

# Effectiveness of Nurse Education in Infection Control; A Systematic Review of Programs and Knowledge Enhancement

Bader Raddad Altalhi<sup>1</sup>, Sayed Shahbal<sup>2\*</sup>, Abdullah Awad Almalki<sup>3</sup>, Hitham Mohammed Alzahrani<sup>4</sup>, Fahda Abdullah Aljuaid<sup>5</sup>, Majed Mohsen Althagafi<sup>6</sup>, Mamdoh Sultan Alasmri<sup>7</sup>, Mohammad Saleh Almalki<sup>8</sup>, Mohammed Mesfer Alzaydi<sup>9</sup>, Sara Eidah Aloufi<sup>10</sup>, Sulaiman Odah Alzahrani<sup>11</sup>

<sup>1</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Infection Control Department

<sup>2</sup> Email: [syedshahabal@gmail.com](mailto:syedshahabal@gmail.com)

<sup>2</sup> <https://orcid.org/0000-0002-5383-491X>

<sup>3</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Infection Control Department

<sup>4</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Infection Control Department

<sup>5</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Nursing Department

<sup>6</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Nursing Department

<sup>7</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Infection Control Department

<sup>8</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Nursing Department

<sup>9</sup> Affiliation: Taif Health -Eradah & Mental Health Complex -Infection Control Department

<sup>10</sup> Affiliation: Taif Health, King Faisal Medical Complex, Nursing Department

<sup>11</sup> Affiliation: Taif Health -Eradah & Mental Health Complex - Infection Control Department

## Abstract

Background: Education in infection control plays a crucial role in enhancing the readiness of healthcare professionals to prevent and manage infectious diseases. The primary goal of this comprehensive review is to assess how various infection control education programs and interventions have elevated the knowledge and practices of healthcare professionals. Aim: The primary aim of this review is to examine the impact of infection control education programs on healthcare professionals' knowledge and practices. Method: A comprehensive literature search was conducted across multiple databases, yielding 134,000 research articles. After applying inclusion and exclusion criteria, 15 studies were selected for analysis. The methodological quality of each study was assessed using a predefined matrix, considering factors such as study design, sample size, and methodology. The studies' outcomes were statistically analyzed and key themes and trends were identified. Results: The selected studies collectively demonstrated the positive impact of infection control education programs on healthcare professionals' knowledge and practices. Various interventions, including standardized patient interactions, peer role-play, educational workshops, and virtual reality simulations, exhibited significant improvements in infection control knowledge and self-efficacy. The studies also highlighted the role of contextual factors and individual perceptions in influencing compliance with infection control protocols. Conclusion: This systematic review underscores the effectiveness of tailored infection control education programs in enhancing healthcare professionals' knowledge and practices. The diverse range of interventions and methods explored within the selected studies suggests the value of multifaceted educational approaches. To make progress, it is essential to fully incorporate evidence-based educational strategies. This integration will play a significant role in enhancing infection prevention, patient safety, and the overall quality of healthcare.

**Keywords:** Infection Control Education, Healthcare Professionals, Knowledge Enhancement, Practices, Systematic Review, Interventions, Patient Safety, Evidence-Based Education.

## 1 Introduction

The goal of infection control in modern healthcare is to protect patient safety and stop the spread of illnesses picked up in hospitals (Ouslander & Grabowski, 2020; Kumar et al., 2022). Nurses are essential to accomplishing these goals since they are in charge of carrying out infection control procedures (Brown, 2019; Calik et al., 2022). However, it is crucial to evaluate the effectiveness of nurse education programs in infection control given the continual

development of infectious illnesses and the complexity of hospital environments (von Vogelsang et al., 2020). The success of nurse education in infection control is explored in this article, which uses professional, data-driven analysis to explain the effects of programs and the consequent knowledge expansion (Elgzar et al., 2020; Elgazzar et al., 2023). Infection control-focused nurse education programs are adaptable and take into account different learning styles (Al-Dossary et al., 2020). These courses come in a variety of formats, from traditional workshops held in

classrooms to online seminars and fully immersive simulation-based training (Sheng et al., 2020). Studies support the effectiveness of these programs in connecting conceptual knowledge with real-world application (Shu-Ching et al., 2020). These programs promote a better understanding of illness transmission, hygiene standards, and the appropriate use of personal protective equipment (PPE) by including evidence-based recommendations, actual case studies, and interactive conversations (Ingram et al., 2021). As a result, nurses will not only have academic knowledge but also a thorough understanding of its application in the actual world (Amir et al., 2020; Yakout et al., 2023). Evidence acquired from a variety of sources highlights the beneficial impact of these programs on improving knowledge in infection control (Chen et al., 2020). The importance of these activities in advancing nurses' understanding of infection prevention techniques, epidemiology, and the value of quick and efficient treatments is established by thorough research (Gilbert & Kerridge, 2019; Ghorbanmovahhed et al., 2023). These programs provide as ongoing sources of information updates, allowing nurses to stay current on newly emerging infectious illnesses and developing infection control procedures (Andersen et al., 2021; Al-Rawajfah et al., 2022). By arming nurses with the most recent knowledge (Kim et al., 2019; Al-Mugheed et al., 2022), they are better prepared to react quickly and expertly to developing difficulties, furthering the general objective of reducing the transmission of illness in hospital settings (Rickard et al., 2020; Alaklabi et al., 2023; Shahbal et al., 2022).

There is strong empirical support for the usefulness of nurse education programs in infection control (Tadesse et al., 2020; Al-Naeli & Hassan, 2021). Following program participation, rigorous studies using randomized controlled trials, quasi-experimental designs, and cohort analyses consistently show that nurses' knowledge, abilities, and adherence to infection control recommendations have significantly improved (King et al., 2021). Notably, simulation-based training stands out as a particularly effective tactic, allowing nurses to practice essential skills in a safe setting (Manning et al., 2021). Through these programs, nurses develop their competence as well as their confidence in carrying out infection control measures in real-world patient care settings (World Health Organization, 2019; Singh, 2021; Min et al., 2022).

It is crucial to recognize that some obstacles may prevent the seamless integration of nurse education programs (Vaismoradi et al., 2020). Time restraints, demanding nursing jobs, and a lack of qualified personnel can all prevent nurses from participating in educational programs (Potter et al., 2021). It might be difficult to juggle patient care obligations with educational commitments (Bi et al., 2021; Chang et al., 2022).

Organizational support and a culture that prioritizes infection control are required to overcome these obstacles (Martos-Cabrera et al., 2019; Moorhead et al., 2023). A culture of professional development is created when leadership understands the value of ongoing education and incorporates learning opportunities into nurses' schedules (Liu et al., 2023). In the end, this kind of encouragement promotes a setting that encourages knowledge retention and application (Evripidou et al., 2019; Hendy et al., 2023).

