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Challenges in Nursing Students' Compliance with Hand Hygiene Practices- Effective Teaching Methods

A Descriptive Literature Review

Metropolia University of Applied Sciences Bachelor of Health Care Degree Programme in Nursing Bachelor's Thesis

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Abstract

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Correctly executed hand hygiene by all health care professionals, including the nursing students, in all health care environments is vital as it is one of the main methods in infection prevention and control. To assure nursing students' understanding of the importance of hand hygiene and full compliance with hand hygiene practices, it is necessary to acknowledge the possible challenges impacting nursing students in this matter. By understanding the challenges faced, it is possible to explore the most effective teaching methods regarding hand hygiene.

This study aims to describe the challenges that nursing students encounter regarding their compliance in hand hygiene practices. It also seeks to describe the teaching methods in order to produce or recommend techniques that will ensure better knowledge comprehension and skills retention among nursing students.

The data for this descriptive literature review was collected from CINAHL and PubMed databases. 13 articles were selected to be analysed based on the inclusion and exclusion criteria that was set prior the database search. The articles were analysed by using inductive content analysis and the results were organised into numerous generic categories and two main categories answering the research questions. The research questions being as follows; ''what are the challenges regarding compliance with hand hygiene practices amongst nursing students'' and ''what teaching methods ensure nursing students' compliance and retention of hand hygiene practices''.

The analysed data disclosed that poor role models, inadequate level of knowledge and training as well as poor attitudes of nursing students towards hand hygiene were some of the main challenges impacting nursing students' compliance with hand hygiene practices. Whereas traditional teaching methods were found not to be sufficient. For teaching to be effective more education should be provided in the form of seminars together with usage of hand scanners, simulations as well as cooperative learning methods. Thus, the literature review showed that further education in different forms on hand hygiene is required to increase the nursing students' knowledge and increased compliance with hand hygiene practices.

Key Words	teaching method, hand hygiene, hand disinfection, nursing student challenges, nursing student competency, nursing education, pre-registration nursing education

Contents

1 Introduction

Infection prevention and control is an essential segment of efficient risk management and patient safety programme. Thus, it must always be included by all healthcare professionals whilst providing patient care in all types of healthcare setting. Healthcare professionals are not only responsible for the care they provide but liable for all their actions. In addition, duty to the care is a legal obligation that is place in order to guarantee patient safety. No harm should be caused to patients due to healthcare workers oversight or act. It is vital for healthcare professionals to acknowledge the responsibility they have considering infection prevention and control as well as keeping their patients safe. (Weston & Burgess 2016: 4.)

According to Karadag et al. (2016) compliance with hand hygiene in infection control is complicated yet important matter. The level of individuals' compliance regarding hand hygiene was found to be affected by individuals' knowledge and perceptual factors regarding hand hygiene. Furthermore, Karadag et al. (2016) established that amongst nursing students there was an average amount of knowledge, practices, perceives and beliefs regarding the importance of hand hygiene. Subsequently Paudel et al. (2016: 169) found out that more than half of the nursing students had a positive viewpoint regarding the practice of hand hygiene, and it was considered as a vital part of nursing. Improved accessibility to hand hygiene facilities was established as a significant factor in improving the compliance to hand hygiene.

Healthcare professionals' hands are the primary transmission route of infections. The easiest yet vital method in preventing the spread of infections is hand hygiene. Regardless, as it was stated in the study by Oh (2021: 913), the performance of hand hygiene amongst healthcare workers was only 40–60%. Considering that nurses are the most frequent ones to have contact with patients, their hand hygiene performance is the most paramount among healthcare workers. Whilst the value of hand hygiene in clinical nursing rises, the competency in hand hygiene from the nursing students is required during their nursing studies. This is to secure the competency of the future nurses. (Oh 2021: 913.) Thus, as mentioned by Oh (2021: 913) further studies regarding the nursing student's present status, and knowledge as well as perception and performance regarding hand hygiene must be established.

In this thesis qualitative research methodology was used. Literature review was used as a method of collecting data. This included reviewing and browsing research and

studies from CINAHL complete and PubMed databases that were published during the past seven years from 2016 till 2022. Data collected was analysed thru inductive content analysis.

This study aims to determine the challenges regarding compliance with hand hygiene practices amongst nursing students and the teaching methods to ensure compliance and retention of hand hygiene habit. Hence, this study seeks to produce new knowledge regarding effective methods of teaching proper hand hygiene.

2 Background

Hand hygiene is a method in which the hands are cleaned by washing them with the use of soap and water, antiseptic hand soap, antiseptic hand gels or foams containing alcohol or surgical hand antiseptics. As a result of hand hygiene, potentially deadly microorganisms are prevented from spreading to patients' and the risk of healthcare providers being colonised or developing infection caused by microorganism acquired from the patient is reduced. The process of using the alcohol-based method includes pouring hand sanitizer on the palms, covering both hands fully and rubbing hands together until dry. This process normally takes approximately 20 seconds. Whereas cleaning hands using soap and water, consist of the following steps. Wetting hands, pouring the amount of soap as instructed by the manufacturer, rubbing hands for minimum of 15 to 20 seconds, rinsing with water, and drying with disposable towel. Towel should be used upon turning off the faucet, also usage of hot water should be avoided to prevent drying of the skin. When washing the hands, right timing should be emphasised. (CDC 2021.)

2.1 Hand hygiene teaching methods as a cornerstone

As the main component of infection control in hospitals, hand hygiene is crucial to ensuring the safety of patients. Student nurses are considered as future health care professionals and they are likely to cause for contamination at the hospital. (Cruz & Bashtawi 2016: 485.) Nursing students should practice good hand hygiene in a low-fidelity simulation before beginning each assignment. The skills are then improved through additional hands-on practice under highly realistic simulation environments as well as throughout the internships on hospital wards and other healthcare facilities. To learn how to perform hand hygiene procedures correctly, nursing students should practice it prior each job assignment in a low fidelity simulation. During internship,

students further improve these skills using a non-biased simulation activity. This includes internship at various health facility or wards at the hospitals. Thus, in order to take care of patients safely and avoid hospital infections, students should be able to complete the process of hand hygiene ideally without making any mistakes before they begin to provide direct care to patients. (Gniadek et al. 2021: 259.)

2.2 Hand hygiene compliance as a challenge

It may be possible to reduce or decrease the transmission of pathogens through direct contact by educating nursing students regarding the correct way of performing hand hygiene procedure. Education of students can help to lower the number of hospitals acquired infections. (Gniadek et al. 2021: 2590.) Furthermore, controlling and preventing infection is the way to prevent patients and health care workers from becoming ill from preventable infections. Patients should not catch any infectious disease while receiving care. Infection can escalate and break out, possibly affecting hundreds of millions of people around the world every year. (WHO 2022.)

