Review Article

Nurses' Knowledge, Attitude, and Practice toward Immobility Complications: A Scoping Review

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ABSTRACT

Immobility complications are challenging for healthcare professionals because they negatively affect individuals' overall health. Following recovery from a severe illness or accident, patients' movement is often impaired, so they may be unable to perform activities of daily living, thus impacting their quality of life. Nurses play a proactive role in preventing immobility's physical and mental impacts. However, several studies have suggested that nurses worldwide lack knowledge, attitude, and practice (KAP) toward immobility complications. Therefore, stakeholders must prioritize this problem to optimize healthcare provision. Accordingly, this study aimed to explore nurses' KAP toward immobility complications. A scoping review of relevant articles utilized PubMed, Scopus, Cochrane, Web of Science, Embase, CINAHL Plus, and EBSCOhost databases. Hawker's tool assessed the risk of bias among the included primary articles. The results were analyzed according to the KAP toward four main immobility complications: pressure injury, deep vein thrombosis, ventilator-associated pneumonia, and urinary tract infection. The database search generated a total of 1398 articles. Of them, only 39 articles met the inclusion criteria for the review. Most articles concluded that nurses' KAP were below the expected level. Education and training were found to optimize nurses' KAP. The KAP toward immobility complications was good among nurses with work experience, high academic grades, and prior training. These findings indicate that nursing staff should receive continuous education and in-service training to improve their KAP toward immobility complications.

KEYWORDS: Attitudes, Deep vein thrombosis, Immobility complications, Knowledge, Nurses, Practice, Pressure injury, Urinary tract infection

INTRODUCTION

Immobility complications are challenging for healthcare professionals because they have considerable detrimental implications on individuals' overall health [1,2]. When recovering from a severe illness or accident, patients often experience impaired movement, so they may be unable to perform their activities of daily living [3], thus impacting their quality of life [1]. The complications of immobility are well-known and are commonly perceived to be preventable. Implementing preventive measures to keep patients healthy and avoid further problems is crucial [4,5]. The major immobility complications reported include pressure injury (PI) [6], deep vein thrombosis (DVT) [7], resistant pneumonia [8], and urinary tract infection (UTI) [9]. In addition to the serious major complications, injuries to the organ systems, including the cardiovascular, endocrine, gastrointestinal, immune, renal, and vestibular systems, have been reported [10]. Other patients also develop cognitive [11] and psychological complications [12,13]. The harmful effects of immobilization on patients' general well-being and function have come into focus in clinical research and healthcare practice. These detrimental effects include increased morbidity and mortality, overall hospital cost, social burden, and prolonged hospitalization [14]. It has been concluded that the quality of life is severely affected by the complications of immobility, including PI [15], DVT [16], and UTI [17]. An earlier study found that nearly 60–70% of patients discharged from the intensive care unit (ICU) developed some degree of disability [18]. Similarly, a recent study showed that nearly 66% of patients admitted to the ICU experienced acquired weakness, and approximately 31% had a certain degree of disability at ICU and hospital discharge [19]. Therefore, disability is correlated with prolonged immobilization.

By proactively adopting treatments, nurses play a substantial role in preventing the physical and mental deteriorations that might result from immobility. Given the imperative role of early mobilization of bedridden patients (e.g., ICU patients), nurses are uniquely positioned to encourage early mobilization and thus

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enhance the quality of healthcare provided to immobile patients [20]. Nurse-driven ambulation programs are proven to be safe and help reduce immobility complications among bedridden patients [21]. Accordingly, nurses may need to be provided with the necessary knowledge and attitude to enhance their healthcare practice toward immobilization. Accumulating evidence emphasizes that understanding nurses' knowledge, attitude, and practice (KAP) is instrumental in providing adequate preventive care for immobilized patients to reduce immobility complications [22].

Furthermore, nurses' KAP is correlated with their education, training, and years of experience [23]. A recent Chinese study found that nurses had a positive attitude toward significant immobility complications but lacked expertise [24]. Therefore, it was recommended that nurses improve their knowledge and attitude concerning the considerable complications of immobility, reducing the incidence of these complications and enhancing patients' quality of life [25]. Moreover, juniority in nursing, lack of training, and inadequate nursing experience were associated with significant immobility complications. Another study reported that although nurses had advanced general knowledge of DVT, there was a deficiency in their knowledge regarding the risks and preventive measures for DVT, along with inadequate practice regarding such measures[26]; experienced nurses with a high knowledge level and a positive attitude perceived appropriate and safe practices for handling patients with a urinary catheter and the associated infection [27]. Thus, adequate knowledge and attitude toward critical immobility problems might minimize their occurrence and improve patients' quality of life [25]. Nurses' knowledge may not cover all critical aspects of immobility complications [26]. Therefore, exploring nurses' KAP and providing adequate education and training would allow nurses to perceive appropriate and safe practices toward immobility complications [28]. Providing nurses with adequate education and training would augment their KAP, thus improving the quality of healthcare provision [29]. Accordingly, it is essential to plan for comprehensive and systematic training programs to enhance nurses' KAP regarding a range of mobility-related complications [26].

To our knowledge, no review has yet evaluated nurses' KAP about several immobility complications. Most existing evidence is related to a single type of immobility complication. Considering previous reports on the significance of knowledge and attitude in improving nursing practice for preventing immobility complications, the current scoping review explores nurses' KAP toward immobility complications. The results are anticipated to highlight research gaps to inform decision-making among healthcare providers and guide health policymakers in developing intervention policies to bridge these gaps.

METHODOLOGY

Research design

The study adopted a scoping review design. This design focuses on knowledge synthesis to obtain available evidence, aiming to guide further research priorities and provide valuable information for practice, program implementation, decision-making, and policy planning [30]. This study adopted the design to examine different study approaches to nurses' KAP toward immobility complications. In addition, the factors associated with nurses' knowledge level were explored.

The methodological framework described by Arksey and O'Malley was followed in this review [31]. The six-stage methodological framework advocated as a guideline involved identifying the research question, searching for relevant studies, selecting relevant studies, charting the data, collating, summarising, and reporting the results, and consulting with stakeholders to validate the findings [31]. Hawker's tool assessed the quality of the primary studies selected for this review [32]. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews were utilized to map and present the results [33].

Research question: The research question formulated was as follows: What is the level of nurses' KAP toward immobility complications?

Study selection process: Articles were identified by searching numerous electronic databases. The following inclusion and exclusion criteria governed the study selection and screening processes.

