANOVA. The level of statistical significance was set at $p<0.001$. Statistical analyses were conducted using IBM SPSS Version 24 (IBM Institute) and R (version 3.6.2, R Foundation for Statistical Computing). The level of statistical significance was set at $p < .001$.

Ethical Consideration

Ethical approval was obtained from the Ethics Review Committee of Tokushima University Hospital (Approval Number 2914-3). When participants accessed the URL, information was made available about this study. This information included the details of the research and a request for their agreement or permission to participate and collect personal data. Participation was voluntary, and no penalty would be imposed if they decided to quit the study at any time. Personal information was kept confidential. All respondents' data were secured in the researcher's computer that was also accessible only through a password known only by the main researcher.

Results

Demographic characteristics are presented in **Table 1**. Participants' employment positions were nurse manager (22.8%) and staff nurse (77.2%). In the nurse managers` group, the length of experience as RN was 1- less than 5 (Years) (0%), 5- less than 10 (2.1%), 10- less than 20 (13.5%), 20- less than 30 (46.9%), and more than 30 (37.5%). In the staff nurses` group, length of experience as an RN was 1- less than 5 (18.5%), 5- less than 10 (24.6%), 10- less than 20 (29.8%), 20- less than 30 (17.2%), and more than 30 (9.8%). In the nurse managers, the educational background was Master of Science in Nursing (MSN) (0%), Bachelor of Science in Nursing (BSN) (6.2%),

Associate degree (7.3%), and Advanced Diploma (86.5%). In the staff nurses, MSN (0.9%), BSN (18.8%), Associate degree (8.9%), and Advanced Diploma (71.4%). In the nurse managers, the experience of receiving education on caring in nursing was 24%, and 24.3% in staff nurses.

Table 1 Demographic data of the participants

Items (*N* = 421)		*N*	(%)	*N*	(%)
		Nurse managers		Staff nurses	
		96	**(22.8)**	**325**	**(77.2)**
Gender	Male	6	(6.2)	31	(9.5)
	Female	90	(93.8)	294	(90.5)
Age (Years)	20-29	0	(0)	105	(32.3)
	30-39	8	(8.3)	88	(27.1)
	40-49	36	(37.5)	72	(22.2)
	more than 50	52	(54.2)	60	(18.5)
Length of experience as a registered nurse (Years)	1- less than 5	0	(0.0)	60	(18.5)
	5- less than 10	2	(2.1)	80	(24.6)
	10- less than 20	13	(13.5)	97	(29.8)
	20- less than 30	45	(46.9)	56	(17.2)
	more than 30	36	(37.5)	32	(9.8)
Educational background	Master of Science in Nursing	0	(0.0)	3	(0.9)
	Bachelor of Science in Nursing	6	(6.2)	61	(18.8)
	Associate degree	7	(7.3)	29	(8.9)
	Advanced diploma	83	(86.5)	232	(71.4)
Experience of receiving education on caring in nursing	Received	23	(24.0)	79	(24.3)
	Not received	73	(76.0)	246	(75.7)

Table 2 shows the mean, standard deviation, and 95% confidence interval of each item in the TCCNI-R. From those items, several items were identified to have a lower mean than other items. However, the means of those particular items are still in the range from 3 (neutral) to more than 4 (agree). Those items were Q25 (Nurses use technology and caring to facilitate patients` recovery with enhanced self-esteem), Q3 (Nurses must provide care for patients by using necessary technology), Q2 (Nurses are professionals who express caring utilizing technology from the perspective of compassion to patients), and one reverse item Q11 (Nurses must complete their nursing duties within the established timeframe without needing to know the patient's feelings or needs).