According to Sundal et al. (2017: 465) the challenge that remains in clinical community is the healthcare workers' adherence to hand hygiene. To reduce associated healthcare-associated infections, it is important to prepare students to follow instructions during their clinical placement. Determining the hand hygiene performance of student nurses is the first phase in making an education plan to enhance and maintain their overall as well as time-specific compliance. Mentors must be conscious of their impact on students' performance. They must promote good hand hygiene skills, motivate students to comply, and give frequent feedback to ensure students compliance during clinical placement. (Sundal et al. 2017: 465.)

Adequate hand hygiene is vital to minimising the transmission of microorganisms in healthcare settings. Healthcare professionals are highly mobile in healthcare environments and their hands are constantly in contact with patients as well as with inanimate objects required in healthcare settings. Therefore, they are regarded as an important route for the spread of pathogenic organisms and antimicrobial resistance factors. The skin of a person is colonised by a variety of organisms. These consist of organisms that play a positive role in the health of a person, but also those that are relevant in healthcare. These can be either infectious pathogens or transmission means for antimicrobial resistance determinants. It has been shown that healthcare workers' hands get increasingly contaminated whilst providing patient care and that

skin contact, respiratory care as well as nappy changes are all individually related with increased bacterial counts. Several studies have investigated the risk of transmission associated with particular pathogens or certain activities. (Pittet & Boyce 2017: 1.)

2.3 Hand hygiene teaching methods

Hand hygiene competency is one of the most essential results of nursing education. Ensuring that student nurses know when and how to perform hand hygiene is vital given the growing rate of healthcare associated infections. Students' skills, knowledge and education would improve using empirically assessed approaches such as diversified teaching interventions, and real-life simulation on hand hygiene. This also include different programmes on education. The task of the nursing mentors in improving hand hygiene competency of nursing student has a significant impact. Healthcare facility to school supervisors should provide constant encouragement and supervision to ensure that the protocol on hand hygiene programmes is implemented by all health workers in each health facility. (Labrague et al. 2017.)

3 Purpose, aim and study questions

The purpose of this study is to describe the challenges regarding compliance with hand hygiene practices amongst nursing students and what are the teaching methods to ensure nursing compliance and retention of hand hygiene practices.

This study aims to produce new knowledge regarding effective methods of teaching proper hand hygiene for both teachers of healthcare professionals and nursing students.

Study Questions

1. What are the challenges regarding compliance with hand hygiene practices amongst nursing students?

2. What teaching methods ensure nursing students' compliance and retention of hand hygiene practices?

4 Methodology and Method

Qualitative study is a type of a social study that concentrates on the ways in which researchers try to understand their experiences and encounters as well as make sense of the world in which they live in. Within the larger framework of this type of research, there are several different approaches. Much of this research has the same goal: to understand or make sense, describe, and interpret social phenomena as they are understood by individuals, groups, and cultures. Qualitative approaches are used by the researchers study the behaviour, feelings and experiences of people and their habits; grounded theorists' study social processes and interactions, while phenomenologists look at and illuminate a phenomenon and describe the 'lifeworld' or Lebenswelt. Qualitative approaches are practical when studying change or conflict. Qualitative research is based on the interpretative approach of people's actual experience. (Holloway & Galvin 2017: 287.)

A review on literature gives a systematic analysis of the research question and at the same time it shows similarities and differences there are in the research. Coughlan and Cronin (2017: 12) mentioned that review of literature is a wider phrase that encircle wide range perspectives of searching, analysing, and reporting data. A descriptive literature review describes individual events, observation, and observances. Descriptive literature analysis addresses a particular characteristic of a population by distinguishing issues or illuminating existing problems in a group of people or system through collected data that fully describes the circumstances. During review on literature, the results and data gathered must not change and provide adequate explanation of the data collection sample. (Siedlecki 2020: 8.)

A descriptive type of literature review was used in this bachelor thesis. A descriptive review on literature can be also called a reported, general, or traditional review. Welldone descriptive literature reviews are an important part of scholarship in any field and are used to identify, examine, evaluate, and explain a systematic knowledge on a specific subject. Because of the growing needs on the methodological conduct on review of literature it must include a minimum of one understandable stated method by which it was conducted. (Coughlan & Cronin 2017: 12.)

4.1 Data search and selection

Study questions that were developed for this thesis served as a guide for the descriptive review on literature (Kangasniemi et al. 2013). The data used in this study were obtained by searching, reviewing, and analysing published research articles on teaching methods for hand hygiene in nursing education. Data were searched in reliable databases, including CINAHL and PubMed, the main databases of Metropolia University of Applied Sciences, and scientific publications were also used. The search terms used in the search were teaching method, hand hygiene or hand disinfection, nursing education or pre-registration nursing education.

Cumulative Index to Nursing and Allied Literature (CINAHL) holds quality references to articles from numerous of nursing journals from the UK, USA as well as other countries. Also, there are links to thousands of journal articles in full text. PubMed is a free database that supports the exploration and recovery of biomedical and life science literature. It includes more than 34 million references and abstracts of biomedical literature. However, it does not contain full-text journal articles. Having said that, links to the full texts are frequently available and accessible when obtained from other sources. (PubMed.gov.)

The researchers used Boolean technique and selected peer reviewed articles in CINAHL. Upon searching and looking at the results, duplicate titles were automatically removed resulting 143 research results. The mesh technique that was used in PubMed together with the usage of the free full text filter displayed 83 results. As it shown in the data search, the total number of articles from CINAHL and PubMed was 226. The data search table can be found below (Table 1).

Table 1. Data search

Data base	Cinahl	Pubmed	Total
Search terms	teaching method AND hand hygiene OR hand disinfection AND nursing education OR preregistration nursing education	teaching method AND hand hygiene OR hand disinfection AND nursing education OR preregistration nursing education	
Number of hits	143	83	226
Selected based on the title	40	15	55
Selected based on abstract	24	10	34
Selected based on the whole text	8	5	13

Search in database was conducted by the following guidelines, the date of publication was between 2016 and 2022. Furthermore, these literatures had to be validated thru peer-review, applicable to the study and the two-study question that were formed. English language was primarily used in the studies based in full text and nursing students had to be included exclusively. The table of inclusion and exclusion criteria are listed under (Table 2).

Table 2. Inclusion and exclusion criteria

Inclusion criteria	**Exclusion criteria**
English language primary research studies in full text	Non-English language primary research studies and not in full text
Studies published from January 2016 up to 2022	A study published beyond December 2016
Nursing Students	Qualified Nurses
Answers the study question	Does not answer the study question
Peer reviewed	Not peer reviewed

To appraise the articles that had been selected from the database search, the quality of the journal was checked, using peer-reviewed articles. A publication forum in Finland in which researcher used to rate and classify the quality assessment of the research article. There are four classification levels that evaluate the main foreign and domestic publishing channels in JUFO. 1 corresponds to the basic level, 2 to the leading level, 3 to the highest level and 0 means that the publication channels do not meet the criteria for level 1. (JUFO 2021).