Inclusion criteria: Articles addressing the knowledge and/or attitude and/or practice of nurses toward immobility complications including PI, DVT, UTI, and pneumonia; articles focusing mainly on nurses working with bedridden patients such as patients admitted to intensive care, orthopedic, geriatric, and medical-surgical departments; quantitative studies; peer-reviewed articles; clinical studies; full-text articles published in English; and articles published from 2017 to 2022 were included.

Exclusion criteria: Unpublished manuscripts, letters, reports, conference abstracts, letters to the editor, books, protocols, and dissertations were excluded.

Search strategy and data charting: Relevant databases, including PubMed, Scopus, Cochrane, Web of Science, Embase, CINAHL Plus, and EBSCOhost were searched. Relevant articles cited in selected studies were also included.

Two researchers screened the search results. Electronic screening was applied to exclude duplicate results based on the same title, the same author(s), and the same publication year. The exclusion of studies was based on the title of the articles. After

that, the abstract and full text of the articles were screened. Manual screening was also conducted for the bibliographic references of the included studies to detect any other eligible studies that may have been overlooked at the previous stage. A spreadsheet was used to collect and extract the data for further data processing. The selection of studies was based on the eligibility criteria. Research articles that did not address the research question were excluded. Disagreements between the researchers were resolved via discussion. The following data were extracted from the articles: author and year, country, purpose, sample, design, setting, nursing workplace (e.g., ICU, medical-surgical department, or orthopedic department), main findings, and recommendations. After that, the collected data were tabulated.

Quality assessment: The quality assessment tool developed by Hawker et al. was used to assess the 39 studies that met the inclusion criteria. The tool consists of several elements, such as the abstract and title, introduction and aims, methodology and data, sampling and data processing, ethics and bias, findings and results, transferability and generalizability, implications, and usefulness of the study [32]. The total and subtotal scores are calculated to reflect the strengths and weaknesses of each article according to the proposed criteria. Each item is rated as either "good" (28–36 points), "fair" (19–27 points), or "poor" (9–18 points). Most of the studies included had a high-quality assessment score.

RESULTS

Screening results

The database search yielded 1398 articles, of which 180 were duplicates. The titles and abstracts were screened, excluding 1109 articles and leaving 109 articles for retrieval. Nineteen articles were not retrieved, and only 90 were assessed for eligibility. After full-text review, 54 articles were excluded: 47 articles did not fulfil the inclusion criteria; one article was not published in English; one article was a thesis and was not peer-reviewed; one article did not focus on KAP; one article did not involve nurses; two articles had a mixed study design; and one article was retracted at the time of manuscript writing. Finally, 36 articles were included in the review; three articles from other literature were additionally included (**Figure I**).

Quality assessment

Of the 39 included studies, 30 attained a quality assessment score of 36 points, while only nine scored less than 36, with a minimum score of 20. Thus, the studies showed a minimal risk of bias for the overall evidence (**Table I**)