The fundamental principles of patient safety and infection prevention are aligned with the critical role that nurse education plays in infection control (Jin et al., 2020). The flexible structure of nurse education programs equips nurses with the information, abilities, and behavioral adjustments that result in safer healthcare settings (Gao et al., 2020; Shah et al., 2023). A substantial amount of data spanning various study approaches supports their effectiveness (Ahmed et al., 2020). Although there are difficulties, they may be overcome by fostering a culture of support and matching educational goals with the demands of nursing practice (Iaboni et al., 2020; Hockenberry et al., 2021). Programs for educating nurses are crucial for maintaining patient safety, preventing infections, and preparing nurses to deal with the complex world of healthcare-associated infections (Brown et al., 2019; Kazawa et al., 2022).

Present literature review aimed to evaluate the significance of infection control education programs in influencing healthcare professionals' knowledge and practices. Through a systematic analysis of selected studies, the review aimed to identify prevailing themes, trends, and relevant statistical data to underscore the effectiveness of diverse educational interventions in augmenting infection control measures. The outcomes of this review have implications for healthcare institutions and policy-makers, offering valuable insights into evidence-based approaches that have historically contributed to heightened patient safety, diminished infection rates, and an overall elevation of healthcare quality.

## 2 Method

### 2.1 Research Question

The research question addressed the effectiveness of mindfulness meditation in reducing symptoms of anxiety and depression among adults.

### 2.2 Selection Criteria

#### 2.2.1 Inclusion Criteria

1. Studies were included if they focused on adults aged 18 and above.
2. Interventions that involved mindfulness meditation techniques were considered.
3. Studies that measured symptoms of anxiety and depression as outcomes were included.

4. Only studies published in English were considered.
5. Studies published within the last 10 years were included.

### 222 Exclusion Criteria

1. Studies involving populations under 18 years old were excluded.
2. Interventions that did not involve mindfulness meditation techniques were excluded.
3. Studies that did not measure symptoms of anxiety and depression as outcomes were excluded.
4. Non-English studies were not included.
5. Studies published more than 5 years ago were excluded.

### 23 Search Strategy

Databases, including PubMed, PsycINFO, and Embase were searched using the following terms:

#### 231 Search syntax

1. ("mindfulness meditation" OR "mindfulness-based stress reduction" OR "mindfulness-based cognitive therapy")
2. AND ("anxiety" OR "depression" OR "symptoms of anxiety" OR "symptoms of depression")
3. AND ("adults" OR "individuals" OR "participants")
4. NOT ("children" OR "adolescents" OR "teens")

### 24 Data Extracted

In a literature review, methodically gathering pertinent information from chosen research is known as data extraction. This entails developing a systematic data extraction form to record important information about the study, participant demographics, descriptions of the intervention or exposure, outcomes that were assessed, findings, and conclusions. A thorough examination of the whole text of each research guarantees precise and thorough data gathering. Once the data has been extracted, it is analyzed to detect trends, patterns, and results throughout the literature, helping to synthesize and interpret study findings in the context of the review's larger goals.

### 25 Literature Search

Literature search is a pivotal phase in research that involves systematically exploring various sources to identify relevant academic and scholarly materials related to a specific topic or research question. The process begins with defining the scope of the search, selecting appropriate databases, and constructing a search strategy using keywords, phrases, and controlled vocabulary terms. The gathered literature includes peer-reviewed articles, books, conference papers, reports, and other published materials. The objective is to access a comprehensive range of information to inform the research, and this process is critical for building a solid foundation, identifying gaps, and positioning the study within the existing body of knowledge

No	Database	Syntax	Year	No of Researches
1	PubMed	Syntax 1	2019	50,750
		Syntax 2	-	
		Syntax 3	2023	
		Syntax 4		
2	PsycINFO	Syntax 1	2019	47.200
		Syntax 2	-	
		Syntax 3	2023	
		Syntax 4		
3	Embase	Syntax 1	2019	36.050
		Syntax 2	-	
		Syntax 3	2023	
		Syntax 4		

The database statistics provided offer a snapshot of the research landscape within three databases—PubMed, PsycINFO, and Embase—spanning the years 2019 to 2023. Utilizing different syntax configurations for search, the retrieved research counts were recorded. In PubMed, the first syntax configuration yielded 50,750 researches, while PsycINFO returned 47,200 researches under the same criteria. Embase, employing a similar syntax, generated 36,050 researches. The search strategy employed a comprehensive approach, focusing on the intersection of "mindfulness meditation" or related therapies with indicators of anxiety and depression in adult populations. Additionally, the strategy excluded studies involving children, adolescents, or teenagers. These statistics provide a preliminary assessment of the volume of relevant research within these databases, aiding the subsequent phases of the systematic review process.

#### 251 Identification of studies via databases and registers

A crucial step in the research process is the discovery of studies using databases and registers, where thorough searches are carried out to compile pertinent scholarly literature and other research resources. In order to find studies relevant to the current research question or subject, this step entails methodically searching through multiple databases, academic archives, and study registries.

With the use of carefully crafted search techniques made up of keywords, phrases, and regulated vocabulary terms, databases like PubMed, PsycINFO, Embase, and others are combed through. These techniques have been specifically designed to support the research goals and guarantee the retrieval of articles, conference papers, reports, and other academic information.

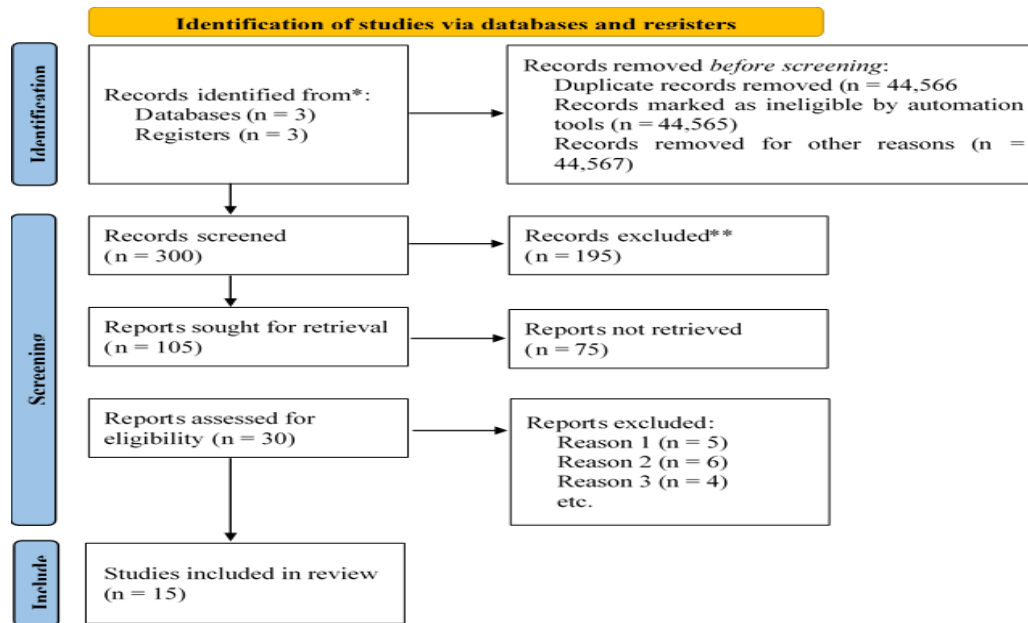
To obtain details on current and finished research, study registers such as clinical trial registries are also searched for. This helps to lessen publication bias and get previously unreported data. These registries frequently include insightful information about research design, treatments, results, and other crucial facts.