Upon checking the chosen articles for this thesis on JUFO, ten of the selected articles got a score of one which was in the basic level and one of the chosen articles got a score of two, in which was the highest score in the search articles. Also, there were two article that did not pass the evaluation standard of JUFO and got the score of zero.

As illustrated in the below PRISMA Flow Diagram (Figure 1), the articles in the study were carefully and systematically selected. After selecting the final 13 articles for content analysis, the articles were ordered and organised and listed in Appendix 2. The articles were observed and carefully viewed in detail. Moreover, records identified through database searching from CINAHL complete and PubMed with a total of 226 articles, after the duplicates were removed, a total of 55 articles were selected and from those articles, records were examined and selected with a total of 24 articles and 31 articles were excluded. Full text articles were also assessed for eligibility with a total of 15 articles and 2 of them were excluded with reasons. Overall, a total of 13 articles were used in this thesis.

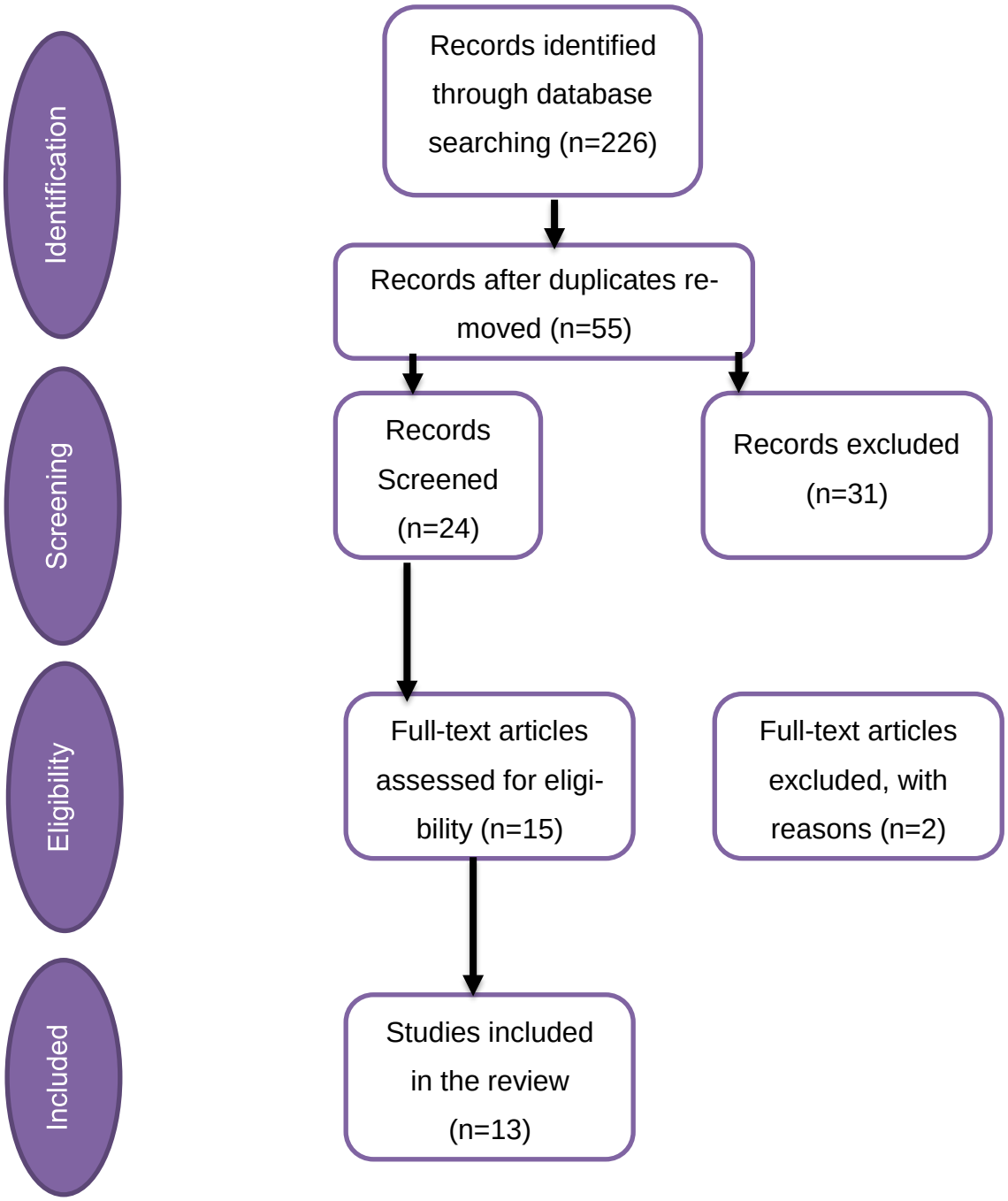

Figure 1. PRISMA Flow Diagram

4.2 Data analysis method

Iterative processes are used in data analysis. Iteration is the process by which researcher refine the questions they derive from the data as they move back and forth between data collection, analysis and interpretation. Insight into this process enables researchers to allocate and divide their time appropriately. Health researchers often lack time for proper data analysis at the end of their study because they do not anticipate that the complex nature of qualitative research requires more time. (Holloway and Galvin 2016: 4.)

Thirteen references were used for this descriptive literature review. Articles were related to research study and validated thru peer reviews that answered the two-questions posed by the researcher. The studies were from ten different countries, institutions and classes of nursing students and were published between 2016 and 2022.

Inductive content analysis is a technique frequently applied in qualitative studies to examine data. This method can be used to both open and semi-structured data. It consists of the method of abstraction to data organising and summarisation. After a research unit is selected, the researcher goes through the articles to identify open codes. These are then linked to additional open codes with related content. All this is done to create sub concepts, categories, and themes. (Kyngäs 2020: 13-21.) For the researchers to address the study questions, inductive content analysis was utilized in this thesis.

As mentioned in the earlier step, these sub-concepts, categories, and topics were grouped into concepts, categories, and topics. The meaningful concepts or main concepts, categories, and topics form the foundation for the reporting of the results of the analysis. Content analysis is data dependent; therefore, the researcher should return to the initial data multiple times throughout the analysis to make sure the outcome has a solid relationship to the data analysed. (Kyngäs 2020: 13-21.) Thereafter, the process of the data analysis is from the understanding of the data as the initial step. Interconnected phrases were acquired from thirteen selected studies as the meaning units, accompanied by simplifying them, which was considered as reduction or coding. Furthermore, parallel words and phrases that described nursing students' challenges and teaching methods to ensure compliance towards hand hygiene practice were grouped as subcategories. Individual category was analysed

and combined to form generic category. In addition, main category was constructed to answer the two research questions: What are the challenges regarding compliance with hand hygiene practices amongst nursing students and what teaching methods ensure nursing students' compliance and retention of hand hygiene practices.