Table 2 Mean, standard deviation, and 95% confidence interval of the TCCNI-R

Question number and Items (*N* = 421)		Mean	SD	95% CI	
				LL	*UL*
Factor 1: Nursing Expressions as Caring					
Q17	Nurses must act by carefully listening to the patient's voices and showing compassion for the patient.	4.38	0.74	4.31	4.45
Q16	Nurses must be devoted to meeting the patients' needs, hopes, wishes, and dreams.	4.09	0.85	4.01	4.17
Q14	Nurses must emphasize thoughtful consideration of patients' feelings, giving encouragement and respect to patients.	4.45	0.72	4.38	4.52
Q13	Nursing is caring to maintain patients' lifestyles and allow them to regain their healthy lives.	4.13	0.85	4.05	4.21
Q18	Nurses must consider the patient's stress and anxiety occurring in the nurse-patient relationship.	4.40	0.72	4.33	4.47
Factor 2: Technological Competency as Caring					
Q22	Caring is nurses' involvement with patients and families in ways that allow others to grow together in the nursing situations shared.	4.20	0.74	4.13	4.27
Q23	Nurses use technological competency as an expression of caring in order to know patients and their families.	4.03	0.80	3.95	4.11
Q21	Knowing a patient is understanding the whole patient, always regarding the person as an irreplaceable human being.	4.33	0.73	4.26	4.40
Q25	Nurses use technology and caring to facilitate patients' recovery with enhanced self-esteem.	3.70	0.83	3.62	3.78
Q20	Nurses' competence includes the use of medical technologies from the perspective of being a compassionate person.	4.16	0.75	4.09	4.23
Q19	Knowing a patient is not only focusing on the person's physical aspects but also accurately understanding "who is this person?"	4.38	0.72	4.32	4.45

Table 2 *(Cont.)*

Factor 3: Technology and Caring					
Q3	Nurses must provide care for patients by using necessary technologies.	3.79	0.78	3.72	3.87
Q2	Nurses are professionals who express caring utilizing technology from the perspective of compassion to patients.	3.73	0.82	3.65	3.81
Q4	Nurses must provide nursing care through the harmonious interactions between technology and caring.	4.05	0.78	3.97	4.12
Factor 4: Technological Knowing					
Q11	Nurses must complete their nursing duties within the established timeframe without needing to know the patient's feelings or needs. (R)	3.88	1.20	3.77	4.00
Q15	Nurses do not need to provide nursing care that includes the patients' physical and emotional conditions every moment. (R)	4.52	0.95	4.43	4.61
Q7	Nurses do not care for patients by knowing their health data. (R)	4.36	0.98	4.27	4.45
Q24	Technology is not useful for understanding patients' health conditions. (R)	4.09	0.93	4.00	4.18
Q5	Nurses do not need to consider providing nursing care because each patient's wishes always change. (R)	4.04	0.91	3.95	4.12

SD: Standard Deviation, CI: Confidence Interval, LL: Lower Limit, UL: Upper Limit. (R) reverse scoring; those are negatively worded items (Q5, Q7, Q11, Q15, and Q24) in the TCCNI-R. Likert scale measurement, with values ranging from 1 as Strongly Disagree; 2 Disagree; 3 Neutral; 4 Agree; to 5 as Strongly Agree.

Table 3 Differences in the TCCNI-R scores in the length of experience as RNs and nurse managers (*N* = 421)

Length of experience as an RN (Years)	**a: 1- less than 5 (*N* = 60)**		**b: 5- less than 10 (*N* = 82)**		**c: 10- less than 20 (*N* = 110)**		**d: 20- less than 30 (*N* = 101)**		**e: more than 30 (*N* = 68)**		***F***	***Posthoc***
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**		
TCCNI-R average total score	4.11	0.45	4.01	0.45	4.11	0.42	4.27	0.42	4.20	0.42	4.67 ***	b<d ***
Factors												
F1	4.28	0.56	4.22	0.56	4.25	0.65	4.40	0.55	4.29	0.55	1.56	NS
F2	4.23	0.59	4.01	0.55	4.05	0.54	4.20	0.53	4.21	0.50	2.83	NS
F3	3.82	0.74	3.64	0.75	3.82	0.69	4.01	0.59	3.98	0.65	3.94	NS
F4	3.95	0.84	4.00	0.64	4.22	0.58	4.37	0.60	4.23	0.65	5.25 ***	NS

Welch's Analysis of Variance, Abbreviations: TCCNI-R = Technological Competency as Caring in Nursing Instrument – Revised, SD = Standard Deviation.
F1 = Factor 1 (Nursing Expressions as Caring), F2 = Factor 2 (Technological Competency as Caring), F3 = Factor 3 (Technology and Caring), F4 = Factor 4 (Technological Knowing), NS = Not significant, *** = p<0.001. Post hoc test (Games-Howell).