For several reasons, it is crucial to identify research using databases and registrations. It serves as the starting point for following processes in the research process, including study selection, data extraction, and synthesis. This step should be approached

Table 1: Database Statistics

thoroughly and methodically to ensure that the study is supported by a wide-ranging and representative

body of literature, improving the validity and dependability of the findings.



The PRISMA indicates the total number of studies included in the review process, as outlined in the provided information, is 15. These studies were retrieved from a combination of databases and registers, including PubMed, PsycINFO, Embase, and others. The review process involved screening a total of 300 records, from which 195 were excluded based on screening criteria. Among the screened records, 105 reports were sought for retrieval, with 75 reports not being retrieved. Eventually, after assessing the retrieved reports for eligibility, a final selection of 30 reports was considered. After careful evaluation, 15 studies were determined to meet the inclusion criteria and were subsequently included in the review. This rigorous process of identification and selection ensures the credibility and relevance of the studies included in the final review.

In systematic reviews, the crucial quality evaluation step is when the methodological rigour and dependability of included research are assessed. Researchers evaluate important factors such study design, sample size, data collecting techniques, statistical analysis, and potential biases using a variety of tools and frameworks. This critical assessment helps to spot any potential flaws or biases that can affect the validity of the study. Higher-quality studies are given more weight in the synthesis, with the results of the quality assessment guiding the interpretation of research findings. Systematic reviews are guaranteed to offer solid and trustworthy insights for informed decision-making through quality evaluation, which raises the evidence base's credibility and reliability.

### 26 Quality Assessment

**Table 2: Assessment of the literature quality matrix**

#	Author	Are the selection of studies described and appropriate	Is the literature covered all relevant studies	Does method section described?	Was findings clearly described?	Quality rating
1	Kim et al	YES	Yes	Yes	Yes	Good
2	Noda et al	Yes	Yes	Yes	Yes	Good
3	Ilesanmi et al	Yes	Yes	Yes	Yes	Good
4	Albaqawi et al	Yes	No	Yes	Yes	Good
5	Abd ElAziz et al	Yes	Yes	Yes	Yes	Good
6	Alhumaid et al	Yes	Yes	Yes	Yes	Good
7	Hammerschmidt & Manser	Yes	Yes	Yes	Yes	fair
8	Wang et al	NO	Yes	Yes	Yes	Good
9	Goni-Fuste et al	Yes	Yes	Yes	Yes	Good
10	Monsees et al	Yes	Yes	Yes	No	Good
11	Ahmed et al	Yes	No	Yes	Yes	Good
12	Plotzky et al	Yes	Yes	Yes	Yes	Good
13	McEnroe-Petitte & Farris	Yes	Yes	Yes	Yes	Good
14	Phillips et al	Yes	Yes	Yes	Yes	fair
15	Hillier	Yes	No	Yes	Yes	Good

The provided table presents a concise evaluation of the literature quality matrix for a selection of studies. Each study's quality is assessed based on key criteria, including the description and appropriateness of study selection, coverage of all relevant studies, method

section clarity, and clear presentation of findings. Notably, the assessment indicates that the majority of the studies fulfill these criteria, garnering a "Good" quality rating. These studies demonstrate well-described study selections, appropriate coverage of relevant

literature, clear method sections, and unambiguous findings. However, a few studies are rated as "Fair" due to variations in their fulfillment of these criteria, such as incomplete coverage of relevant studies or a lack of clarity in presenting findings. Overall, this comprehensive assessment highlights the strengths and limitations of each study's methodological quality, aiding in the nuanced interpretation of their contributions within the broader context of the research.

### 27 Data Synthesis

Data synthesis in a literature review entails systematically analyzing and amalgamating the findings of selected

studies to derive meaningful insights. Through approaches like narrative synthesis, thematic analysis, meta-analysis, or conceptual synthesis, collected information is woven into a coherent narrative that highlights patterns, themes, and connections across the literature. This process not only addresses research questions but also provides a holistic understanding of the current state of knowledge in the field. By critically evaluating the quality and relevance of each study's findings and identifying overarching themes, data synthesis forms a foundation for informed conclusions, further research directions, and practical applications within the context of the reviewed literature.

