Nursing students' learning experience with healthcare-associated infection prevention and control (HAI-PC) in Asian countries: an exploratory qualitative study

Experiência de aprendizagem de estudantes de enfermagem na prevenção e controlo de infeções associadas aos cuidados de saúde (PC-IACS) em países asiáticos: um estudo qualitativo exploratório

10.29073/jim.v5i1.892

Recebido: 18 de janeiro de 2024.
Aprovado: 8 de fevereiro de 2024.
Publicado: 27 de maio de 2024.

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Abstract

Background: Healthcare-associated infection prevention and control (HAI-PC) education programs in Asian countries seem limited and require improvement and support.

Objective: This study explored students' learning experiences with HAI-PC education programs in Asian countries (two Vietnamese and two Cambodian universities) to support a pedagogical model in HAI-PC.

Method: A qualitative exploratory study design was employed, and inductive content analysis was conducted. Students were selected to participate in the focus group to investigate their experiences with HAI-PC using five structured questions. There were 48 nursing students in total from four universities, 28 from 2 universities in Cambodia, and 20 from two universities in Vietnam.

Results: The summary results gained from the four universities were synthesized by grouping them into sub-categories and four primary categories, which were students' HAI-PC competence, students' current learning methods in HAI-PC Education, the HAI-PC teaching and learning environment, students' capacity, and entrepreneurial skills in HAI-PC development.

Conclusion: This study revealed evidence to improve nursing education in HAI-PC in Asian countries. The new learning method of the simulation scenario and the model fascinated the students; they were happy and more confident about their future careers in practicing HAI-PC skills in their clinical practicum and hospital practice. The current HAI-PC education faces issues related to education and healthcare systems in Asian countries, highlighting the need for improvement.

Keywords: Asian Countries; Healthcare-Associated Infection Prevention and Control; Nursing Students.

Resumo

Enquadramento: Os programas de educação em prevenção e controlo de infeções associadas aos cuidados de saúde (PC-IAS) em países asiáticos parecem ser limitados e necessitam de melhorias e apoio.

Objetivo: Este estudo explorou as experiências de aprendizagem dos estudantes com programas de educação em PC-IAS em países asiáticos (duas universidades vietnamitas e duas universidades cambojanas) para apoiar um modelo pedagógico em PC-IAS.

Método: Foi utilizado um desenho de estudo exploratório qualitativo, e foi realizada uma análise de conteúdo indutiva. Os estudantes foram selecionados para participar no grupo focal para investigar as suas experiências com PC-IAS usando cinco perguntas estruturadas. No total, participaram 48 estudantes de enfermagem de quatro universidades, sendo 28 de duas universidades no Camboja e 20 de duas universidades no Vietname.

Resultados: Os resultados resumidos das quatro universidades foram sintetizados agrupando-os em subcategorias e quatro categorias principais, que eram competência dos estudantes em PC-IAS, métodos de aprendizagem atuais dos estudantes em Educação em PC-IAS, ambiente de ensino e aprendizagem em PC-IAS, capacidade dos estudantes e habilidades empreendedoras no desenvolvimento de PC-IAS.

Conclusão: Este estudo revelou evidências para melhorar a educação em enfermagem em PC-IAS em países asiáticos. O novo método de aprendizagem do cenário de simulação e o modelo cativaram os estudantes; eles ficaram felizes e mais confiantes em relação às suas futuras carreiras na prática de habilidades em PC-IAS no estágio clínico e na prática hospitalar. A educação atual em PC-IAS enfrenta questões relacionadas aos sistemas de educação e saúde em países asiáticos, destacando a necessidade de melhorias.

Palavras-Chave: Estudantes de Enfermagem; Países Asiáticos; Prevenção e Controlo de Infeções Associadas à Saúde.

Introduction

Healthcare-associated infections (HAIs) are caused by bacteria, fungi, viruses, and other transmission agents and affect people receiving healthcare in any healthcare facility, such as hospitals and long-term care facilities [1]. HAIs are a significant cause of illness and a primary worldwide concern that leads to severe emotional, financial, and medical consequences and can be a cause of death, with about 1 in 31 hospitalized patients experiencing such an adverse event [2], [3]. The infectious disease caused by SARS-CoV-2 and COVID-19 explains the situation of the contagious disease being transmitted rapidly via communication valves in public and hospital settings. It shows the capability of healthcare-associated infection prevention and control (HAI-PC) and the potential gap in controlling the infection chain and response [4].