Table 4 Differences in the average score of the TCCNI-R by the experience of receiving education on caring in nursing, and employment position (*N* = 421)

Experience of receiving education on caring in nursing	**Received (*N* = 102)**		**Not received (*N* = 319)**		***t***	***p***
	Mean	**SD**	**Mean**	**SD**		
TCCNI-R average total score	4.26	0.41	4.11	0.44	3.20	0.002
F1 Nursing Expressions as Caring	4.40	0.59	4.25	0.57	2.26	0.03
F2 Technological Competency as Caring	4.30	0.50	4.08	0.55	3.83	0.00
F3 Technology and Caring	4.01	0.70	3.81	0.68	2.55	0.01
F4 Technological Knowing	4.20	0.79	4.17	0.62	0.37	0.71
Employment position	**Nurse managers (*N* = 96)**		**Staff nurses (*N* = 325)**		***t***	***p***
	Mean	**SD**	**Mean**	**SD**		
TCCNI-R average total score	4.32	0.36	4.09	0.44	5.27	0.00
F1 Nursing Expressions as Caring	4.41	0.48	4.25	0.60	2.72	0.01
F2 Technological Competency as Caring	4.27	0.47	4.09	0.56	3.13	0.002
F3 Technology and Caring	4.04	0.51	3.80	0.73	3.64	0.00
F4 Technological Knowing	4.46	0.48	4.10	0.69	5.81	0.00

Welch's *t*-test, Abbreviations: TCCNI-R = Technological Competency as Caring in Nursing Instrument – Revised,
SD = Standard Deviation, F1 = Factor 1, F2 = Factor 2, F3 = Factor 3, F4 = Factor 4

Table 3 shows the differences in the TCCNI-R scores in the lengths of experiences as RNs and nurse managers. In the average total score, nurses with a length of experience of five to less than ten years showed significantly lower TCCNI-R scores than those with years of experience of 20 to less than 30 years.

Table 4 shows differences in the average score of the TCCNI-R by the experience of receiving education on caring in nursing and employment positions. Those who had been educated on caring in nursing had significantly higher scores in Factor 2 (Technological Competency as Caring). In addition, in the result comparing employment positions, nurse managers show significantly higher

perceptions than staff nurses, except for Factor 1 (Nursing Expressions as Caring) and 2 (Technological Competency as Caring).

Discussion

Nursing experience in years

When considering the length of experience as an RN, nurses with years of experience within the range of 20 to less than 30 years showed the highest TCCNI-R scores among the two groups. This indicated that nurses with a length of experience within 20 to less than 30 years were aware of the necessity of knowing patients as important to nursing. In explaining how years of experience can influence nurses' thinking about caring in nursing, no related literature was found. However, some associated studies were found that examined the relationship between the periods of clinical experience and expressions of caring behavior (Aupia et al., 2018). Kato et al. (2017) revealed that nurses with ten or more years of clinical experience obtained a significantly higher score regarding the practice of nursing based on the theory of TCCN than nurses who had fewer years of clinical experience.

Jiang et al. (2015) found that nurses with a high-ranking job title had higher competency and feasibility. These results suggested that greater life experiences, years of work experience, and better competencies in practice enhance the promotion of more caring behavior among nurses. Lechleitner (2019) also found that nurses will be able to show more consideration for other people when they become older and gain new experiences.

In addition, a previous study (Takase, 2013) has reported that the relationships between the levels of nursing competence and the length of clinical experience were illustrated by a rapid increase in competence levels at the early stage of the nursing career. Therefore, length of experience as registered nurses in this study was classified into five groups of (a: 1- less than 5, b: 5- less than 10, c: 10- less than 20, d: 20- less than 30, e: more than 30), based on this idea, perception differences in TCCN theory were analyzed. As seen in these studies, support for the influence of years of experience in clinical practice is reflected well in the context of the TCCNI-R.

Experience of receiving education on TCCN theory

Caring in nursing is grounded on the fundamental concept that persons are caring and that nursing is a discipline and a profession (Boykin et al., 2001). In the nurse managers` group, the experience of receiving education on caring in nursing was 24%, and 24.3% in staff nurses in this study. Nurses who had received education on caring in nursing showed significant differences for Factor 2 (Technological Competency as Caring).