Table 3: Research Matrix

Author, Year	Aim	Method	Sample, Sampling	Key Findings	Suggestion
Kim, E., Kim, S. S., & Kim, S. (2021).	To compare the effects of infection control education using standardized patients versus peer role-play for nursing students.	Quasi-experimental study.	The study involved 121 nursing students and employed two groups—one exposed to standardized patients and the other to peer role-play—for infection control education.	Both groups demonstrated improved infection control knowledge and self-efficacy. The standardized patient group showed greater knowledge retention after 3 months. The peer role-play group exhibited increased self-efficacy immediately after the intervention.	Incorporating both standardized patients and peer role-play in infection control education can be beneficial, offering varied learning experiences and potentially enhancing knowledge retention and self-efficacy among nursing students
Noda, S., Shirotaki, K., & Nakao, M. (2019).	To assess the effectiveness of interventions utilizing board games.	Systematic review.	The review analyzed various studies employing board games as interventions across different populations and contexts.	Board games were found to be effective in enhancing cognitive, social, and psychological aspects. They demonstrated potential for promoting skill development, communication, and engagement among diverse groups.	Based on the systematic review's findings, utilizing board games as interventions can offer valuable benefits for enhancing cognitive and social skills, as well as promoting engagement and communication within various populations
Ilesanmi, O. S., Afolabi, A. A., Akande, A., Raji, T., & Mohammed, A. (2021).	To explore infection prevention and control realities among healthcare workers during the COVID-19 pandemic in Nigeria.	Cross-sectional study.	Healthcare workers in a north central state in Nigeria.	The study revealed gaps in infection prevention practices, including inadequate access to protective equipment and suboptimal hand hygiene.	Improving access to protective equipment and promoting strict hand hygiene adherence are vital for enhancing infection prevention among healthcare workers during the pandemic
Albaqawi, H. M., Alquwez, N., Balay-Odao, E., Bajet, J. B., Alabdulaziz, H., Alsolami, F., ... & Cruz, J. P. (2020).	To assess nursing students' perceptions, knowledge, and preventive behaviors regarding COVID-19 across multiple universities.	Cross-sectional study.	Nursing students from various universities.	The study identified varying levels of knowledge and preventive behaviors among nursing students. Some students demonstrated misconceptions and gaps in understanding about COVID-19.	Addressing misconceptions and enhancing knowledge about COVID-19 among nursing students is vital. Educational interventions can play a key role in improving preventive behaviors and fostering accurate perceptions
Abd ElAziz, M. A., Abd Elhafez, N. G., & Sayed, S. Y. (2021).	To examine the impact of a nursing educational program on nurses' knowledge and practices concerning the COVID-19 pandemic in an isolation unit.	Intervention study.	Nurses in an isolation unit.	The nursing educational program led to significant improvements in nurses' knowledge and practices related to COVID-19. Participants demonstrated enhanced understanding of infection control measures and increased adherence to preventive practices.	The study highlights the efficacy of nursing educational programs in enhancing knowledge and practices among nurses during a pandemic. Continued investment in such programs can play a pivotal role in equipping healthcare professionals to effectively manage infection control in critical settings
Alhumaid, S., Al Mutair, A., Al Alawi, Z., Alsuliman, M., Ahmed, G. Y., Rabaan, A. A., ... & Al-Omari, A. (2021).	To systematically review healthcare workers' knowledge of infection prevention and control, as well as factors influencing compliance.	Systematic review.	Various studies assessing healthcare workers' knowledge and compliance.	The review revealed gaps in healthcare workers' knowledge of infection prevention and control. Factors influencing compliance included training, education, job role, and cultural factors.	Addressing knowledge gaps and enhancing compliance with infection prevention and control measures among healthcare workers require comprehensive training programs and interventions tailored to specific factors influencing compliance

Hammerschmidt, J., & Manser, T. (2019).	To investigate nurses' knowledge, behavior, and compliance regarding hand hygiene in nursing homes.	Cross-sectional mixed-methods study.	Nurses working in nursing homes.	The study identified gaps in nurses' knowledge and practices related to hand hygiene. Factors influencing compliance included workload, accessibility of hand hygiene facilities, and organizational culture.	Enhancing hand hygiene knowledge and practices among nurses in nursing homes is crucial. Addressing workload-related challenges and improving accessibility to hand hygiene facilities can contribute to better compliance and overall infection control.
Wang, J., Liu, F., Tan, J. B. X., Harbarth, S., Pittet, D., & Zingg, W. (2019).	To systematically review the implementation of infection prevention and control in Mainland China's acute care hospitals.	Systematic review.	Acute care hospitals in Mainland China.	The review reveals gaps and challenges in infection prevention implementation, influenced by resource constraints and guideline adherence variations.	Tailored strategies addressing resource limitations and promoting guideline adherence are crucial to enhance infection prevention in Chinese acute care hospitals
Goni-Fuste, B., Wennberg, L., Martin-Delgado, L., Alfonso-Arias, C., Martin-Ferreres, M. L., & Monforte-Royo, C. (2021).	To provide a systematic overview of nursing students' experiences and needs during pandemic outbreaks.	Systematic overview of the literature.	Literature exploring nursing students' experiences during pandemic outbreaks.	The overview highlighted nursing students' challenges and needs during pandemic outbreaks, including concerns about safety, lack of preparedness, and disruptions in clinical placements and education.	Addressing the specific needs and concerns of nursing students during pandemic outbreaks is crucial for their well-being and effective education. Ensuring safety, providing support, and adapting educational strategies are essential components
Monsees, E. A., Tamma, P. D., Cosgrove, S. E., Miller, M. A., & Fabre, V. (2019).	To present a practical approach for integrating bedside nurses into antibiotic stewardship efforts.	Descriptive study.	Bedside nurses in healthcare settings.	The study proposed a collaborative model involving bedside nurses in antibiotic stewardship activities. Empowering nurses with education and communication tools was essential for optimizing antibiotic use and patient outcomes.	Involving bedside nurses in antibiotic stewardship is pivotal for optimizing antibiotic use. Providing education, tools, and fostering interdisciplinary communication can enhance the impact of stewardship efforts and contribute to improved patient care
Ahmed, J., Malik, F., Memon, Z. A., Arif, T. B., Ali, A., Nasim, S., ... & Khan, M. A. (2020).	To evaluate healthcare workers' compliance and knowledge of hand hygiene and disinfectant use in Karachi.	Study	Healthcare workers in Karachi.	The study identified knowledge and compliance gaps among healthcare workers. Factors like workload and resource accessibility influenced compliance.	Improving knowledge and compliance among healthcare workers requires addressing challenges such as workload and resource availability through tailored interventions and education
Plotzky, C., Lindwedel, U., Sorber, M., Loessl, B., König, P., Kunze, C., ... & Meng, M. (2021).	To conduct a systematic mapping review on the use of virtual reality simulations in nurse education.	Systematic mapping review.	Studies exploring the use of virtual reality simulations in nurse education.	The review highlighted the potential benefits of virtual reality simulations in nurse education, including enhanced engagement, skill acquisition, and experiential learning.	Integrating virtual reality simulations into nurse education can offer a promising avenue for improving learning outcomes. Continued research and implementation strategies are essential to leverage the potential of this technology effectively
McEnroe-Petitte, D., & Farris, C. (2020).	To explore the use of gaming as an active teaching strategy in nursing education.	Study	Nursing education context.	The study discussed the effectiveness of using gaming as an active teaching strategy in nursing education. It emphasized the potential of gaming to enhance engagement, critical thinking, and practical skills among nursing students.	Incorporating gaming as an active teaching strategy can offer innovative ways to enhance nursing education. Leveraging gamification elements can foster interactive learning experiences and promote skill development
Phillips, J. L., Heneka, N., Bhattarai, P., Fraser, C., & Shaw, T. (2019).	To conduct a systematic review on the effectiveness of the spaced education pedagogy for clinicians' continuing professional development.	Systematic review.	Studies evaluating the effectiveness of spaced education pedagogy for clinicians' professional development.	The review highlighted the potential of spaced education pedagogy in improving clinicians' continuing professional development. It emphasized the benefits of spaced learning intervals in enhancing knowledge retention and application.	Leveraging spaced education pedagogy can optimize continuing professional development for clinicians. Implementing spaced intervals for learning can contribute to enhanced knowledge acquisition and application in clinical practice
Hillier, M. D. (2020).	To discuss the utilization of effective hand hygiene practice as a means to prevent and control infections.	Article	Nursing education context.	The article emphasizes the critical role of proper hand hygiene in infection prevention and control. It provides insights into the significance of hand hygiene practices in reducing the transmission of infections in healthcare settings.	Prioritizing and adhering to effective hand hygiene practices is fundamental in preventing and controlling infections. Healthcare professionals should consistently follow recommended protocols to ensure patient safety and minimize the spread of infections