Figure I: Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 flow diagram

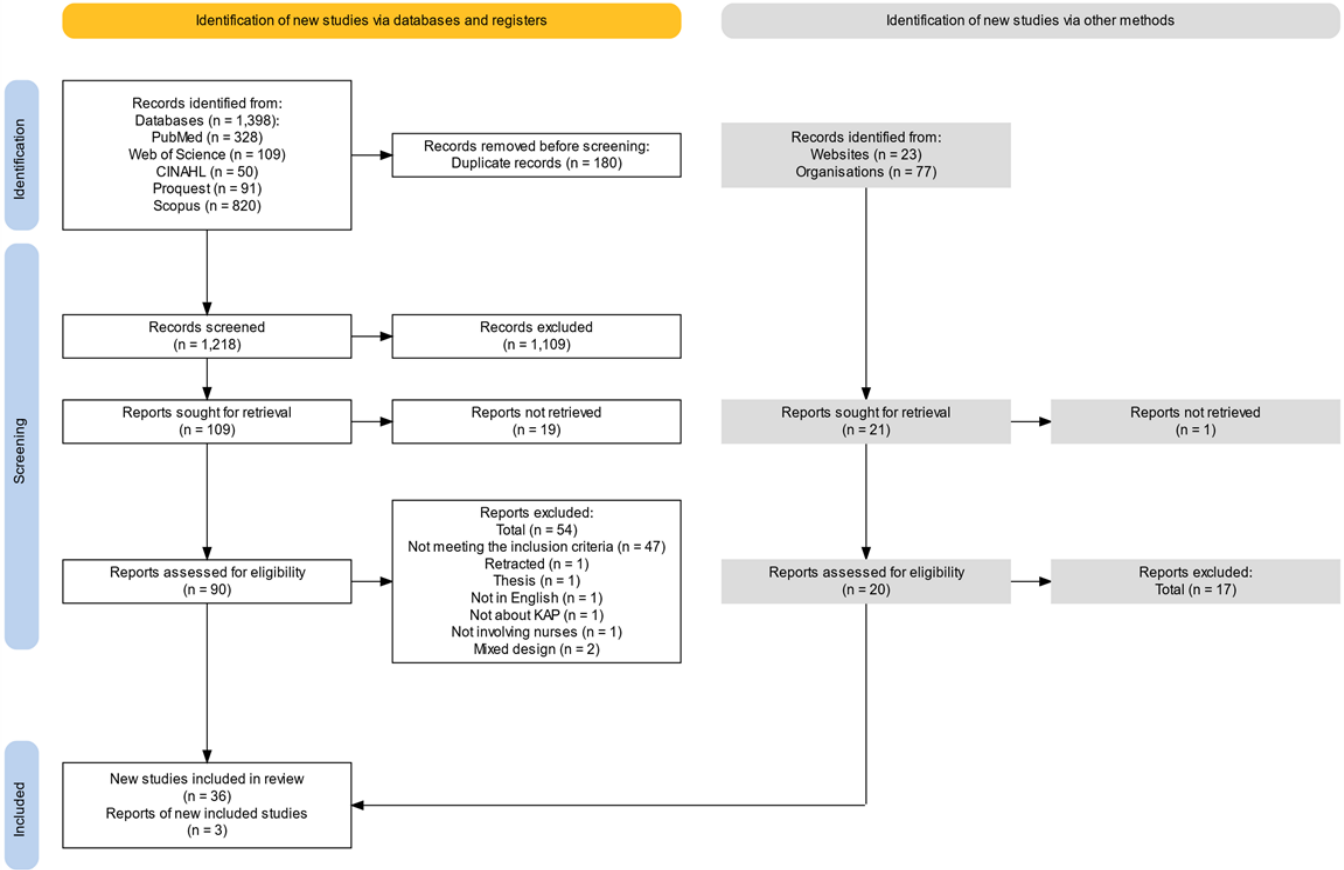

Table I: Quality assessment of the included studies

Author/year	Abstract and title	Introduction and aims	Method and data	Sampling	Data analysis	Ethics and bias	Results	Trans-ferability	Implica-tions	Score
Cebeci & Şenol Çelik, 2022[34]	4	4	4	4	4	4	4	4	4	36 Good
Getahun et al., 2022[35]	4	4	4	4	4	4	4	4	4	36 Good
Huang & Saensom, 2022[36]	4	4	4	4	4	4	4	4	4	36 Good
John & Srivastava, 2022[37]	4	4	4	3	4	4	3	4	3	33 Good
Li et al., 2022 [24]	4	4	4	3	4	4	4	4	3	34 Good
Mong et al., 2022 [27]	3	4	4	4	3	4	3	4	4	33 Good
Niyongabo et al., 2022 [38]	4	4	4	4	4	4	4	4	4	36 Good
Parisod et al., 2022[39]	4	4	4	4	4	4	4	4	4	36 Good
Yohannes et al., 2022 [40]	4	4	4	4	4	4	4	4	4	36 Good
Asfaw et al., 2021[41]	4	4	4	4	4	4	4	4	4	36 Good
Grešš Halász et al., 2021[42]	4	4	4	4	4	4	4	4	4	36 Good
Hu et al., 2021 [23]	4	4	4	4	4	4	4	4	4	36 Good
Sari et al., 2021 [43]	4	4	4	4	4	4	4	4	4	36 Good
Wang et al., 2021 [44]	4	4	4	4	4	4	4	4	4	36 Good
Awad & Hewi, 2020 [45]	4	4	4	4	4	4	4	4	4	36 Good
Aysegul et al., 2020 [46]	4	4	4	4	4	4	4	4	4	36 Good
Berihu et al., 2020 [47]	3	4	4	4	4	4	4	4	4	35 Good
Kalyan et al., 2020 [48]	4	4	4	4	4	4	4	4	4	36 Good
Wangmo et al., 2020 [49]	3	4	3	4	3	1	3	1	1	23 Fair
Khojastehfar et al., 2020[50]	4	4	4	4	4	4	4	4	4	36 Good
Khong et al., 2020 [51]	4	4	4	4	4	4	4	4	4	36 Good
Olorunfemi et al., 2020 [52]	4	4	4	4	4	4	4	4	4	36 Good
Rafiei et al., 2020 [53]	4	4	4	4	4	4	4	4	4	36 Good
Charalambous et al.,2019[54]	3	4	4	4	3	4	3	3	3	31 Good
Dawa et al., 2019 [55]	4	4	4	3	4	4	4	4	4	35 Good
De Meyer et al., 2019 [56]	4	4	4	4	4	4	4	4	4	36 Good
Dumbre, 2019 [57]	3	4	3	3	1	3	1	1	1	20 Fair
Ebi et al., 2019 [58]	4	4	4	4	4	4	4	4	4	36 Good
Kim & Lee, 2019 [59]	4	4	4	4	4	4	4	4	4	36 Good
Saleh et al., 2019 [60]	4	4	4	4	4	4	4	4	4	36 Good
Yılmazer et al., 2019 [61]	4	4	4	4	4	4	4	4	4	36 Good
Al-Mugheed & Bayraktar, 2018 [26]	4	4	4	4	4	4	4	4	4	36 Good
Barakat-Johnson et al., 2018 [28]	3	4	4	4	4	3	3	3	4	32 Good
Habiballah, 2018 [62]	4	4	4	4	4	4	4	4	4	36 Good
Hamdan et al., 2018 [63]	4	4	4	4	4	4	4	4	4	36 Good
Li et al., 2018 [25]	4	4	4	4	4	4	4	4	4	36 Good
Tirgari et al., 2018 [64]	4	4	4	4	4	4	4	4	4	36 Good
Tallier et al., 2017 [65]	4	4	4	4	4	4	4	4	4	36 Good
Ünver et al., 2017 [66]	4	4	4	4	4	4	4	4	4	36 Good

Study characteristics

All articles were published from 2017 to 2022. Nearly all were cross-sectional studies (n = 38 ,(except one was a pretest-posttest pre-experimental study. The studies involved a total of 12810 participants. Most studies evaluated the KAP among nurses toward PI (n = 26), followed by ventilator-associated pneumonia (VAP) (n = 6 ,(DVT (n = 3 ,(and UTI (n = 2). Only two studies investigated all four immobility complications. Moreover, the reviewed studies were conducted across various regions of the world: China (n = 5 ,(Ethiopia (n = 5), Turkey (n = 4), India (n = 3), Iran (n = 3), the United States of America (USA) (n = 2), Cyprus (n = 2), Jordan (n = 2), Australia (n = 1), Belgium (n = 1), Bhutan (n = 1), Burundi (n = 1), Egypt (n = 1), Finland (n = 1), Indonesia (n = 1), Malaysia (n = 1), Nigeria (n = 1), Singapore (n = 1), Korea (n = 1), Slovakia (n = 1), and Saudi Arabia (n = 1). The design, aim, sample size, setting, country, results, and recommendations of each study are shown in **Table II**.