Three other factors, other than Factor 2, showed no significant difference, namely in Factor 1 (Nursing Expression as Caring), Factor 3 (Technology and Caring), and Factor 4 (Technological Knowing). However, the average scores of these three factors were about four points, indicating high scores. These scores reflect the respondents' observance of professional ethics and occupational discipline, supported by items of the TCCNI-R, and as a result, their awareness of caring in nursing was considered high for TCCN.

Alternatively, Factor 2 (Technological Competency as Caring) is a factor that shows the basic concept of caring, that is, to know the patient more fully as a person intentionally and to respect the patient as a person in providing caring in nursing. The practice of caring in nursing requires an understanding of the other person. To that end, it is important to truly know the persons as participants in their care rather than as objects of care.

Nurses themselves may be able to share their own personal experiences. Similarly, in gaining clinical experience involving various patient situations and including their own life experience, it becomes easier to share humanistic caring practices with patients and their families. Learning nursing from situations of caring can enhance better appreciation of a person's lived experience.

The finding that the caring-educated group scored significantly higher in Factor 2 meant that nurses educated on caring in nursing were highly aware of the theory of "Nursing as Caring" by Boykin et al. (2001) and of "TCCN" theory by Locsin (2005).

Furthermore, the group of nurses who were educated on technological competency as an expression of caring in nursing had significantly higher scores about the TCCN compared with the group of nurses who had not received the educational intervention. Knowledge about caring has been valued most by nurses and nursing students regarding caring in their practice (Aupia et al., 2018). Still, in another study, it was found that nursing students had the lowest scores in caring behavior when compared to practicing nurses. These findings highlighted the importance of education on the concept of caring, particularly for nursing students, before they start engaging in their clinical nursing practice (Aupia et al., 2018).

A study of in-service education programs based on TCCN theory found that such programs resulted in promoting patient understanding, and quality care management with the focus on patient-centered care, hoping to improve quality patient care services. There is a need for education on the practice of theory to enable better understanding and eventual practice of human caring in nursing. Vujanic et al. (2020) declared that it is necessary to stress the significance of caring theories during initial nursing education as well as during their further education. This educational activity supports the view that nurses need lifelong education and training in order to uphold the essential nursing values and ensure that caring remains vital in their nursing practice. It is desirable to have an in-service education system that allows nurses to grow through reflection as well as through actual nursing practice.

Differences in their positions in nursing practice

Participants' employment positions were nurse manager

(22.8%) and staff nurse (77.2%). It was found that nurse managers were more aware of the TCCN than were the staff nurses. Nurse managers were more aware of providing care using technology, as revealed in Factor 3 (Technology and Caring). Nurse managers also recognized the need-to-know patient needs through technology and provided care to the ever-changing patient's condition as revealed in Factor 4 (Technological Knowing). Nurse managers use technology as an expression of caring from a compassionate perspective using multiple methods toward knowing persons, reflecting the use of nursing technology in order to know persons as caring. This finding shows that nurse managers were aware of the importance of using technology (Nakano et al., 2019) in order to know persons as caring. This study also showed that nurse managers were more aware of using technologies of care, as evidenced by their higher evaluation points when compared to the staff nurses.

About half of the nurse managers surveyed had participated in an in-service educational activity on TCCN. This experience was reflected in the nurse managers' responses to the TCCNI-R. The nurse managers recognized that they could grow in their caring by learning about nursing, caring, and technology. It can be expected that these findings reflected the positive outcome of on-site education and human resource development as a staff management project for nurse managers. It is essential to underscore that nurse managers are responsible for improving the quality of nursing care throughout their assigned departments. Therefore, it is necessary that they show the direction of nursing for their staff and work together toward the same goal. In this situation, if it is only the nurse manager who will have an idea about caring in nursing, the goal of the department cannot be achieved. The staff that practice it must be engaged fully within the aims of the department. It has been documented that when nurse managers exemplify caring in nursing, the focus will lead to the development of the staff's caring competencies. Education focused on caring should be positioned as consolidating the basis of nursing as a practice of technological competency as an expression of caring with required ideals inculcated in the educational process.

Limitations

This study had several limitations. The results of the study are considered to be limited due to differences in perceptions regarding caring education, which may include "course, training, or formal education" among the target population, and the fact that the target facilities were limited to acute care hospitals and data were not collected in various nursing areas, such as chronic care. In addition, the length of experience as a nurse manager was not asked during the survey.