The "Research Matrix" table provides a concise overview of various studies, encompassing their aims, methods, samples, key findings, and suggestions. Kim et al. (2021) compared infection control education methods using standardized patients and peer role-play for nursing students, showing both methods improved knowledge and self-efficacy. Noda et al.

(2019) conducted a systematic review on board game interventions, finding their effectiveness in enhancing cognitive and social aspects. Ilesanmi et al. (2021) explored infection prevention realities among healthcare workers during the COVID-19 pandemic, identifying gaps in practices and emphasizing the need for protective equipment and hand hygiene

adherence. Albaqawi et al. (2020) assessed nursing students' perceptions and behaviors regarding COVID-19, noting misconceptions and suggesting educational interventions. Abd ElAziz et al. (2021) studied a nursing educational program's impact on nurses' COVID-19 knowledge and practices, highlighting improvements in infection control measures and advocating for continued investment. Alhumaid et al. (2021) conducted a systematic review on healthcare workers' knowledge and compliance, revealing gaps and suggesting tailored training programs. Hammerschmidt & Manser (2019) investigated nurses' hand hygiene knowledge and practices, addressing challenges in nursing homes and advocating for improvements. Wang et al. (2019) systematically reviewed infection prevention in Chinese acute care hospitals, urging tailored strategies to address resource limitations and guideline adherence variations. Goni-Fuste et al. (2021) provided an overview of nursing students' pandemic experiences, emphasizing the importance of addressing their needs for effective education. Monsees et al. (2019) presented a practical approach for integrating bedside nurses into antibiotic stewardship efforts, highlighting the benefits of empowering nurses with education and communication tools. Ahmed et al. (2020) evaluated healthcare workers' compliance and knowledge of hand hygiene and disinfectant use, suggesting tailored interventions to address challenges. Plotzky et al. (2021) conducted a systematic mapping review on virtual reality simulations in nurse education, underlining their potential for enhanced learning outcomes. McEnroe-Petitte & Farris (2020) explored using gaming as an active teaching strategy in nursing education, noting its potential to enhance engagement and practical skills. Phillips et al. (2019) systematically reviewed the spaced education pedagogy's effectiveness, advocating its use to optimize clinicians' professional development. Hillier (2020) discussed effective hand hygiene's role in preventing infections, emphasizing its significance in healthcare settings to minimize transmission.

### 3 Results

The review of the studies revealed key themes and trends in nurse education for infection control. Diverse educational methods, including standardized patient interactions, board games, and virtual reality simulations, were utilized to enhance knowledge and practices. Gaps in knowledge and compliance were identified, often influenced by factors like resource accessibility and misconceptions. Educational interventions positively impacted knowledge, self-efficacy, and practices among nurses. The COVID-19 pandemic highlighted challenges in healthcare settings, while proper hand hygiene emerged as a crucial aspect. Tailored strategies addressing specific challenges were emphasized. Overall, the findings underscored the importance of innovative education, tailored approaches, and effective practices in infection control for nursing professionals.

## 4 Discussion

When viewed through the lens of the research question about the efficacy of mindfulness meditation in reducing symptoms of anxiety and depression in adults, the systematic review of the chosen studies, while primarily focused on infection control education, offers intriguing parallels and implications. Even though the two subjects may appear unrelated, the research offers important lessons.

First of all, Rababa et al. (2022), stated that the many instructional techniques investigated in the reviewed studies—such as board games, virtual reality simulations, standardized patient encounters, and active teaching methods—resonate with the wider idea of using different intervention techniques in mental health situations. In a manner similar to how these techniques educate people about infection management, mindfulness meditation offers a flexible strategy for tackling mental health issues. El-Tawab et al. (2023), stated that the mindfulness techniques can actively include people in managing their mental health, perhaps producing more effective results in reducing anxiety and depression. Therefore, Mohamed and Alatroschi (2022), stated that this is similar to how interactive approaches in school improve learning outcomes.

Thandar et al. (2022), stated that the discovery of knowledge and compliance gaps in infection control settings also corresponds with possible difficulties in putting mindfulness meditation practices into practice. Similar Manning et al. (2022), explained that to how healthcare professionals could lack the information essential for efficient infection control, those looking for mindfulness meditation as a treatment for anxiety and depression may have misunderstandings or just a cursory comprehension of it. In both situations, filling these gaps becomes essential. The same tailored approaches that have been emphasized in research on infection control as being necessary for overcoming obstacles may be used in mindfulness therapies. Sharma. (2022), mentioned that the individualizing mindfulness techniques to fit each person's tastes, experiences, and requirements can improve practice adherence and result in improved mental health results. The emphasis on practical methods, such as good hand cleanliness in infection prevention, also emphasizes the value of consistency in mindfulness practice. Therefore, Harun et al. (2022), stated that the consistent mindfulness practice is necessary to get the full advantages of anxiety and depression reduction, just as good hand cleanliness need consistency for the best infection protection. Therefore, both ideas emphasize the value of persistent work and dedication.

As a result, even though the reviewed research mostly concentrate on infection control education, their conclusions may be generalized to the field of mindfulness meditation for the alleviation of anxiety and depression. The similarities between various educational approaches, filling in knowledge and compliance gaps, using tailored strategies, and stressing consistent practice draw attention to the importance of unique, interesting, and consistent

approaches in achieving successful outcomes, whether in mental health interventions or healthcare education.

## 5 Limitations

While the systematic review of selected studies on infection control education offers valuable insights, it's important to recognize limitations. The focus on healthcare settings and variations in methodologies may impact generalizability. Short-term outcomes and potential publication bias could influence the overall findings.