Table II: Summary of the included studies

Author, year, and country	Aim	Design	Participants	Total sample	Setting	Variable	Findings	Recommendations
Cebeci & Şenol Çelik, 2022 [34], Turkey	Assess the knowledge and practice toward PI among operating room (OR) nurses	Descriptive cross-sectional study	OR nurses	234	11 hospitals located in Ankara, Turkey	PI	OR nurses' knowledge score was below 60%, indicating insufficient knowledge. OR nurses' practice score was inadequate.	The study recommends establishing organized training courses that prevent OR-related PIs and provide ongoing professional development.
Getahun et al., 2022 [35], Ethiopia	Measure the knowledge of VAP prevention among ICU nurses	Cross-sectional study	ICU nurses	204	ICU of a multi-centre institution (Amhara Regional State Referral Hospital)	VAP	Approximately 51.96% of ICU nurses had poor knowledge regarding VAP prevention.	The study suggests that the curriculum for nurses should be modified to include preventive measures against intensive care infection. Furthermore, administrators should emphasize establishing VAP prevention policies.
Huang & Saensom, 2022 [36], China	Explore the relationships between perceived competence and experience, knowledge, attitude, and self-efficacy in PI care among nurses	Descriptive correlational study	Nurses	111	1 tertiary hospital in Yunnan Province, China	PI	Nurses had inadequate knowledge and low self-efficacy when providing PI care. Despite this, they had positive attitudes (79.23%) and adequate perceived competence in providing PI care (83.59%).	The study recommends acquiring expertise in wound care, joining a course, reading a publication or textbook, and understanding PI practice guidelines, all of which are directly correlated with nurses' perceived competence in providing PI care.
John & Srivastava, 2022 [37], India	Evaluate the level of knowledge and practice of nurses toward the avoidance of VAP and examine the relationship between knowledge and practice about specific factors	Descriptive correlational study	ICU nurses	100	Surgical ICUs, cardiac ICUs, and medical ICUs of three hospitals in Delhi	VAP	Most nurses exhibited adequate knowledge (54%) and practice (74%) scores.	The same research can be replicated using a more extensive sample encompassing diverse hospitals. Additionally, it is possible to compare the competencies and instructional methods of staff nurses and assess their level of knowledge and practical skills improvement before and after training courses on evidence-based recommendations for avoiding the occurrence of VAP. Evidence-based guidelines from reliable organizations, such as the World Health Organization and the Centers for Disease Control and Prevention, must be implemented in healthcare practices.
Li et al., 2022 [24], China	Compare and assess the PI knowledge of medical and surgical nurses, as well as determine the predictors of PI knowledge within these categories	Cross-sectional study	Medical and surgical nurses	404	24 medical and surgical wards in a tertiary care center in China	PI	Nurses exhibited inadequate knowledge, as 82.9% scored less than 60%.	The study recommends an urgent enhancement of the knowledge of nurses in PI. The impact of education on nurses' practice should also be determined. Surgical nurses performed better than medical nurses, so further research is required to explain the variations in their professional practices.

Mong et al., 2022 [27], Malaysia	Measure the level of knowledge, attitude, and perceived practice of nurse practitioners toward catheter-associated urinary tract infection (CAUTI) and its prevention	Cross-sectional study	Nurses	301	Tertiary Hospital in Kuala Lumpur, Malaysia	UTI	Nurses had a positive attitude, adequate knowledge, and good practice of CAUTI prevention.	It is recommended that a study be conducted in multiple settings to ensure greater objectivity and examine nurses' actual practice in preventing CAUTI.
Niyongabo et al., 2022 [38], Burundi	Measure the level of knowledge, attitude, and practice about PI prevention and treatment among nurses	Cross-sectional study	Nurses	25	ICU, internal medicine unit, and inpatient surgery unit at Clinique Prince Louis Rwagasore in Bujumbura, Burundi	PI	Nurses' knowledge and practice scores were inadequate (less than 50%). Despite this, their attitude was positive, with a score of more than 65%.	The study recommends that additional clinical trials and ongoing training are necessary to expand nurses' understanding and enhance their practice in avoiding and treating PI. Moreover, it is essential to thoroughly record and submit incidents of PI to the Ministry of Health.
Parisod et al., 2022 [39], Finland	Evaluate nurses' attitudes regarding PI prevention and identify the factors contributing to these attitudes	Correlational cross-sectional study	Nurses	554	Primary and specialized healthcare units in two district hospitals	PI	Nurses had a negative attitude toward PI prevention. Staff nurses in primary care had a more positive attitude toward PI prevention than those in specialized care. A more extended work experience was associated with more positive attitudes.	The study suggests ongoing education to enhance nurses' attitudes about PI avoidance. It is essential to prioritize nurses in the nursing profession's initial phases.
Yohannes et al., 2022 [40], Ethiopia	Evaluate the level of knowledge and practice and other factors related to the prevention of DVT among nurses	Cross-sectional study	Nurses	412	Medical, surgical, emergency, ICU, and gynecology–obstetric wards of 5 government hospitals in Amhara	DVT	The results were inadequate, as the knowledge score was 55.5%, and the practice score was 48.8%.	Ongoing training is emphasized.
Asfaw et al., 2021 [41], Ethiopia	Assess the knowledge, attitudes, and practices of nurses regarding immobility complications	Cross-sectional study	Nurses	418	Adult inpatient wards in 3 hospitals in Addis Ababa City	Immobility complications	Approximately 70.8% of participants had a high knowledge level; only 66.7% had a favorable attitude, and 55.9% had good practices.	Nurses on the job are suggested to learn about immobility complications, and a standard structure is recommended for evaluating practices toward immobility complications.
Grešš Halász et al., 2021 [42], Slovakia	Assess the knowledge and attitudes of nurses toward the prevention of PI, as well as determine the correlations and variations between particular variables	Exploratory cross-sectional study	Nurses and nurse managers	225	Medical, surgical, ICU, geriatric, trauma, neurology, physiotherapy, and oncology wards of 4 major eastern Slovak facilities	PI	Approximately 45.5% and 67.9% of participants had inadequate knowledge and a negative attitude, respectively.	The researchers recommend evaluating and contrasting the curriculum of nursing educational programs. It is also essential to thoroughly assess nurses' ongoing education and training.
Hu et al., 2021 [23], China	Assess the level of PI prevention knowledge, attitudes, and practices among ICU nurses	Cross-sectional descriptive study	ICU nurses	510	Critical care units in secondary and tertiary hospitals in China	PI	Approximately 94.4% of participants had insufficient knowledge of PI prevention, while the majority had acceptable attitudes and self-reported practices toward PI prevention.	The researchers recommend that nursing leaders investigate methods to ensure the active involvement of nurses and enhance the quality of training and efficacy of education.
Sari et al., 2021 [43], Indonesia	Assess nurses' knowledge and attitudes toward PI	Cross-sectional study	Community Nurses	235	Public health center in Bandung, Indonesia	PI	An unsatisfactory level of knowledge and a positive attitude toward PI prevention were noted among nurses.	Further studies must be undertaken to investigate the specific requirements of community nurses to enhance their involvement in preventing PI.
Wang et al., 2021 [44], China	Assess nurses' knowledge, attitude, and practices toward venous thromboembolism (VTE) and its prophylaxis	Cross-sectional study	Orthopedic nurses	485	Neuro-medicine, neurosurgery, general surgery, general medicine, orthopedic, geriatric, and critical care units of 25 hospitals in China	DVT	The results revealed inadequate VTE prophylactic knowledge and practice among orthopedic nurses. However, nurses exhibited an overall positive attitude toward prophylaxis after orthopedic surgery.	More research should examine the reasons underlying the findings from various viewpoints, encompassing factors such as the accessibility of resources, the expertise and knowledge of healthcare professionals, and patients' views. It is necessary to create nursing approaches to encourage evidence-based nursing practices.
Awad & Hewi, 2020 [45], Egypt	Assess the impact of preventive PI nursing actions on nurses' knowledge, attitudes, and practices	Pre-experimental (pretest-posttest) study	Nurses	40	Orthopedic wards of El Hadara Hospital, as well as the medical–surgical unit and ICU at University Hospital in Alexandria	PI	Nurses' post-intervention scores for knowledge, attitude, and practices regarding PI prevention were significantly greater than their total mean pre-intervention scores. At post-intervention, nurses showed a high level of knowledge (92.84%), positive attitude (70.65%), and good practice (69.55%).	Recognizing and prioritizing ongoing utilization and updating PI risk evaluation sheets are essential. Any obstacles to implementing pressure ulcer prevention methods should be consistently resolved to improve practice effectively.