Table 3. Example of content analysis

Meaning Unit	Reduction/coding	Sub-category	Generic-category	Main-category
1. "In the examined group of student's significant problems in performing the procedure of hand disinfection were. regular training and assessment of the compliance with hand hygiene procedures should take place after completing each cycle of nursing education.	Problems were identified among students in following proper hand hygiene. Regular training, assessment and compliance should take place to ensure proper hand hygiene among nursing students upon completion of nursing studies.	Lack of proper hand hygiene upon finishing nursing studies Lack of sufficient training, assessment, and compliance Ineffective teaching methods	Inadequate training, assessment, and compliance Insufficient compliance with hand hygiene ensured by training and assessment Incompetent educators	Factors affecting Nursing student compliance and Competency related to proper Hand Hygiene

5 Results

The results were classified into categories which included sub-category, generic category, and main category. Under the main category, assessment regarding factors affecting nursing student's compliance and competency connected to proper hand hygiene and efficient methods of teaching hand hygiene to nursing students were recognized. From the main category, generic category was assessed for inadequate training and compliance, inadequate knowledge and skills, lack of competency, simulation, theoretical teaching, and use of the scanner. From generic category, subcategory was assessed for poor performance and poor attitude of nursing student. It also assessed insufficient teaching skills/method, level of knowledge frequent errors, ineffective practice and immediate feedback from the educator. Lastly, it assessed improvement in skill, decision making, develop and provide new knowledge and non-biased and accurate decision.

5.1 Challenges regarding compliance with hand hygiene practices amongst nursing students

5.1.1 Poor performance and poor attitude of nursing students

The analysis of data revealed that lack of hand hygiene compliance among nursing students is one of the challenges. Based on the studies by Barrett and Randle (2008), Gould and Drey (2013), Numminen et al. (2014) and Korhonen et al. (2019: 104-110), it is possible that the poor role modelling of trained nurses in executing hand hygiene may influence students' knowledge and comprehension of evidence-based hand hygiene. Several authors argued that the closer students get to the profession, the more convinced they are that they will perform the technique, leading to poorer performance (Lopez et al. 2021). According to Oyapero and Oyapero (2018: 150) there are other factors that can contribute to poor performance which includes lack of handwashing sinks, time spent on hand hygiene, patients' condition, effect of hand hygiene product on skin. In addition, mentors, group behaviour and the extent of management support affect the level of compliance.

It has been demonstrated that the effect of poor role modelling negatively impacts hand hygiene compliance amongst students. In addition, healthcare professionals' intention to perform hand hygiene is often affected by how they perceived the beliefs of their mentors. (Oyapero & Oyapero 2018: 150.) Student nurses' poor attitudes may also be influenced by other staff members' practices when exposed to the clinical setting (Zimmerman et al. 2020: 6). In a study by Bounou et al. (2021), infection risk was one of the most important factors influencing students' attitudes towards hand hygiene.

5.1.2 Insufficient teaching skills and teaching method

Teaching competency plays a critical role in introducing hand hygiene to nursing students. Hand hygiene competency is a vital element and stays the main challenge for nursing instructors. (Kısacık et al. 2021.) Given the importance of hand hygiene education, the appropriateness of the approach used to teach the skills and the ability to effective and sustainable behaviours are also important (Konicki & Miller 2016; Kısacık et al. 2021; Suen et al. 2019). Thus, a conventional or traditional teaching method do not appear to be sufficient to provide an adequate understanding of hand hygiene (Lopez et al. 2021). Traditional teaching methods do not lead to long-term

change in behaviour regarding hand hygiene (Lehotsky et al. 2015, Kısacık et al. 2021). A compulsory education and seminars among all nursing student in the study made by Bounou et al. (2021) was mostly popularly suggested. Using visual aids stimulate interest and promotes understanding in teaching (Burgess 2016, Suen et al. 2019). A study conducted by Kacan (2021) suggested that the using various teaching methods and integrating them into curriculum will improve student nurses' hand-washing habits. To avert the spread of infectious diseases, further assessment of teaching approach is required to ensure good technical execution of hand hygiene at the university level (Lopez et al.
2021).

5.1.3 Inadequate training and compliance

Inadequate training and compliance of nursing students are likely to experience poor performance and poor attitude. It is essential to raise hand hygiene understanding and improve hand hygiene compliance of nursing students before they graduate, as they will form the future work force. (Kacan 2021.) Teaching nursing students proper hand hygiene can reduce the transmission of pathogens through direct contact, leading to a decrease in the number of hospital-acquired infections (Gniadek 2021). Even though it is a routine process that comes before and after medical treatments, it is usually carried out carelessly, too quickly, and without the use of the appropriate training. Numerous scientific studies have shown that failure to follow this straightforward procedure leads to transmission of pathogens to the patient and is a common cause of hospitalacquired illnesses transmitted through direct contact. (Gniadek et al. 2021.) There may be underlying reasons in the clinical setting that prevent students from promoting proper practices with clinical staff, such as reporting violations (Kingston et al. 2017, 2018). This concept was showed in clinical supervisors' statements, which indicated a present discrepancy that disempowers some students and prevent them from advocating (Carter et al. 2017; Gould & Drey 2013; Ward 2010; Zimmerman et al. 2020).

5.1.4 Level of knowledge and frequent errors

Nursing education has an essential role in providing student nurses with the necessary knowledge, attitudes, and beliefs to avoid hospital-acquired infections, and to teach and improve their basic hand hygiene skills (Kısacık et al. 2021). It is easier for nursing students to apply their knowledge to practice when they have a solid understanding of

theory behind nursing practice (Korhonen et al. 2019, Kısacık et al. 2021). Connecting theory together with practice is a critical part of achieving adequate hand hygiene habit throughout nursing education (Salmon et al. 2013, Kısacık et al. 2021). A study, after evaluating the level of proficiency of student nurses on handwashing, it was determined that existing hand disinfection information programs need to be improved to fill knowledge gaps and produce extremely certified nurses in the future (Villar et al. 2018).

According to the skills and awareness acquired by nursing students throughout their education, their hand hygiene behaviour and hand washing practises are also anticipated to be tremendous (Bayram et al. 2019; Kacan 2021). The higher the level of nursing education, the higher the knowledge and skills in theory and clinical practise are also anticipated to be (Kacan 2021). Kacan (2021) found that the most common hand hygiene circumstances were "after contact with the patient" and the least common hand hygiene situation was "before putting on gloves". There are also other studies with similar findings (Demir et al. 2013; Kacan 2021; Turan, Mankan & Polat, 2017). Neglecting to change or dispose of tainted gloves, the mistaken perception that the use of gloves the need for hand hygiene, and the failure of medical personnel to perform hand hygiene before and after the utilise of gloves are elements that have already been described and that affect compliance with hand hygiene (Girou et al. 2004; Oyapero & Oyapero 2018).