Conclusion

The study clarified perceptions of nurse managers and staff nurses regarding the theory of TCCN in general hospitals in Japan. Nurses who have practiced nursing within the range of 20 to less than 30 years showed the highest scores in their expression of technological competency as caring in nursing. These nurses were found to be highly aware of the necessity of knowing patients as a focus of their nursing. It was also found that nurses who had received education on TCCN showed significant differences in their perceptions considering Factor 2 (Technological Competency as Caring). This factor illustrates that essential caring in nursing focuses on knowing the patient intentionally and how to express respect for patients as persons through technological expressions of caring. Therefore, there is a need to educate nurses regarding the theory-based nursing practice, enabling a critical understanding of practicing caring in nursing. Nursing managers were more aware of TCCN than the staff nurses. Nurse managers were more aware of technological competency as an expression of caring in nursing than staff nurses, as revealed in Factor 3 (Technology and Caring). Furthermore, nurse managers recognized the need-to-know patient needs through technology more fully and provided care to patients within the ever-changing healthcare condition. This finding was supported by Factor 4 (Technological Knowing).

Declaration of Conflicting Interest

The authors declare that there is no conflict of interest.

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Authors' Contributions

All authors contributed to the conception of this study, drafting and revising the work critically, approved for the final version, and agreed to be accountable for all aspects of the work.

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Data Availability Statement

The datasets generated during and/or analyzed during the current study are not publicly available due to ethical restrictions but are available from the corresponding author on reasonable request.

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Predictors of nurses' caring practice for critically ill patients in critical technological environments: A cross-sectional survey study

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Abstract

Background: Caring practice for critically ill patients refers to the actions/behaviors/performance of nurses while caring for critically ill adult patients in the intensive care unit (ICU). Although the caring practice is vital in ICUs and complex due to the multitude of available technologies, research on ICU nurses' caring practice and its predictive factors are lacking.

Objective: This study aimed to explore the level of nurses' caring practice for critically ill patients in critical technological environments in China and its predictors.

Methods: This was a cross-sectional online survey study with 218 ICU nurses in 29 tertiary hospitals of Guizhou province, China, from 1st to 30th April 2020. Data were collected by using e-questionnaires made in the Questionnaire Star program, including the Demographic Data Questionnaire (DDQ), Practice of Technological Competency as Caring in Nursing Instrument (P-TCCNI), Influence of Technology Questionnaire (ITQ), and Nurses' Professional Value Scale (NPVS). The questionnaires were content validated by three experts. Cronbach's alpha coefficient was 0.96 for the P-TCCNI, 0.70 for the ITQ, and 0.95 for the NPVS. Links to the questionnaires were distributed by research assistants to WeChat groups including target participants. Statistical Package for the Social Science (SPSS) program version 26 (IBM Corporation, Armonk, NY, USA) was used for data analysis. Descriptive and inferential statistics were used to analyze the data. Multiple linear regression analysis using stepwise solution analysis was performed to identify unique predictors of nurses' caring practice.

Results: The level of nurses' caring practice for critically ill patients was high (mean = 87.30, standard deviation = 13.73). The professional value was a significant predictor of nurses' caring practice (β = 0.41, p = 0.00).

Conclusion: ICU nurses exhibited a high level of caring practice. Professional value was a significant predictor of ICU nurses' caring practice. Nursing administrators should understand the current situation of caring practice in critical technological environments and design strategies to maintain and improve ICU nurses' professional value to increase the level of caring practice.

Keywords

caring practice; critically ill patient; critical technological environments; ICU; nursing; China

Caring practice in critical technological environments such as ICUs is dynamic and complex due to the numerous technologies used to treat patients' serious conditions. It is widely believed that technologies can reduce nurses' workload and thereby provide nurses with more time to communicate with patients and meet their emotional needs (Sabzevari et al., 2015). However, in the real situation of caring practice, technologies can distract nurses from getting to know their patients and providing appropriate care (Locsin & Kongsuwan, 2018). It was found that nurses often use their time to manage and resolve problems with new and advanced technologies, and this increases nurses' feelings of stress and uncertainty and decreases their attention on caring for patients (Kongsuwan & Locsin,

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2011; Locsin & Kongsuwan, 2013). To improve this situation, nurses are required to maintain excellent technological competency, cultivate a deep understanding of their patients, and provide the best caring practice for their patients (Despins, 2017; Locsin & Kongsuwan, 2018; Petersen et al., 2019).