Aysegul et al., 2020 [46], Turkey	Measure the knowledge and application of evidence-based VAP prevention strategies among ICU nurses	Descriptive cross-sectional study	ICU nurses	102	Internal medicine unit, anesthesia unit, and pulmonary ICU of 3 hospitals in Izmir	VAP	The majority of ICU nurses showed above-average knowledge and practice regarding VAP.	Continuing educational activities incorporating evidence-based methods must be periodically repeated, and their efficacy should be assessed.
Berihu et al., 2020 [47], Ethiopia	Measure nurses' knowledge and practices regarding PI prevention	Cross-sectional study	Nurses	122	3 public hospitals in Central Zone, Tigray	PI	Approximately 82.75% of nurses had adequate knowledge, and 82.2% had poor practice toward PI.	Ongoing training is emphasized.
Kalyan et al., 2020 [48], India	Measure critical care nurses' knowledge and practices toward VAP prevention in addition to the relationship between knowledge and practice	Descriptive cross-sectional study	ICU nurses	108	ICU of a tertiary care center in Chandigarh, India	VAP	ICU nurses had average knowledge and practice levels regarding VAP prevention.	Determining the methods, instruments, and approaches necessary to prevent VAP is essential. Conducting quality improvement research is necessary to enhance practices.
Wangmo et al., 2020 [49], Bhutan	Measure nurses' knowledge, attitude, and practice toward the prevention of PI	Cross-sectional study	Nurses	389	High-risk departments at Jigme Dorji Wangchuk National Referral Hospital in Bhutan	PI	The knowledge score was good in 64% of nurses; the attitude score was poor in 75.1%, and the practice score was inadequate in 93.1%.	It is highly advisable to prioritize keeping hold of skilled nurses due to the increased knowledge gained with extended employment. Ongoing training is emphasized.
Khojastehfar et al., 2020 [50], Iran	Assess nurses' knowledge, attitudes, and practices regarding the prevention of pressure ulcers and associated factors	Cross-sectional study	ICU nurses	308	ICU of educational health centers in Iran	PI	Most participants had unsatisfactory knowledge, a negative attitude, and poor practice.	It is crucial to create training courses to avoid PI. The research highlights the significance of nursing management supporting new guidelines regarding evidence -based practices for reducing the risk of PI.
Khong et al., 2020 [51], Singapore	Assess the knowledge and attitudes of OR nurses toward PI prevention	Descriptive cross-sectional study	OR nurses	90	1 tertiary hospital with 24 major and 3 minor ORs in Singapore	PI	OR nurses had a deficiency of knowledge and a negative attitude regarding PI prevention.	The study highlights the importance of regular nurse training. The Braden Scale may not be enough for assessing OR-related PI, so risk evaluation and screening, along with a management tool, should be added to the present risk evaluation instrument and repeated often.
Olorunfemi et al., 2020 [52], Nigeria	Assess the knowledge and practices of nurses regarding the prevention of PI	Descriptive cross-sectional study	Nurses	200	Various wards at the University of Benin Teaching Hospital in Nigeria	PI	Nurses had adequate knowledge but inadequate practice in preventing PI.	Hospital administrators must address nursing issues such as the lack of resources and supplies, frustration, shortage of nurses, and ongoing nurse training to enhance nursing practice.
Rafiei et al., 2020 [53], Iran	Assess the level of knowledge of VAP prevention among nurses working in emergency rooms	Descriptive cross-sectional study	Emergency nurses	53	Emergency rooms at Bou-Ali and Velayat teaching hospitals	VAP	Nurses' overall knowledge was insufficient.	Training about VAP is necessary for emergency nursing staff. It is advisable to perform further research on the knowledge and skills of emergency nurses regarding other parts of patient care during mechanical ventilation, such as anesthesia.
Charalambous et al., 2019 [54], Cyprus	Assess nurses' knowledge and attitudes regarding PI prevention	Descriptive cross-sectional study	Nurses	102	Tertiary hospital (Nicosia General Hospital)	PI	Nurses showed positive attitudes and beliefs but inadequate expertise.	Further research should include a more significant number of participants, employ an additional sample collection technique, and examine the extent of the impact of knowledge and attitude on implementing preventive measures against PI.
Dawa et al., 2019 [55], USA	Evaluate the knowledge, attitudes, and behavior of rehabilitation nurses regarding the prevention of UTI in catheterized patients	Cross-sectional study	Rehabilitation nurses	60	3 inpatient rehabilitation centers that are part of the Allina Health System in the USA	UTI	Participants had adequate knowledge and behavior and a positive attitude regarding the prevention of UTI.	The study highlights the importance of conducting regular nurse training and providing nurses with the most recent recommendations that are based on evidence.
De Meyer et al., 2019 [56], Belgium	Assess nurses' knowledge of PI prevention	Cross-sectional study	Nurses	458	16 hospitals (geriatric units, ICUs, and rehabilitation units) in Belgium	PI	Nurses' knowledge levels regarding PI prevention were insufficient (50.7%). Low scores were noted in the prevention and etiology of PI, as well as prevention for specific groups, and high scores were reported in attendance at training sessions.	Nursing educational curricula must undergo rigorous review to ensure that any discovered deficiencies in knowledge are adequately addressed. In addition, instructional programs and other strategies are required to enhance patient care.