5.1.5 Inadequate knowledge and skills

Hand hygiene performance improves thru hand hygiene awareness, promotion, monitoring, evaluation and feedback. Therefore, infection control nurses must prioritise in acquiring knowledge and skills in order to receive education and training in hand hygiene at professional level. Compliance in hand hygiene increases in activity such as training and seminar. Moreover, formal ocular teaching is the primary source of information as reported by the students. (Tavolacci et al. 2017.) An infection control nurse that is knowledgeable a professional educator and trainer in hand hygiene is needed to enhance knowledge and skills (Hyand 2019).

5.1.6 Ineffective practice and frequent contamination

Prior to hand hygiene practices, increase level in contamination will likely decrease in good level of cleanliness (Lopez 2021). According to literature, if not used on regular

basis, skills will deteriorate, and the level of deterioration is associated with the duration in which the skills is not practice or utilised (Price et al. 2018). Lopez et al. (2021) point out that, men performed and scored poorly than women regardless of technique on procedure used. In contrast, greater knowledge on technique were predictive to be higher among male specifically on first year of university education. During clinical placement, exposure to poor practices of staff and supervisor are experienced by nursing students. (Carter et al. 2017: Gould & Drey 2013; Ward 2010; Zimmerman et al. 2020.) Students are negatively influence by the qualified staff that are not following hand hygiene practices (Ward 2012; Zimmerman 2020) and it will also put pressure on them to adapt workplace (Cole 2009; Ward 2011,2013; Zimmerman et al. 2020).

5.1.7 Lack of competency

Competency in nursing students involves intellectual, behavioural and emotional aspect that are needed to guide them to successful learning and working. Furthermore, studies show that there is a direct link between level of competency in doing proper hand hygiene and hospital acquired level of infection. Enough time for developing and practicing proper hand hygiene procedure are crucial in developing competencies that are needed in their future job, and professional education of nursing students are aiming and responsible for these competencies. (Gniadek et al. 2021.) Lack of competency is related to time management, workplace pressure and adequacy of resources for infection prevention and control measure are often stated as a non-compliance reason (Carter et al. 2017; Mitchell et al. 2017; Ward 2010).

5.2 Teaching methods ensuring students' compliance of hand hygiene practice

5.2.1 Non-biased and accurate evaluation

A "Hand-in-Scan" hand hygiene scanner, an automated tool design for hand hygiene training and education were lunched in 2012. With 95.05% sensitivity and 98.01% specificity, this tool can accurately identity disinfected area during hand hygiene practices (Lehotsky et al. 2017; Lorna et al. 2019). Digital images of hand coverage are produced using ultraviolet inked ABHR. For less than one minute, hand hygiene procedure is analysed, and it will give evaluation or feedback that will serve as a reference for the user. Percentage of hands and region missed during hand hygiene

practices are recorded. It also includes percentage of alcohol base hand coverage. (Duong et al. 2017; Lehotsky et al. 2017; Lorna et al. 2019.)

5.2.2 Use of scanner

In clinical setting, the most effective and recognized preventive measure in minimising healthcare acquired infection is hand hygiene (Park et al. 2014). When hand is soiled with dirt or it is visibly dirty and contaminated with bloody fluids, hand hygiene using soap and water is highly recommended. For promotion on understanding the concept of hand hygiene using hand scanner is effective and helpful. It is helpful in a way that using this hand scanner motivates the students, thus it also helps the instructor to teach hand hygiene easily. With this a hundred percent compliance in protocol in hand hygiene is achieved. Additionally, eighty-five percent satisfaction rate towards the utilization of hand scanner as a teaching device in hand hygiene. (Duong et al. 2017; Lehotsky et al. 2017; Lorna et al. 2019.)

5.2.3 Mentors' feedback, improved skills, and enhanced decision

In a group of students, cooperative learning is vital to enhance their full potential as a group or as an individual. Through the collective construction of knowledge, it builds a sense of responsibility for their learning as well as their group. Using their own characteristic and personalities, the instructor facilitates cooperative learning that is functional and build their social skills accordingly. (Sharan 2010; Villar et al. 2018.) Cooperative learning is applied to wide range of fields as well as in specialization of certain task. There is an actual basis that encourage the uses of cooperative learning as it is a proven measure to increase the knowledge and develop skills in hand hygiene among students. It also suggested that practice may need to be supplemented with feedback to motivate students to remember the six-step technique of hand hygiene. (Price et al. 2018.) Different mode of intervention with feedback showed that it promotes and sustains improvement in hand hygiene compliance, thus an absence of instant feedback could be a factor on skill deterioration (Fuller et al. 2012; Price et al. 2018). Another study supports this result, showed that feedback is useful method for enhancing hand hygiene (Diefenbacher et al. 2019; Kısacık et al. 2021).

5.2.4 Simulation

Simulation is like a catalyst that will hasten and solidify the educational capacity of an individual or an institution. It requires different approaches that will help to integrate and develop learning experiences in nursing curriculum. (Bogossian et al. 2018.) Educational level and trainings do not impact hand hygiene practices (Kacan 2021). Practice of hand hygiene are learned through effective simulation. Additionally, it is vital to verify the students' readiness and practice during hand hygiene to mitigate any arising problems. Also, it is important to evaluate and formulate new technique that will be beneficial to hand hygiene practices. Hand hygiene procedure are not directly influenced by the educational level and training of hand hygiene procedure. (Kacan 2021.) Therefore, simulation provides the students opportunity to enhance their skills and knowledge thru practices. Identifying the students' whole aspect in learning would help to formulate techniques that improve hand washing procedure compliance. (Akyol 2007; Karadag, Yildirim & Pekin 2016.)

Another factor that will contribute to the high hand hygiene practice is the positive and encouraging attitude of faculty members. Hand hygiene is essential in every nurse patient interaction to prevent healthcare acquired infection; therefore, students are oblique to learn hand hygiene procedure correctly and effectively. Different teaching techniques are recommended while integrating hand hygiene practices to the curriculum. (Kacan 2021.)

It was concluded that effective and high-quality simulation and the traditional long hours of discussion are almost giving equal hand hygiene practice score. Standardized simulation curriculum and training techniques are used in this study. (Hayden et al. 2014.) Simulation impacts are clearly indicated that students are well prepared and knowledgeable enough during their nurse patient interaction. In other words, it makes them clinically competent. This this support the universally accepted pedagogy in nursing where simulations are discussed with rarely disadvantages. (Larue, Pepin & Allard 2015.)

5.2.5 Developed and produced new knowledge

According to Bounou et al. (2021) trainers' behaviour and the knowledge they get during lectures were accepted as efficient in moulding hand hygiene practice of the students. Upon using infographics on other teaching strategy, the instructor must first

consider the students' diversity including the age and learning capabilities (Lopez et al. 2021; Minervini 2005; Sancho 2010). Use of visual materials are effective in students in their first year. However, there is a diminishing effect of this visual material due to over exposure during their succeeding academic years. This will result in shifting from your expected result. Visual aids are useful for optimising and hastening the comprehension process of the student. But the lack of precise, first-hand hygiene knowledge and actual simulation are the main barrier to the visual aids' effectiveness. (Aguirre et al. 2015; Naparin et al. 2017; Lopez et al. 2021.)