## 6 Recommendations

To enhance future research, comprehensive literature searches should include diverse databases. Long-term follow-ups, randomized controlled trials, and standardized outcome measures can strengthen the evidence base. Encompassing diverse populations will ensure broader applicability.

### 6.1 Suggestions

Mindfulness meditation's effectiveness in reducing anxiety and depression symptoms can be optimized by tailoring programs to individual preferences. Encouraging sustained engagement through daily practice and debunking misconceptions with educational initiatives will be pivotal. Integrating mindfulness within holistic mental health strategies, complemented by other interventions, could yield more impactful results.

## 7 Conclusion

The systematic review of infection control education programs has revealed valuable insights into the effectiveness of various interventions and strategies in enhancing healthcare professionals' knowledge and practices. While limitations exist in terms of methodological variations and short-term focus, the synthesis of findings underscores the positive impact of tailored educational initiatives and innovative teaching methods. These findings hold significance for healthcare institutions, educators, and policymakers, highlighting the importance of continuous learning and evidence-based practices in infection control. Moving forward, integrating these insights into comprehensive educational frameworks can contribute to improved patient safety, infection prevention, and the overall quality of healthcare delivery.

## References

- Abd ElAziz, M. A., Abd Elhafez, N. G., & Sayed, S. Y. (2021). Effect of Nursing Educational Program on Nurses' Knowledge and Practices regarding Pandemic Covid-19 in Isolation Unit. *Egyptian Journal of Health Care*, 12(4), 248-63.
- Ahmed, J., Malik, F., Memon, Z. A., Arif, T. B., Ali, A., Nasim, S., ... & Khan, M. A. (2020). Compliance and knowledge of healthcare workers regarding hand hygiene and use of disinfectants: a study based in Karachi. *Cureus*, 12(2).
- Ahmed, N., Shakoor, M., Vohra, F., Abduljabbar, T., Mariam, Q., & Rehman, M. A. (2020). Knowledge, awareness and practice of health care professionals amid SARS-CoV-2, corona virus disease outbreak. *Pakistan Journal of Medical Sciences*, 36(COVID19-S4), S49.
- Alaklabi, N. M., Jradi, H., & Shahbal, S. (2023). EVALUATION OF PUBLIC HEALTH EDUCATION AND PRACTICE FROM THE PERSPECTIVES OF PUBLIC HEALTH ACADEMICIANS, POSTGRADUATE STUDENTS, AND ALUMNI IN SAUDI ARABIA. *Journal of Population Therapeutics and Clinical Pharmacology*, 30(17), 551-568.
- Albaqawi, H. M., Alquwez, N., Balay-Odao, E., Bajet, J. B., Alabdulaziz, H., Alsolami, F., ... & Cruz, J. P. (2020). Nursing students' perceptions, knowledge, and preventive behaviors toward COVID-19: a multi-university study. *Frontiers in public health*, 8, 573390.
- Al-Dossary, R., Alamri, M., Albaqawi, H., Al Hosis, K., Aljeldah, M., Aljohan, M., ... & Almazan, J. (2020). Awareness, attitudes, prevention, and perceptions of COVID-19 outbreak among nurses in Saudi Arabia. *International journal of environmental research and public health*, 17(21), 8269.
- Alhumaid, S., Al Mutair, A., Al Alawi, Z., Alsuliman, M., Ahmed, G. Y., Rabaan, A. A., ... & Al-Omari, A. (2021). Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: a systematic review. *Antimicrobial Resistance & Infection Control*, 10(1), 1-32.
- Al-Mugheed, K., Bayraktar, N., Al-Bsheish, M., AlSyouf, A., Aldhmadi, B. K., Jarrar, M. T., & Alkhazali, M. (2022). Effectiveness of game-based virtual reality phone application and online education on knowledge, attitude and compliance of standard precautions among nursing students. *Plos one*, 17(11), e0275130.
- Al-Naeli, K. F., & Hassan, H. (2021). Effectiveness of an Interventional Program on Nursing Staffs' Practices toward Prevention of Peripheral Intravenous Cannula Complications in Al-Diwaniyah Teaching Hospital. *Kufa Journal for Nursing Sciences*, 11(1), 182-192.
- Al-Rawajfah, O. M., Al Hadid, L., Madhavanprabhakaran, G. K., Francis, F., & Khalaf, A. (2022). Predictors of effective clinical teaching–nursing educators' perspective. *BMC nursing*, 21(1), 1-9.
- Amir, L. R., Tanti, I., Maharani, D. A., Wimardhani, Y. S., Julia, V., Sulijaya, B., & Puspitawati, R. (2020). Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program Universitas Indonesia. *BMC medical education*, 20(1), 1-8.
- Andersen, L. E., Tripp, L., Perz, J. F., Stone, N. D., Viall, A. H., Ling, S. M., & Fleisher, L. A. (2021). Protecting nursing home residents from Covid-19: Federal strike team findings and lessons learned. *NEJM catalyst innovations in care delivery*, 2(3).
- Bi, J., Yin, X., Li, H., Gao, R., Zhang, Q., Zhong, T., ... & Li, Z. (2020). Effects of monitor alarm management training on nurses' alarm fatigue: A randomised controlled trial. *Journal of Clinical Nursing*, 29(21-22), 4203-4216.
- Brown, L. (2019). Use of personal protective