Dumbre, 2019 [57], India	Evaluate the knowledge and adherence of nurses to the ventilator care bundle	Exploratory survey	ICU nurses	60	ICU of a healthcare setting in Pune, India	VAP	Most participants had adequate knowledge about and compliance with the ventilator care bundle.	The staff must have extensive knowledge regarding ventilators and care for mechanically ventilated patients.
Ebi et al., 2019 [58], Ethiopia	Determine nurses' perceived barriers to PI prevention and assess nurses' knowledge of PI prevention	Descriptive cross-sectional study	Nurses	212	10 public hospitals in Wollega zones, Addis Ababa, Ethiopia	PI	Approximately 91.5% of participants had inadequate knowledge of PI prevention. The most commonly reported barriers to PI prevention were a lack of pressure-relieving devices and inadequate staffing and training.	More observational research is required to identify PI prevention practices. Ongoing training is emphasized.
Kim & Lee, 2019 [59], Korea	Evaluate the level of knowledge, attitude, and performance toward PI prevention among Korean nurses	Descriptive cross-sectional study	Nurses	282	Long-term care hospitals in Korea	PI	Nurses showed moderate knowledge (60.1%), positive attitude (68.4%), and high-level practice.	Ongoing training is emphasized.
Saleh et al., 2019 [60], Jordan	Evaluate nurses' knowledge and practice of PI prevention and treatment and factors that influence PI	Correlational study	ICU nurses	377	Medical–surgical department and critical care unit of 11 hospitals in Jordan	PI	Most nurses had inadequate knowledge and practice regarding PI prevention and treatment.	Further research with an experimental methodology is necessary to understand the topic better.
Yilmazer et al., 2019 [61], Turkey	Assess nurses' knowledge and attitudes regarding PI prevention	Cross-sectional study	ICU nurses	81	ICUs of a university hospital in Turkey	PI	ICU nurses had inadequate knowledge and a negative attitude regarding PI prevention.	Ongoing training is emphasized.
Al-Mugheed & Bayraktar, 2018 [26], Cyprus	Measure nurses' knowledge and practices regarding DVT risks and preventive measures	Descriptive cross-sectional study	Nurses	165	Medical, obstetric, oncology, surgical, rehabilitation, intensive care, and emergency care units at the University Hospital in Northern Cyprus	DVT	Nurses had inadequate knowledge and practice regarding DVT risks and preventive measures.	Implementing organizational standards and adhering to recommendations for preventing DVT are necessary to enhance nursing practices.
Barakat-Johnson et al., 2018 [28], Australia	Assess nurses' knowledge and attitudes toward preventing PI as well as examine whether there is a correlation between knowledge, attitude, and years of experience	Cross-sectional study	Nurses	998	9 hospitals and health centers in a local health district in Sydney, Australia	PI	Nurses had adequate knowledge (>70%) and a positive attitude (>80.7%) regarding PI prevention.	More studies are required to assess the relationships between knowledge, attitude, and clinical practice regarding PI prevention.
Habiballah, 2018 [62], Jordan	Measure nurses' attitudes regarding PI prevention and determine any aspects that might have an impact on these attitudes	Descriptive cross-sectional study	ICU nurses	112	ICUs at 1 university hospital and 2 government hospitals in Jordan	PI	ICU nurses had a positive attitude regarding PI prevention.	It is essential to examine any obstacles that could hinder the implementation of preventive actions.
Hamdan et al., 2018 [63], Saudi Arabia	Measure the attitudes and perceived barriers of oncology nurses toward PI prevention	Descriptive cross-sectional study	Oncology nurses	118	Cancer Center of King Fahad Medical City in Riyadh, Saudi Arabia	PI	Oncology nurses had a positive attitude regarding PI prevention, and most perceived PI assessments as problematic due to patients' conditions.	The importance of continuous training is highlighted.
Li et al., 2018 [25], China	Evaluate nurses' knowledge and attitudes toward significant immobility complications and investigate the relationship between the occurrence of these complications and nurses' attitudes and knowledge	Cross-sectional study	Nurses	3903	Various departments (neurosurgery, general surgery, general medicine, orthopedic, geriatric, and ICU) in China	Immobility complications	Participants had a positive attitude but inadequate knowledge about major immobility complications.	The importance of continuous training is highlighted.
Tirgari et al., 2018 [64], Iran	Measure the level of knowledge and attitude toward PI prevention among staff nurses working in ICUs in hospitals affiliated with Zahedan Medical Sciences University	Descriptive analytical study	ICU nurses	89	ICUs in medical facilities affiliated with Zahedan University in Iran	PI	Most participants had insufficient knowledge but a moderate attitude regarding PI prevention.	Enhanced institutional policies and guidelines are required. Nursing leaders should distribute guidelines and the most reliable scientific evidence to enhance the efficacy of preventive measures against PI. It is essential to offer an educational course on PI prevention to nurse instructors so that they can acquire the necessary knowledge to pass on to nursing students effectively.
Tallier et al., 2017 [65], USA	Assess the knowledge, attitudes, practices, and barriers regarding PI prevention among OR nurses and whether expertise and accessibility of a pressure ulcer staging tool are predictive of PI prevention behavior	Descriptive cross-sectional study	OR nurses	62	10 acute care hospitals in the USA	PI	Most participants had inadequate knowledge and practice levels but had a positive attitude.	A nursing educational program that specifically targets the evaluation and prevention of PI in the perioperative area is needed. The efficacy of the program must be comprehensively evaluated in further studies.
Ünver et al., 2017 [66], Turkey	Determine surgical nurses' attitudes regarding preventing PI	Descriptive cross-sectional study	Surgical nurses	101	ICU, OR, and surgical unit of a university hospital in Eastern Thrace, Turkey	PI	Participants had a positive attitude (80.5%) regarding PI prevention.	The importance of continuous training is highlighted.