Through the incorporation of education, the level of the nursing students learning can be enhanced. Learning professional knowledge use in a nursing practice is significant to acquire and expand comprehension to help gather skills and generate knowledge that is essential in making a health care decision. Hand hygiene attitude are highly impacted by the knowledge acquired and trainers' attitude during classes. It is supported by a study that shows that most of the students favoured the inclusion of hand hygiene practices, to their curriculum, with emphasise to the effectiveness of education and seminars to increase hand hygiene practice compliance. (Bounou et al. 2021.)

6 Discussion

6.1 Discussion of findings

The purpose of this study was to describe the challenges regarding the compliance with hand hygiene practices amongst nursing students and what are the teaching methods to ensure nursing compliance and retention of hand hygiene practices. Its aim was to produce new knowledge regarding effective methods of teaching proper hand hygiene for both teachers of healthcare professionals and nursing students. The findings associated with this study were categorized into six generic categories and together with its subcategory were titled as shown in Figure 1. This review found 13 studies that attained the inclusion criteria which were mainly made up of qualitative approaches. After cautious review of accessible literature, these findings produce insights that affect the competency of nursing students and how to expand their knowledge and skills to hand hygiene practices that can be utilised in the future.

The result of this study recognised the challenges that influenced the competency of nursing students and teaching methods that ensure nursing students' compliance and

retention to hand hygiene practices. Subsequently, with their poor performances, poor attitudes, ineffective hand hygiene practices, frequent contamination and even further infections. The six categories that were recognised summarized completed with subcategories and this shows what are the challenges that influenced nursing students' compliance and effective teaching methods of appropriate hand hygiene practices during their studies.

These findings are significant as it can possibly utilised as a cornerstone when recognising challenges that influences nursing students' compliance. Additionally, it can be beneficial to understand the teaching methods to ensure nursing students' compliance and retention for performing hand hygiene practices nowadays and hereafter. Often unnoticed, nursing students are more than responsible and cooperative of handling various factors along with appropriate reinforcement, guidance and information that nursing students may overcome to avoid unsatisfactory performance towards proper hand hygiene practices.

6.2 Discussion of validity

Validity refers to the veracity and truthfulness of the data, process and tools that are being used. The content of the study from the research question, methodology of choice, research design, data sampling techniques and data analysis and lastly the conclusions must be valid. (Leung 2015: 325.) Furthermore, to ensure the reliability of a literature review consulting and referring to a reliable, credible, and valid data and sources is most (Burns & Grove 2001: 110-111; Parahoo 2014: 131; Polit & Beck 2014:
119-123).

To make sure the validity of this study, reliable data bases recommended by the Metropolia University of Applied Sciences' library were utilized. Two databases ensured a wide search and facilitate valid comparison that will enhance the validity of the research (Burns & Grove 2001:119). Trustworthiness is also a key component in the validity of a literature review, and this was enhanced using reputable sources (Polit & Beck 2004: 36; Elo & Kyngäs 2008: 108,112). Furthermore, the researcher conducts through review on literature and avoid personal biases that will jeopardise the study (Polit & Beck, 2014: 185, 493). When applying content analysis in qualitative research, the general criteria and strategies for trustworthiness and validation of qualitative

research defined above are applied to increase the validity of the research (Elo and Kyngäs 2008: 112).

Credibility is particularly relevant aspect of trustworthiness. Credibility is gained to the extent that research methods inspire confidence in the veracity of the data and in the researchers' interpretations and conclusions from the data. The credibility of a qualitative study can be improved through a variety of approaches, but one strategy in particular deserves early discussion because it has implications for the design of all studies. (Polit and Beck 2011: 106.)

To ensure the quality of the journals, they were checked from the scientific publication forum used in Finland which was established by the Finnish scientific community to encourage the quality evaluation of academic research (JUFO). The information that was gathered were reviewed by both authors of this study surely observed the instruction

on how to perform a descriptive literature review and how to avoid biases. The choice and analysis of articles had been distinctly documented and were validated for reliability.

6.3 Ethical consideration

Hand hygiene prevents transmission of infection. It ensures that the patients are safe, thus it is moral and professional obligation of a healthcare provider to do this practice. Based on one of our fundamental ethics in nursing which is “non-maleficence” or the obligation to not inflict harm. By not doing hand hygiene practice nurses unintentionally harming the patient. Based on a data gathered by Vitalacy there are six major lawsuits filed against healthcare provider in which poor hand hygiene was noted as a factor in two of these lawsuits. (Gallese 2018.)

However, in some medical situations, hand hygiene procedure may cause delay in giving medical attention specifically in emergency scenario. Although it takes a minute to do hand hygiene procedure, this time is crucial for the survival of the patient. Considering the balance of risk and benefits, there may be trade-off between the speed of response and thoroughness of hand hygiene. (MBPHEN 2015.) In particular to this research, researcher vigilance and understanding too unforeseen ethical dilemma that may arise.

Researchers want their conclusions to be consistent with the truth. Research cannot provide insights for clinical practice if the results are inaccurate, biased or do not reflect the experiences of the target population. Consumers of research must judge the quality of the studies' findings by evaluating the conceptual and methodological choices made by researchers. Those who conduct research must be able to make choices that result in findings of the highest potential quality. (Polit & Beck 2017: 230-240.)

The recommendation provided by the Finnish national board on research integrity TENK was also obeyed throughout the entire research process. Careful analysis and proper citation of the authors work were valued and recognized in referencing. Taking this kind of process working with literature review showed respect to authors of the work on which thesis was based. Furthermore, the output of the study was also checked using Turnitin which was used to prevent plagiarism and promote student work outcomes.

7 Conclusion and recommendations

A good quality hand hygiene habit is significant to help to avoid the spread of infectious diseases, as part of a comprehensive package of general health and infection prevention and control measures. Nursing students play an important role in giving care for patients after they finish their studies. The characteristic of a nursing education needs to be enhanced theoretically, productively and progressively in order to sustain a quality of free health associated infections. Using this thesis, it could be used to improve nursing students’ knowledge and skills in practicing proper hand hygiene. It could guide nursing students to demonstrate their competency in performing proper hand hygiene to avoid the spread of infection before they completed their studies. Hence, this thesis could be utilised by instructors or teachers when evaluating the students’ level of understanding regarding hand hygiene practices. In addition, this thesis will help expand new knowledge and develops skills and attitudes among nursing students. The knowledge, perspective and skills of future nurses through appropriate hand hygiene teaching method and factors affecting their compliance will occupy a significant role in the prevention of infection. According to the results of this thesis, it was determined that sustained improvement of students' hand hygiene compliance is necessary.