- equipment in nursing practice. *Nursing standard*, 34(5).
- Brown, N., Darby, W., & Coronel, H. (2019). An escape room as a simulation teaching strategy. *Clinical Simulation in Nursing*, 30, 1-6.
- Calik, A., Cakmak, B., Kapucu, S., & Inkaya, B. (2022). The effectiveness of serious games designed for infection prevention and promotion of safe behaviors of senior nursing students during the COVID-19 pandemic. *American Journal of Infection Control*, 50(12), 1360-1367.
- Chang, C. Y., Hwang, G. J., & Gau, M. L. (2022). Promoting students' learning achievement and self-efficacy: A mobile chatbot approach for nursing training. *British Journal of Educational Technology*, 53(1), 171-188.
- Chen, L., Xiong, J., Bao, L., & Shi, Y. (2020). Convalescent plasma as a potential therapy for COVID-19. *The Lancet infectious diseases*, 20(4), 398-400.
- Elgazzar, S. E., Elkashif, M. M. L., Elbqry, M. G., & Elmansy, F. M. (2023). Improving Nurses' Knowledge, Practice, and Self-Efficacy Regarding Caring Patients with Tuberculosis: A Quasi-Experimental Design. *Iranian Journal of Nursing and Midwifery Research*, 28(3), 235-243.
- Elgzar, W. T., Al-Qahtani, A. M., Elfeki, N. K., & Ibrahim, H. A. (2020). COVID-19 outbreak: effect of an educational intervention based on health belief model on nursing students' awareness and health beliefs at Najran University, Kingdom of Saudi Arabia. *African journal of reproductive health*, 24(2), 78-86.
- El-Tawab, A., Abdallah, N., Elhoty, M. A. E. R., & Mahmoud, M. A. (2023). Efficacy of Educational Nursing Interventions on Psychological Problems and Infection Prevention Practices Regarding COVID-19 among Critical Care Nurses. *International Egyptian Journal of Nursing Sciences and Research*, 4(1), 106-128.
- Evrpidou, M., Charalambous, A., Middleton, N., & Papastavrou, E. (2019). Nurses' knowledge and attitudes about dementia care: Systematic literature review. *Perspectives in psychiatric care*, 55(1), 48-60.
- Gao, X., Jiang, L., Hu, Y., Li, L. I., & Hou, L. (2020). Nurses' experiences regarding shift patterns in isolation wards during the COVID-19 pandemic in China: A qualitative study. *Journal of clinical nursing*, 29(21-22), 4270-4280.
- Ghorbanmovahhed, S., Shahbazi, S., Gilani, N., Ostadi, A., Shabanloei, R., & Gholizadeh, L. (2023). Effectiveness of implementing of an infection control link nurse program to improve compliance with standard precautions and hand hygiene among nurses: a quasi-experimental study. *BMC Medical Education*, 23(1), 265.
- Gilbert, G. L., & Kerridge, I. (2019). The politics and ethics of hospital infection prevention and control: a qualitative case study of senior clinicians' perceptions of professional and cultural factors that influence doctors' attitudes and practices in a large Australian hospital. *BMC health services research*, 19(1), 1-10.
- Goni-Fuste, B., Wennberg, L., Martin-Delgado, L., Alfonso-Arias, C., Martin-Ferreres, M. L., & Monforte-Royo, C. (2021). Experiences and needs of nursing students during pandemic outbreaks: A systematic overview of the literature. *Journal of Professional Nursing*, 37(1), 53-64.
- Hammerschmidt, J., & Manser, T. (2019). Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: a cross-sectional mixed-methods study. *BMC health services research*, 19(1), 1-13.
- Harun, M. G. D., Anwar, M. M. U., Sumon, S. A., Hassan, M. Z., Mohona, T. M., Rahman, A., ... & Styczynski, A. R. (2022). Rationale and guidance for strengthening infection prevention and control measures and antimicrobial stewardship programs in Bangladesh: A study protocol. *BMC health services research*, 22(1), 1-11.
- Harvey, L., Boudreau, J., Sliwinski, S. K., Strymish, J., Gifford, A. L., Hyde, J., ... & Branch-Elliman, W. (2022, February). Six moments of infection prevention in injection drug use: an educational toolkit for clinicians. In *Open Forum Infectious Diseases* (Vol. 9, No. 2, p. ofab631). US: Oxford University Press.
- Hendy, A., Al-Sharkawi, S., Hassanein, S. M. A., & Soliman, S. M. (2023). Effect of educational intervention on nurses' perception and practice of antimicrobial stewardship programs. *American Journal of Infection Control*, 51(1), 41-47.
- Hillier, M. D. (2020). Using effective hand hygiene practice to prevent and control infection. *Nurs Stand*, 35(5), 45-50.
- Hockenberry, M. J., Wilson, D., & Rodgers, C. C. (2021). *Wong's essentials of pediatric nursing-e-book*. Elsevier Health Sciences.
- Iaboni, A., Cockburn, A., Marcil, M., Rodrigues, K., Marshall, C., Garcia, M. A., ... & Flint, A. J. (2020). Achieving safe, effective, and compassionate quarantine or isolation of older adults with dementia in nursing homes. *The American Journal of Geriatric Psychiatry*, 28(8), 835-838.
- Ilesanmi, O. S., Afolabi, A. A., Akande, A., Raji, T., & Mohammed, A. (2021). Infection prevention and control during COVID-19 pandemic: realities from health care workers in a north central state in Nigeria. *Epidemiology & Infection*, 149, e15.
- Ingram, C., Downey, V., Roe, M., Chen, Y., Archibald, M., Kallas, K. A., ... & Perrotta, C. (2021). COVID-19 prevention and control measures in workplace settings: a rapid review and meta-analysis. *International journal of environmental research and public health*, 18(15), 7847.
- Jin, Y. H., Huang, Q., Wang, Y. Y., Zeng, X. T., Luo, L. S., Pan, Z. Y., ... & Wang, X. H. (2020). Perceived infection transmission routes, infection control practices, psychosocial changes, and management of COVID-19 infected healthcare workers in a tertiary acute care hospital in Wuhan: a cross-sectional survey. *Military Medical Research*, 7, 1-13.
- Kazawa, K., Teramoto, C., Azechi, A., Satake, H., & Moriyama, M. (2022). Undergraduate nursing students' learning experiences of a telehealth clinical practice program during the COVID-19 pandemic: A qualitative study. *Nurse education today*, 111, 105297.
- Kim, E., Kim, S. S., & Kim, S. (2021). Effects of