Main findings: The KAP domains were categorized into adequate or inadequate according to the study results **(Table III).**

Table III: Adequacy of nurses' knowledge, attitude, and practice toward immobility complications

Immobility complication domain	Total number of studies	Knowledge		Attitude		Practice	
		Adequate	Inadequate	Adequate	Inadequate	Adequate	Inadequate
Pressure injury	26	4	19	11	8	1	10
Deep vein thrombosis	3	0	3	1	0	0	3
Ventilator-associated pneumonia	6	3	3	0	0	2	1
Urinary tract infection	2	2	0	2	0	1	0
Immobility complications	2	1	1	2	0	1	0
Summation	39	10	26	16	8	5	14

Four main immobility complications, PI, DVT, VAP, and UTI, were thematically analyzed (**Table IV**).

Table IV. Categories and themes of the analysis results of the included studies

Author and year	Immobility complication domain	Adequacy of knowledge, attitude, and practice	Educational intervention	Correlation between the knowledge, attitude, and practice domains	Nurses' self-evaluation needs should guide training.	Continuous education and in-service training are recommended or proven
Cebeci & Şenol Çelik, 2022 [34]	Pressure injury	Inadequate knowledge and practice				Education and in-service training
Getahun et al., 2022 [35]	Ventilator-associated pneumonia	Inadequate knowledge	Experience and education are associated with good knowledge.			Education and in-service training
Huang & Saensom, 2022 [36]	Pressure injury	Inadequate knowledge but a positive attitude	Experience and education are associated with good knowledge.			Education and in-service training
John & Srivastava, 2022 [37]	Ventilator-associated pneumonia	Adequate knowledge and practice	Experience and education are associated with good knowledge.	Knowledge does not correlate with practice.		Education and in-service training
Li et al., 2022 [24]	Pressure injury	Inadequate knowledge	Experience and education are associated with good knowledge.			Education and in-service training
Mong et al., 2022 [27]	Urinary tract infection	Adequate knowledge and practice and a positive attitude		Knowledge correlates with attitude and practice.		Education and in-service training
Niyongabo et al., 2022 [38]	Pressure injury	Inadequate knowledge and practice but a positive attitude		Knowledge negatively correlates with attitude, but attitude does not correlate with practice.		Education and in-service training
Parisod et al., 2022[39]	Pressure injury	Inadequate knowledge and practice and a negative attitude	Experience and education are associated with good knowledge.	Attitude correlates with knowledge and practice.	Nurses' self-evaluation targets training.	Education and in-service training
Yohannes et al., 2022 [40]	Deep vein thrombosis	Inadequate knowledge and practice	Experience and education are associated with good practice.	Knowledge correlates with attitude and practice.		Education and in-service training
Asfaw et al., 2021 [41]	Immobility complications	Adequate knowledge, positive attitude, and good practice	Experience and education are associated with good knowledge.			Education and in-service training
Grešš Halász et al., 2021 [42]	Pressure injury	Inadequate knowledge and negative attitude	Experience and education are associated with good knowledge.	Knowledge correlates with attitude.		Education and in-service training
Hu et al., 2021 [23]	Pressure injury	Inadequate knowledge but adequate practice and a positive attitude	Experience and education are associated with good knowledge.			Education and in-service training
Sari et al., 2021 [43]	Pressure injury	Inadequate knowledge but a positive attitude	Education is correlated with good knowledge and a positive attitude.			Education and in-service training

Wang et al., 2021 [44]	Deep vein thrombosis	Inadequate knowledge and practice but a positive attitude				
Awad & Hewi, 2020 [45]	Pressure injury	Inadequate knowledge and practice and a negative attitude				Education and in-service training
Aysegul et al., 2020 [46]	Ventilator-associated pneumonia	Adequate knowledge and practice				Education and in-service training
Berihu et al., 2020 [47]	Pressure injury	Adequate knowledge but inadequate practice				Education and in-service training
Kalyan et al., 2020 [48]	Ventilator-associated pneumonia	Inadequate knowledge and practice		Knowledge does not correlate with practice.		Education and in-service training
Wangmo et al., 2020 [49]	Pressure injury	Adequate knowledge but inadequate practice and a negative attitude		Knowledge correlates with attitude and practice.		
Khojastehfar et al., 2020 [50]	Pressure injury	Inadequate knowledge and practice and a negative attitude				Education and in-service training
Khong et al., 2020 [51]	Pressure injury	Inadequate knowledge and negative attitude		Knowledge does not correlate with attitude.		Education and in-service training
Olorunfemi et al., 2020[52]	Pressure injury	Adequate knowledge but inadequate practice				
Rafiei et al., 2020 [53]	Ventilator-associated pneumonia	Inadequate knowledge	Experience and education are associated with good knowledge.			Education and in-service training
Charalambous et al., 2019 [54]	Pressure injury	Inadequate knowledge but a positive attitude				Education and in-service training
Dawa et al., 2019 [55]	Urinary tract infection	Adequate knowledge and a positive attitude	Experience and education are associated with good knowledge.	Knowledge correlates with attitude.		Education and in-service training
De Meyer et al., 2019 [56]	Pressure injury	Inadequate knowledge			Training should be based on the identified knowledge gap.	Education and in-service training
Dumbre, 2019 [57]	Ventilator-associated pneumonia	Adequate knowledge	Experience and education are associated with good knowledge.			
Ebi et al., 2019 [58]	Pressure injury	Inadequate knowledge				Education and in-service training
Kim & Lee, 2019 [59]	Pressure injury	Inadequate knowledge but a positive attitude				Education and in-service training
Saleh et al., 2019 [60]	Pressure injury	Inadequate knowledge and practice				Education and in-service training
Yılmazer et al., 2019 [61]	Pressure injury	Inadequate knowledge and negative attitude		Knowledge does not correlate with attitude.		Education and in-service training
Al-Mugheed & Bayraktar, 2018 [26]	Deep vein thrombosis	Inadequate knowledge and practice				Education and in-service training
Barakat-Johnson et al., 2018 [28]	Pressure injury	Adequate knowledge and a positive attitude	Experience and education are associated with good knowledge.	Knowledge correlates with attitude.		
Habiballah, 2018 [62]	Pressure injury	Positive attitude	Experience and education are associated with a good attitude.			
Hamdan et al., 2018 [63]	Pressure injury	Positive attitude				Education and in-service training
Li et al., 2018 [25]	Immobility complications	Inadequate knowledge but a positive attitude				
Tirgari et al., 2018 [64]	Pressure injury	Inadequate knowledge and moderate attitude		Knowledge correlates with attitude and practice.		Education and in-service training
Tallier et al., 2017 [65]	Pressure injury	Inadequate knowledge and practice but a positive attitude		Knowledge correlates with attitude and practice.		Education and in-service training
Ünver et al., 2017 [66]	Pressure injury	Positive attitude				Education and in-service training

DISCUSSION

Immobility complications that might arise in bedridden patients are serious problems related to the KAP of nurses working at different levels of healthcare services. Such complications may have adverse effects. Successful nursing care and prevention involve having good KAP. However, an absence of evidence addresses nurses' knowledge and attitude toward immobility problems. Therefore, this study aimed to explore the KAP of nurses toward immobility complications, including PI, DVT, VAP, and UTI.