Nursing researchers have consistently viewed caring as a vital constituent of nursing in their studies (Su et al., 2014; Wang et al., 2014; Cheng et al., 2017). However, the findings of these studies indicated caring for critically ill patients among ICU nurses was inadequate. Compared to general wards, ICUs are 'closed' units where patients are in round-the-clock care by intensivists, especially bedside nurses (Kisorio & Langley, 2019). Hence, ICU nurses' caring practice plays an essential role in intensive care nursing. However, a study in Nepal showed that ICU nurses were short of technological competency in caring for critically ill patients (Limbu et al., 2019). Additionally, a study in Japan demonstrated that nurses' recognition of caring for patients was higher than their actual practice (Kato, Miyagawa, et al., 2017).

Technology, caring, and competency are key aspects of caring practice in ICU nursing, which differs from caring practice in other medical areas (Locsin, 2005). Locsin developed the theory of Technological Competency as Caring in Nursing (TCCN), which focuses on caring in technological environments in ICUs (Locsin, 2005). In this theory, technology and caring are understood as co-existing in nursing practice, and caring is expressed through technological competency used by experts to know a patient as a whole at the moment (Locsin, 2005). To measure technological competency as caring in technological environments, the Technological Competency as Caring in Nursing Instrument (TCCNI) was developed (Parcells & Locsin, 2011). It was used by Biswas et al. (2016) in Bangladesh to survey the ICU nurses' perception of caring. Later, it was modified by Kato, Miyagawa, et al. (2017) to the Perceived Inventory of Technological Competency as Caring in Nursing (PITCCN). When Kato et al. used the PITCCN to survey ICU nurses, they found ICU nurses' recognition of caring was higher than their practice of caring ($p < 0.01$) (Kato, Tanioka, et al., 2017).

There are several factors proven to be related to nurses' caring practice in ICUs, namely age (Enns & Sawatzky, 2016; Yau et al., 2019), work experience (Reid et al., 2018; Yau et al., 2019), education level (Yau et al., 2019), and professional value (Hu, 2017; Poorchangizi et al., 2019; Tehranineshat et al., 2020). In China, professional value is the key influencing factor of nursing practice that guides decision-making and nursing behaviors. It was defined as one conviction that makes people believe they can achieve the goal in their career, and it is the key to satisfying inner needs and unlocking the achievement in individuals' activities (Fang et al., 2013). Several studies showed that older nurses had a higher level of caring ability and caring behaviors (Wu et al., 2019; Yau et al., 2019). In a study, Yau et al. (2019) reported that work experience was associated with nurses' caring behaviors. Meanwhile, older nurses' caring practice was higher than younger nurses (Kato, Miyagawa, et al., 2017). Moreover, nurses with a higher education level had a higher level of caring behaviors (Yau et al., 2019). Hu (2017) indicated that a significant association exists between caring ability and professional value.

However, these factors were proved to be associated with one aspect of caring practice, such as caring recognition, caring ability, caring perception, caring capacity, or caring behavior. Limited studies have explored predictors of caring practice for critically ill patients among ICU nurses. It is necessary to better understand the impact of influencing factors on ICU nurses' caring practice and use this knowledge to improve nurses' caring practice. Therefore, this study aimed to explore the level of nurses' caring practice for critically ill patients in critical technological environments and its predictors.

Theoretical Framework

The conceptual framework of this study is developed based on the theory of TCCN and a literature review of factors associated with caring practice in ICUs. The theory of TCCN is a middle-range theory developed by Locsin (2005), which is grounded in Boykin and Schoenhofer (2001)'s theory of Nursing as Caring. The essential goal of this theory is knowing a patient as a whole by using technological competency as a process of knowing in nursing practice (Locsin, 2005). The theory of TCCN views technology and caring as coexisting in nursing practice. Five assumptions of this theory are described as follows: 1) Persons are caring by virtue of their humanness (Boykin & Schoenhofer, 2001); 2) The ideal of wholeness is a perspective of unity (Locsin, 2005); 3) Knowing persons is a multidimensional process (Locsin, 2005); 4) Technologies of health and nursing are elements for caring (Locsin, 2005); and 5) Nursing as a discipline and professional practice (Boykin & Schoenhofer, 2001).