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Figure 1. Data analysis result

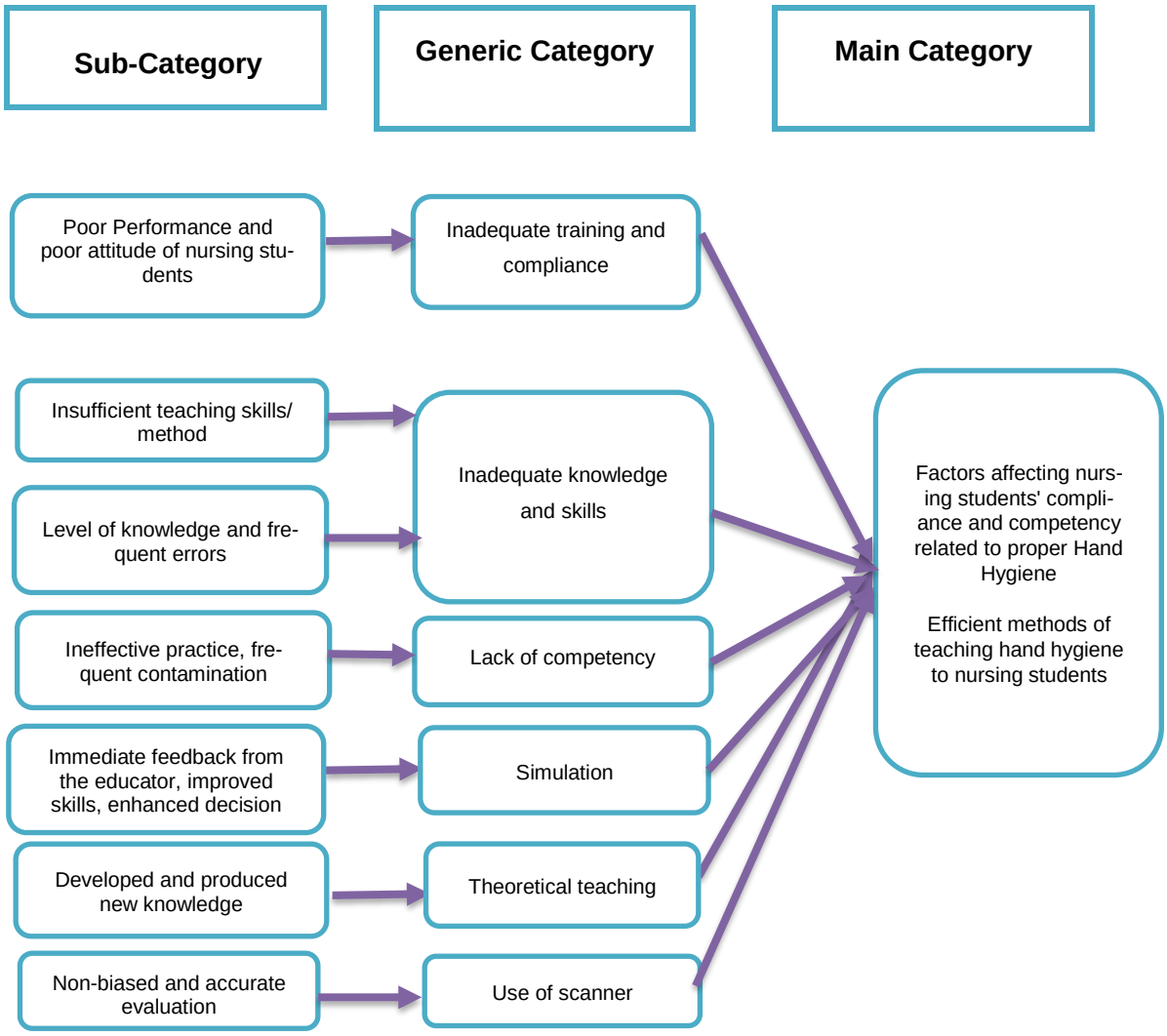

Table 3. Summary of reviewed articles

STUDY	AIM	PARTICIPANTS	RESEARCH DESIGN/METHODOLOGY AND METHOD	MAIN FINDINGS	LIMITATIONS
1. Gniadek, A. et al 2021, Hand Regions Which Are Commonly Forgotten during Hand Disinfection by Nursing Students Who Finished a Foundation Educational Course in Hand Hygiene. Poland	To evaluate the production and adequacy of a hand-rub and disinfection method among nursing students in standard simulation circumstances on their final study, prior exposure to patients	N= 190 first year nursing students	1 Quantitative and Qualitative evaluation was made. 2 A prospective quasi experiment. 3 a systematic review composed	Study revealed that 15% of the participant were able to carry out the process of sanitation method in exemplary approach. 74% of participants perform hand sanitation in their palm without any liability	Number of the nursing students who participated has a percentage of only one. Second evaluation regarding the sanitation compliance of the participants were not conducted instead, in the universities.
2. Lopez, G.M et al. 2021 Posters as an instrument to ameliorate Improve Hand Hygiene among Nursing Students: Case-Control Study. Spain	To assess the efficacy of posters as a teaching tool and element accompanied with hand hygiene quality	N= 321 nursing students	Qualitative Spearman's chi-square. Descriptive statistics Chi-square test Cramér's V and Cohen's d statistic.	It was connected along with the results of number of studies revealed that the application of Alcohol base hand rub substantially eliminates the microbial burden and considered a suitable strategy for nosocomial infection control. There were no differences between sexes in the level of hand hygiene post utilisation of a poster method.	One study location Presence of an observer while in practice. Utilisation of same, pre- and post, petri dish hand hygiene culture.

3. Khubrani, A, et al. 2017 Knowledge and information origin on standard precautions and infection control of health nursing students at King Saud bin Abdulaziz University for Health Sciences, Saudi Arabia, Riyadh Saudi	King Saud bin Abdulaziz University students for health Sciences were evaluated on their understanding of standard precautions (SP) and infection control (IC).	N= 129 students (medicine n=75, dentistry n=18, applied medical sciences n=17, nursing n=14, pharmacy n=5)	Cross-sectional study, questionnaires demographic data (general concept of IC and SPs, hand hygiene, PPE, disposal and injuries from sharp objects Health providers' care). Multiple choice questions and as well as close ended questions were used. Excel utilised or data entry and SPSS version 24. Chi-squared test. T-test Qualitative	It was exposed that the knowledge on infection control and standard precaution among Saudi Arabian nursing students were acceptable. There is no significant dissimilarities between gender or between nursing students, medicine students or other college.	The sample size is in the small scale and was gathered in a single university