Knowledge of immobility complications

The mean knowledge score for PI was low in the studies by Cebeci and Şenol Çelik and Niyongabo et al. [34,38]. Nurses were found to lack knowledge about PI's staging and risk factors and inadequately practice assessment to prevent PI risks [34]. Inadequate knowledge impacted nurses' attitudes and practices [38,49]. In other studies, adequate training, educational lectures, and following guidelines were concluded to augment the knowledge and competence of nurses toward PI among immobile patients [36]. Moreover, basic knowledge about DVT was lacking among nurses [26,44], and a high level of knowledge was associated with years of experience [40]. Nurses falsely believed that the prevention of DVT relies mainly on pharmacological therapy, overlooking the substantial importance of mechanical prophylaxis [44]. ICU nurses were also reported to have inadequate knowledge about VAP [35,37,46]. These results agree with other reports highlighting the importance of knowledge of the measures and procedures for reducing VAP [67–69]. Therefore, nurses should have adequate knowledge and guidelines concerning preventing VAP in ICU facilities [46].

Regarding UTIs, investigators were less concerned about the knowledge of nurses. One study concluded that nurses had a high level of expertise regarding UTI prevention, including the indications for catheterization and preventive measures against catheter-induced UTI [27]. However, nurses lacked basic knowledge about UTIs, such as the indications for catheterization, the micro-organisms responsible for UTIs, and the relevant database for acquiring the needed knowledge [55].

Attitude toward immobility complications

In most studies, the mean attitude score for PI exceeded 70% [36,38,43]. Despite their high attitude score, nurses assumed that PI prevention and treatment were time-consuming and that PI had become less frequent than before [38]. Moreover, the gaps in the attitude toward PI included nurses' self-confidence in PI prevention, confidence in implementing preventive measures, and priority of PI prevention [23]. Educational interventions significantly improved the attitude of nurses toward preventive measures against PI [45]. Notably, nurses had inadequate knowledge but positive attitudes toward PI prevention, with a significant correlation found between attitude and knowledge [54]. These findings indicate that educational programs are fundamental for improving the attitude of nurses toward preventive measures against PI [36,64,65].

Nurses' attitudes toward DVT underrated the quality of care in preventing the development of this complication in immobile patients [44]. Dawa and colleagues further emphasized the correlation between knowledge and attitude in the context of preventive measures against UTI [55].

Practice toward immobility complications

In the study by Niyongabo et al., good practice of nurses toward PI prevention was reported to not correlate with their attitude [38]. In the study by Hu et al., a correlation between experience and education was emphasized [23]. This finding reflects the gap between acquiring knowledge and attitude and practising such. Most nurses admitted not practising risk factor assessment and documentation for their patients and other preventive measures [38]. In an educational interventional study, knowledge and practice were significantly correlated after the intervention [45]. Similarly, an inadequate practice of nurses toward DVT was reported in the study by Yohannes et al. [40]. Knowledge and experience were shown to be significantly correlated with nurses' excellent practice of DVT prevention [40].

Good practices of nurses toward immobility complications, including VAP and UTI, were consistently reported in some studies [27,48]. However, no correlation was found between knowledge and practice toward VAP [37,48]. Therefore, education and in-service practice were emphasized across these studies [27,37,48].

Factors influencing nurses' KAP

Accumulating evidence emphasizes the fundamental role of experience [36,37], education [28,35], and in-service training [70] in bridging the gap between the current and standard nurses' KAP 40 levels. In a study conducted in Malaysia, the final results showed improvement in nurses' practices after receiving an educational intervention [71]. A recent study concluded that an educational intervention increased the mean knowledge score of nurses toward PI prevention, evaluation, and management [72]. Egyptian research conducted in two university hospitals concurred with the literature that an educational interventional program can expand the knowledge, improve the attitude, and augment the practice of nurses toward immobility complications among bedridden patients [45]. Since there is evidence that educational interventions can improve the KAP of nurses toward immobility complications, appropriate educational interventions are recommended to improve the quality of healthcare provided to bedridden patients [73].

CONCLUSION

The findings reveal that nurses are vital in delivering healthcare to patients who cannot move. Nurses' KAP regarding immobility complications varies widely. Most

studies report that nurses' KAP toward PI, DVT, VAP, and UTI are insufficient. Moreover, their KAP toward immobility complications improve with work experience, high educational grades, and acquired training. Nurses serve as caregivers, facilitators, and educators to address the needs of immobile patients and enhance their health conditions. Thus, it is necessary to implement strategies to improve nurses' KAP. The findings suggest that organizations should mandate nursing staff to undergo continuous education, seminars, and in-service training and apply policies emphasizing the significance of preventing immobility complications by improving nursing staff's KAP toward these complications.

RECOMMENDATIONS

- In-service training programs targeting nurses must be established to enhance their KAP in preventing immobility complications, and nursing practice must be assessed after completing such educational programs.
- Before taking independent responsibilities for patient care, newly recruited nurses across departments must pass an examination assessing their fundamental KAP. This aspect must be included as a component of nursing competency assessment to ensure nurses' awareness regarding this matter and the safety of patient care they provide.
- Including a compulsory course on preventing complications related to immobility in the nursing training curriculum is essential. This course will adequately equip nursing students to provide successful care to patients.
- It is essential to organize periodic academic conferences, seminars, and tutorials for staff members to stay updated with the continuously expanding knowledge and practices required for providing good nursing care to immobile patients.
- Future research is needed to assess the barriers that influence nurses' KAP in implementing preventive measures against immobility complications.

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AUTHOR CONTRIBUTION

Alhassoon AH**:** Conceptualization, methodology, validation, formal analysis, writing—original draft preparation, and visualization.
Alharazi R**:** Methodology, validation, formal analysis, writing, review and editing, visualization, and project administration.
Almutary H**:** Methodology, validation, formal analysis, writing, review and editing, visualization, and supervision.

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