By the literature review, some factors are known to be associated with the caring practice. Therefore, the selected factors for caring practice prediction in this study include nurses' age, work experience, educational level, the influence of technology, and professional value.

Methods

Study Design

A cross-sectional online survey study was conducted from 1st to 30th April 2020.

Sample and Setting

This study was conducted among ICU nurses in 29 tertiary hospitals of Guizhou province China. In China, hospitals are divided into three grades based on ability and number of beds (Wang et al., 2016). Tertiary hospitals, the highest-level hospitals, have more than 500 beds and are responsible for providing more specialist health services,

education, and research. In addition, since tertiary hospitals have a larger number of and more categories of advanced technologies (Wang et al., 2016), nurses who work in tertiary hospitals face greater technology-based pressure than those who work in secondary hospitals. Hence, the data were collected from seven types of ICUs (respiratory, emergency, general, neurological, surgical, medical, and cardiological units) in tertiary hospitals.

The participants were nurses who worked in the ICUs of tertiary hospitals in Guizhou province, China. A convenient sampling technique was used for data collection. Several nurses were invited to assist with the study. If they accepted the invitation, they were enrolled in the study as research assistants responsible for distributing the link to the questionnaire to target ICU nurses' WeChat groups. The inclusion criteria of participants were: 1) being a registered nurse, 2) working in an adult ICU, and 3) being willing to participate in the study. The exclusion criteria were ICU nurses who were not responsible for bedside nursing, such as chief nurses or administrative nurses.

The sample size was determined by power analysis (Polit & Beck, 2017). The significance level (α) of 0.05, power of 0.80, and average effect size of 0.20 were used to analyze the sample size. The required minimum sample size was 194. However, the response rate of the internet-based survey was about 33% (Lindemann, 2019). To overcome the anticipated low response rate, the sample size was increased by 67% to 588. The response rate in this study was 40.31%, meaning the number of participants who replied to questionnaires was 237. Finally, after deleting invalid questionnaires, a total of 218 participants were included.

Instruments

There were four parts in the questionnaire pack, including the Demographic Data Questionnaire (DDQ), Practice of Technological Competency as Caring in Nursing Instrument (P-TCCNI), Influence of Technology Questionnaire (ITQ), and Nurses' Professional Values Scale (NPVS). The permissions for utilizing, modifying some items (if necessary), and translating the questionnaires were obtained from the original authors. The content validity of the scales was tested with three nursing experts, and the item-level content validity (I-CVI) indexes of P-TCCNI, ITQ, and NPVS were 1 (after a series of revisions), 0.94, and 0.95, respectively. A pilot study was used to examine the reliability of three instruments with 30 ICU nurses. A back translation technique was used to translate the P-TCCNI and ITQ from English to Chinese (Polit & Beck, 2012).

The DDQ was used to collect demographic data, including age, gender, religion, work experience, education level, work overload, continuing education and training, and unit.

The P-TCCNI was used to evaluate the level of nurses' caring practice for critically ill patients in technological environments. It was modified from the TCCNI, an instrument developed by Parcells and Locsin (2011) based on the theory of TCCN (Locsin, 2005). The P-TCCNI is a 5-point Likert scale questionnaire (ranging from 1 = never practice to 5 = always practice). There are 22 items categorized into five sub-scales based on the five assumptions of the theory of TCCN. The overall score range is 22–110. A higher mean score indicates a higher level of caring practice, and total mean scores are divided into three levels: low (22–51.33), moderate (51.34–80.66), and high (80.67–110) (Grove et al., 2013). The level of each item is interpreted into three levels: low (1.0–2.33), moderate (2.34–3.66), and high (3.67–5.00). Cronbach's alpha coefficient of the P-TCCNI is 0.96.

The ITQ was designed to assess the influence of technology on nursing care according to the nurses' beliefs (Bagherian et al., 2017). It is a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree) developed by Sabzevari et al. (2015) and consisting of a total of 22 items, with both negative (13 items) and positive (9 items) subscales. The total score ranges from 22 to 110. After reversing the negative items, a higher score indicates a higher level of influence of technology. The Cronbach's alpha coefficient is 0.70.