4. Villar, D.T et al. 2018 Cooperative Learning and Hand Disinfection in Nursing Students Spain	To assess the efficacy of an educational intervention based on cooperative education on the acquisition of knowledge and skills on hand hygiene practices.	N= 49 nursing students	A questionnaire Likert-type scale Sociodemographic status (age and gender) Descriptive analysis Mann-Whitney U test Mcnemar test Qualitative study	Based on the evaluation of the study, progression of the educational intervention originated from cooperative education, respectively accompanied with the Aronson puzzle method, progressed in nursing students the hand disinfection method and related understanding, which is why it is advised to maintain applying this methodology to incorporate knowledge on hand disinfection at Universida Jaume I.	The sample size is in the small scale and was conducted in a single institution
5. Kacan, C.Y 2021 Evaluation of Hand Hygiene Practice Status of Nursing Students in Turkey. Turkey	To assess the hand hygiene practices of nursing students accompanied with Hand Hygiene Practices Inventory which was adopted in Turkey in 2016	N= 431 2nd, 3rd and 4th year nursing students	Demographic and sociological data collection. Questionnaire Descriptive statistics Qualitative	Scores that gathered from the students were elevated with regards to hand hygiene practices. Hand hygiene practices was not affected by trainings and educational level. It was suggested that utilization of multimodal teachings and incorporating them to curriculum to provide the students a proper hand hygiene routine.	Verbal approval Volunteer Single core

6. Korhonen, A. et al. 2019 Increasing nursing students' knowledge of evidence-based handhygiene: A quasi-experimental study. Finland	Assessment of nursing students' knowledge of evidence-based hand hygiene as a result of a multi-component intervention	N= 146 nursing students	Quasi-experimental Five-point Likert scale Questionnaires Qualitative study	Comprehensive tutoring in hand sanitation had limited effects on students' knowledge	There was an inequality from the group 2 when the study started. Sample size was small and uncapable to determine regardless student knowledge of the groups' status and how it affects their feedback.
7. Zimmerman, P. A et al. 2020 Elements influencing hand hygiene practice of nursing students: A descriptive, study of mixed method Australia	To explore theoretical knowledge of IPC, high-lighting hand hygiene of nursing students and; clinical instructors' perceptions of factors influencing these practices while in clinical practice	N= 225 1st to up 3rd yr. nursing students	Questionnaires and participant information sheet. Interviews Thematic analysis Descriptive, mixed method design.	Highlighted the significance of efficient supervision of participants through clinical practice to make sure students compliance and advocates, proper IPC practices. Healthcare staff's attitude and behaviour toward student have a huge impact on their practice, along with powerful advocate and ideal role models.	Voluntary Rather than observing any changes in students' attitudes and behaviour as they progress through their degree, we were only able to assess students' answers amongst' different year levels. The comparison of the students' feedbacks beyond year levels rather than detection of changes amongst students' behaviours and attitudes as their progression throughout the degree.
8. Bounou, L. et al. 2021	The evaluate the type and level of the final year amongst nursing students' education on	N= 111A nursing students N= 132 medical students.	A Literature review Questionnaire.	Healthcare students appeared of having average knowledge and practice of hand hygiene	The study sample is small in size and composed of nursing students from one department of medicine. Lastly, one came

Hand hygiene education of Greek nursing students; A crosssectional study Scotland	hand hygiene practice, their characteristics and attitudes on hand hygiene education, along with the impact of the type of education they received regarding hand appropriate hygiene practices. As future healthcare workers, final year university students constitute part of the chosen population.			procedures. Medical students have slightly significant lower knowledge on hand hygiene compared to nursing students.	from Department of Nursing in Athens, Greece. Self-reported The questionnaire is redesigned.

9. Kısacık, Ö. G et al. 2021 The huge significant factor of utilising fluorescent concretization intervention on efficacy of hand hygiene among nursing students Scotland	The aim was to distinguish the impacts of a fluorescent concretization intervention and conventional education in developing hand hygiene skills and reliance of nursing students.	N= 126 nursing students	A test was conducted before and after randomized controlled experimental design Descriptive statistics	Application of glo germ among nursing students improved hand hygiene belief score than the control group	The outcome of the evaluation and assessment was a month after the education intervention. The study was not able to inspect on how the enhancement of nursing students' handwashing skills illuminates into longer word on behavioural changes. The failure to perform scoring on photographs gathered from a hand scanner and the demand for qualified observers composed constraints of the study.
10. Bogossian, F. et al. 2018 Foremost practice in clinical simulation education. Are we there yet? A cross-sectional survey of simulation in Australian and New Zealand pre-registration nursing education. Australia & New Zealand	To describe the current application of simulation in nursing education programs in Australia and New Zealand that prepare nurses for registration as nurses. Additionally, it will identify significant investments in simulation over the past five years that have improved the quality and diversity of simulation experiences offered in tertiary nursing schools.	N= 61 participants	Cross-sectional electronic survey Likert scale A descriptive statistical analysis	Using different simulation tools and incorporating them in curriculum was reported by the majority of responded (51.6%). There is enough environment simulation, and staff knowledge, time, and resources are hindrance to quality of simulation.	Sample size has a minor impact. A voluntary participation

11. Oyapero, A. & Oyapero, O 2018 An evaluation of hand hygiene insight and practices among undergraduate nursing students in Lagos State: A pilot study. NIgeria	The goal was to arise baseline figures on hand hygiene exercises among Lagos State School of Nursing Students and to decide their insight regarding the fairness of instructions they acquire.	N= 189 nursing students (the approximate sample meas-ure N= 69 nursing students (the pilot study) N= 35 ≤20 years old (50.7%)and were in their second year of study N= 31 (44.9 %,).	A descriptive, cross-sectional study on a probability random sample. Self-administered survey form Likert Scale	There is direct relation to the level of threat to the level of compliance. Health belief are not notably affected by age and gender of the participants.	Sample size Single centre chosen. It would be more successful if compliance with hand hygiene was examined rather than acquired with a questionnaire.
12. Price, L. et al. (2018) Exploring the effect of preparation for and engagement in a handsanitizing relay on nursing students' potential to remember the WHO 6-step hand hygiene technique, Glasgow UK	To examine if preparation for and participation in a hand-sanitizing relay had any impact on nursing students' ability to remember the WHO 6-step technique for hand hygiene 12 months after participation.	N= 163 nursing stu dent N=146/90% (female)	Cross-sectional survey Descriptive statistics Chisquared test Quantitative	The study determined that almost all student performed the 6 step of Hand hygiene technique properly at the time of the relay. However, the preparation of the participants may contribute to its' success. It also shows that the potential to perform the 6 step of hand hygiene deteriorate in a year. There is a direct relationship between level of skill decay to the time that skills are not practice.	It was voluntary Only active infection control nurse who is registered under the Korean Association of infection control participated.
13. Oh H. S. 2019. Knowledge, perception, performance, and attitude regarding hand hygiene and related factors among infection control nurses in South Korea: A cross-sectional study.	The objective was to determine study of the current state of knowledge, perception, attitude, and presentation of hand hygiene among ICNs in order to identify the factors influencing these variables and provide basic information for the development of professional hand	N= 388 participants	Descriptive statistics A Pearson correlation analysis Correlation analysis Questionnaire Qualitative study	There is a positive correlation among participants attitude, role model, perception and their performance on hand hygiene.	It was voluntary Only active infection control nurse who is registered under the Korean Association of infection control participated.

Korea	hygiene education programs for newly assigned ICNs.				