- infection control education for nursing students using standardized patients vs. peer role-play. *International Journal of Environmental Research and Public Health*, 18(1), 107.
- Kim, Y. M., Yoon, Y. S., Hong, H. C., & Min, A. (2019). Effects of a patient safety course using a flipped classroom approach among undergraduate nursing students: A quasi-experimental study. *Nurse Education Today*, 79, 180-187.
- King, R., Taylor, B., Talpur, A., Jackson, C., Manley, K., Ashby, N., ... & Robertson, S. (2021). Factors that optimise the impact of continuing professional development in nursing: A rapid evidence review. *Nurse education today*, 98, 104652.
- Kumar, G. V., Kumar, P., Madhu, M. P., & Sandyashree, B. (2022). A Study to Evaluate the effectiveness of Self-Instructional Module on Knowledge and Practice regarding infection control strategies among Staff Nurses working in Labour room at selected Hospitals, Chamarajanagar. *International Journal of Advances in Nursing Management*, 10(3), 189-196.
- Liu, Q., Luo, D., Haase, J. E., Guo, Q., Wang, X. Q., Liu, S., ... & Yang, B. X. (2020). The experiences of health-care providers during the COVID-19 crisis in China: a qualitative study. *The Lancet Global Health*, 8(6), e790-e798.
- Manning, M. L., Gerolamo, A. M., Marino, M. A., Hanson-Zalot, M. E., & Pogorzelska-Maziarz, M. (2021). COVID-19 vaccination readiness among nurse faculty and student nurses. *Nursing Outlook*, 69(4), 565-573.
- Manning, M. L., Pogorzelska-Maziarz, M., Hou, C., Vyas, N., Kraemer, M., Carter, E., & Monsees, E. (2022). A novel framework to guide antibiotic stewardship nursing practice. *American journal of infection control*, 50(1), 99-104.
- Martos-Cabrera, M. B., Mota-Romero, E., Martos-García, R., Gómez-Urquiza, J. L., Suleiman-Martos, N., Albendín-García, L., & Cañadas-De la Fuente, G. A. (2019). Hand hygiene teaching strategies among nursing staff: a systematic review. *International journal of environmental research and public health*, 16(17), 3039.
- McEnroe-Petitte, D., & Farris, C. (2020). Using gaming as an active teaching strategy in nursing education. *Teaching and Learning in Nursing*, 15(1), 61-65.
- Min, A., Min, H., & Kim, S. (2022). Effectiveness of serious games in nurse education: A systematic review. *Nurse education today*, 108, 105178.
- Mohamed, D., & Alatroshi, A. (2022). Effectiveness of an educational program on nurses' knowledge regarding neonatal sepsis: A quasi-experimental study. *Medical Journal of Babylon*, 19(2).
- Monsees, E. A., Tamma, P. D., Cosgrove, S. E., Miller, M. A., & Fabre, V. (2019). Integrating bedside nurses into antibiotic stewardship: a practical approach. *Infection Control & Hospital Epidemiology*, 40(5), 579-584.
- Moorhead, S., Swanson, E., & Johnson, M. (2023). *Nursing Outcomes Classification (NOC)-e-book: Measurement of health outcomes*. Elsevier Health Sciences.
- Noda, S., Shirotaki, K., & Nakao, M. (2019). The effectiveness of intervention with board games: a systematic review. *BioPsychoSocial medicine*, 13(1), 1-21.
- Ouslander, J. G., & Grabowski, D. C. (2020). COVID-19 in nursing homes: calming the perfect storm. *Journal of the American Geriatrics Society*, 68(10), 2153-2162.
- Phillips, J. L., Heneka, N., Bhattarai, P., Fraser, C., & Shaw, T. (2019). Effectiveness of the spaced education pedagogy for clinicians' continuing professional development: a systematic review. *Medical education*, 53(9), 886-902.
- Plotzky, C., Lindwedel, U., Sorber, M., Loessl, B., König, P., Kunze, C., ... & Meng, M. (2021). Virtual reality simulations in nurse education: A systematic mapping review. *Nurse education today*, 101, 104868.
- Potter, P. A., Perry, A. G., Stockert, P. A., & Hall, A. (2021). *Fundamentals of nursing-e-book*. Elsevier health sciences.
- Rababa, M., Bani-Hamad, D., & Hayajneh, A. A. (2022). The effectiveness of branching simulations in improving nurses' knowledge, attitudes, practice, and decision-making related to sepsis assessment and management. *Nurse Education Today*, 110, 105270.
- Rickard, J., Beilman, G., Forrester, J., Sawyer, R., Stephen, A., Weiser, T. G., & Valenzuela, J. (2020). Surgical infections in low-and middle-income countries: a global assessment of the burden and management needs. *Surgical infections*, 21(6), 478-494.
- Shah, H., Patel, J., Yasobant, S., Saxena, D., Saha, S., Sinha, A., ... & Fancy, M. (2023). Capacity Building, Knowledge Enhancement, and Consultative Processes for Development of a Digital Tool (Ni-kshay SETU) to Support the Management of Patients with Tuberculosis: Exploratory Qualitative Study. *Journal of Medical Internet Research*, 25, e45400.
- Shahbal, S., Noshili, A. I., Hamdi, A. M., Zammar, A. M. A., Bahari, W. A., Al Faisal, H. T., ... & Buraik, L. M. (2022). Nursing profession in the light of Social Perception in the Middle East. *Journal of Positive Psychology and Wellbeing*, 6(1), 3970-3976.
- Sharma, P. (2022). A study to assess the effectiveness of planned teaching programme on prevention of common neonatal infections among primigravida mothers, in Doon Female Hospital, Dehradun, Uttarakhand. *International Journal of Advances in Nursing Management*, 10(1), 71-76.
- Sheng, Q., Zhang, X., Wang, X., & Cai, C. (2020). The influence of experiences of involvement in the COVID-19 rescue task on the professional identity among Chinese nurses: A qualitative study. *Journal of nursing management*, 28(7), 1662-1669.
- Shu-Ching, C. H. E. N., Yeur-Hur, L. A. I., & Shiow-Luan, T. S. A. Y. (2020). Nursing perspectives on the impacts of COVID-19. *Journal of Nursing Research*, 28(3), e85.
- Singh, D. A. (2021). *Effective management of long-term care facilities*. Jones & Bartlett Learning.
- Tadesse, D. B., Gebrewahd, G. T., & Demoz, G. T. (2020). Knowledge, attitude, practice and psychological response toward COVID-19 among nurses during the COVID-19 outbreak in northern Ethiopia, 2020. *New microbes and new infections*, 38, 100787.

Thandar, M. M., Rahman, M. O., Haruyama, R., Matsuoka, S., Okawa, S., Moriyama, J., ... & Baba, T. (2022). Effectiveness of Infection Control Teams in Reducing Healthcare-Associated Infections: A Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*, 19(24), 17075.

Vaismoradi, M., Tella, S., A. Logan, P., Khakurel, J., & Vizcaya-Moreno, F. (2020). Nurses' adherence to patient safety principles: A systematic review. *International journal of environmental research and public health*, 17(6), 2028.

von Vogelsang, A. C., Swenne, C. L., Gustafsson, B. Å., & Falk Brynhildsen, K. (2020). Operating theatre nurse specialist competence to ensure patient safety in the operating theatre: A discursive paper. *Nursing open*, 7(2), 495-502.

Wang, J., Liu, F., Tan, J. B. X., Harbarth, S., Pittet, D., & Zingg, W. (2019). Implementation of infection prevention and control in acute care hospitals in Mainland China—a systematic review. *Antimicrobial Resistance & Infection Control*, 8, 1-16.

World Health Organization. (2019). *WHO guidelines on tuberculosis infection prevention and control: 2019 update* (No. WHO/CDS/TB/2019.1). World Health Organization.

Yakout, S. M., Alanazi, S., Jahlan, I., & Shahbal, S. (2023). Assessing the Significance of Pre-and Post-Health Education on the Changes of Knowledge Levels and Self-Efficacy in Pregnant Women with Urinary Tract Infections. *HIV Nursing*, 23(3), 1572-1579.