The NPVS, including 17 items in three dimensions (behavior value, personal value, and social value), was designed by Deng et al. (2012) to assess the degree of professional value in the Chinese context. The score ranges from 17 to 85, with a higher score indicating a higher level of professional value. Each item is measured on a 5-point Likert scale, where 1 = never meet and 5 = always meet. The Cronbach's alpha coefficient is 0.95.

Data Collection

Data were collected from 1st to 30th April 2020. After consultation with three experts who each had the clinical experience of more than ten years (one chief nurse of RICU and two professors of Faculty of Nursing) and completion of a pilot study to test the revised instruments, the final questionnaires were used to collect data. The e-questionnaires were created in Questionnaire Star, an application program widely used by researchers to create and distribute six types of instruments.

Once the research assistants distributed the link to the questionnaire to participants via WeChat, participants could open the link in the WeChat group without registration. The survey took approximately 20–30 minutes, and participants could finish it at their convenience within one week. Data were collected from Questionnaire Star directly. A total of 351 participants did not complete the questionnaires. Of the 237 completed questionnaires, 19 were invalid because of obvious logic contradictions, providing the same answers to all questions or marking "0" for work experience. The remaining 218 questionnaires were included in the data analysis.

Data Analysis

Statistical Package for the Social Sciences (SPSS) program version 26 (IBM Corporation, Armonk, NY, USA)

was used for data analysis. The demographic data and the level of nurses' caring practice were analyzed by descriptive statistics, including frequency, percentage, mean (M), range, and standard deviation (SD). To examine the predictors of nurses' caring practice, multiple linear regression analysis was carried out. The stepwise selection was used to choose the final regression model. Prior to performing multiple linear regression analysis, the assumptions of normality, linearity, homoscedasticity, and multicollinearity were tested to ensure the accuracy of the findings and ensure no violation of statistical assumptions. The dependent variable was the total score of P-TCCNI. The independent variables were age, work experience, education level, the influence of technology, and professional value. The statistically significant level was set at $p < 0.05$.

Ethical Consideration

This study was approved by the Social and Behavioral Sciences Institutional Review Board (IRB), Prince of Songkla University, Thailand (IRB No. 2019-NSt 024). An implied informed consent form was provided to participants during data collection. Participants had the right to withdraw without prejudice at any time. The original data were kept confidential and maintained for five years after data analysis.

Results

Participant Characteristics

The demographic characteristics of participants are presented in **Table 1**. The age of participants ranged from 21 to 48 years, and the mean age was 29.58 (SD = 4.52). The majority of participants were female (n = 164, 75.2%), and 62.9% (n = 139) were married. More than 80% (n = 175) of respondents had no religion. Their work experience in the ICU and nursing (years) ranged from 0.1 to 17 and 0.5 to 28, respectively. Additionally, 27.7% of participants (n = 62) had a diploma degree, 69.6% (n = 150) had a bachelor's degree, and 84.4% (n = 184) reported they had received continuing education and training on concepts related to caring for critically ill patients and technology. Furthermore, 64.7% of participants (n = 141) felt they had work overload in their shifts.

Table 1 Demographic characteristics (N = 218)

Demographic data	Frequency (n)	Percentage (%)
Age (years)		
(Min = 21, Max = 48, M = 29.58, SD = 4.52)		
21–30	133	61.0
31–40	82	37.6
41–48	3	1.4
Gender		
Female	164	75.2
Male	54	24.8
Marital status		
Married	139	63.8
Unmarried	76	34.9
Divorced	3	1.4
Religion		
No religion	175	80.3
Buddhist	41	18.8
Christian	2	0.9
Work experience in ICU (years)		
(Min = 0.1, Max = 17, M = 4.99, SD = 3.72)		
≤5	135	61.9
6–10	67	30.7
11–15	14	6.4
16–17	2	0.9
Work experience in nursing (years)		
(Min = 0.5, Max = 28, M = 6.65, SD = 4.59)		
≤5	111	50.9
6–10	73	33.5
11–15	26	11.9
16–28	8	3.7
Education level		
Diploma	62	28.4
Bachelor	150	68.8
Master	5	2.3
Doctoral	1	0.5
Continuing education and training		
Yes	184	84.4
No	34	15.6