The most common HAIs are catheter-associated urinary tract infections, central line-associated bloodstream infections, hospital-onset methicillin-resistant staphylococcus aureus bacteremia, surgical site infections, and Ventilator-associated Pneumonia (lung infection) [3]. Sengupta, Barman, and Lo (2019) stated that the World Health Organization, the Centers for Disease Control, and The European Centers for Disease Prevention and Control are struggling to reduce infection rates and elevate HAI-PC to keep patients safe and spread information globally, especially in developing countries. A recent study has reported that the prevalence of HAIs in developing countries was about 10–30% and 5–10% in developed countries [6]. One of the risk factors of HAIs is related to malpractice concerning standard hygiene, which can prevent and control infection by implementing standard hygienic guidelines and punctual performance [7], [8]. Moreover, other factors involved in HAIs have been seen to impact healthcare workers, such as workload, insufficient equipment, and failure to implement sanitary facilities and guidelines [9], [10]. Ling, Apisarnthanarak, and Madriaga (2015) reported that the burden of the pooled incidence of infection happens in the intensive care unit and surrounding areas; however, the mortality rate and the period of hospitalization ranged up to 46% and 5 to 21 days of hospitalization, respectively [11].

Daud-Gallotti et al. (2012) mentioned that excessive nursing workloads were a key indicator of increasing infection in hospital wards [9],[12].

The HAI-PC strengthening will elaborate on the quality of care and reduce the hospitalization rate [13]. The learning process regarding demand and convenience has gradually changed, especially for HAI-PC in developing countries [14]. The WHO has suggested that national HAI-PC curricula and training programs should be integrated and developed with academic staff to establish HAI prevention and control programs effectively [3]. Additionally, Mozafaripour (2021) mentioned that simulation education provides students with an opportunity to perform their clinical skills in real situations [37], and a study by Silva et al. (2012) conducted in the ICU with students using HAI-PC simulation education demonstrated its effectiveness [15]. The WHO has defined core competencies as the knowledge, skills, and attitudes required in professional practice by applying critical thinking, reflection, and analysis in assessment and decision-making in HAI-PC [4].

Nursing students play an essential role in preventing and controlling HAI, which requires them to learn about theoretical and clinical practice to gain knowledge, skills, and attitudes for providing nursing care safely and effectively [16],[17]. Clinical learning environments also play an essential role in acquiring professional abilities and training nursing students [18]. Nursing students are active clinical practitioners in healthcare settings who are at risk of HAIs due to their performance in invasive procedures [16], [19], [20]. The students have poor knowledge of HAI prevention and control, which is related to insufficient HAI content and training [21],[22],[23]. Additionally, nursing students have inadequate knowledge related to microorganism infection and a lack of using gloves while providing nursing care [24]. The issue that mainly affects HAIs is the country's economy, yet there are differences between countries; most developed countries have a low risk of infection and are more knowledgeable about HAIs. Therefore, training and intervention programs related to HAIs are needed for public teaching hospitals, especially in ICU wards [25]. A study by Elison, Verani, and McCarthy (7015) showed the importance of HAI knowledge and skilled practice to prevent the prevalence and safe practice of HIV patients among healthcare workers during the burden of HIV in Southeast Asia, which suggested strengthening the nursing and midwifery professions and HIV service delivery specifically of the HAIs. The continuing education and range of practice that the training like HAI-PC is needed to fulfill the need of the hospital practice [26].

A meeting report on health professional education reforms in transition economy countries in Cambodia 2018 stated that healthcare professional competency is needed to reform the healthcare system [27]. Healthcare workers' competency related to HAIs has the potential to ensure the quality of care and the safety of healthcare workers and the client, especially during invasive therapy. Skilled and well-performed HAI-PC is the basic principle for reducing mortality and morbidity rates, especially in the ICU units [28], [29]. Therefore, cutting the infection chain can indicate a quicker patient recovery rate. Still, there are a few main issues related to HAIs, especially education limitations regarding HAIs and types of learning [28]. WHO (2019) indicated that infection reduction should begin by decreasing the risk of infection through invasive therapy [29]. One of the major problems we have found so far in stopping the chain of infection transmission is handwashing. Therefore, healing care workers' hands is the most common. Among healthcare workers, handwashing is a significant element in stopping infection transmission [30] which should be integrated into the healthcare education curriculum [29].

Considering the prevailing data from previous studies, an internationally Erasmus-funded consortium, the Prevention Infection Project (PrevInf), comprised of higher education institutions (HEIs) from Vietnam, Cambodia, Portugal, and Finland, has undertaken the task of developing a novel guiding model intended to inform and enhance the pedagogical practices of nursing educators across both undergraduate and postgraduate nursing programs in Asia called PrevInf-model. To achieve this objective, we aimed to explore the learning experiences of Asian undergraduate nursing students with HEIs in HAI-PC.

Methodology

Design

A qualitative exploratory study design was used to investigate undergraduate nursing Students' learning experience with HAI prevention and control in Asian countries through focus group discussions using five (5) main structured questions (Table 1).

Population and Sampling

There were 48 nursing students in total from four universities, as indicated, of which 28 were from two universities in Cambodia (12 from International University and 16 from Bolyno Institute) and 20 from the two universities in Vietnam (8 from Haiduong Medical Technical University, and 12 from Nam Dihn University of Nursing) from second- and third-year nursing programs.

Inclusion Criteria

The nursing students who introduced the HAI-PC education program and the simulation scenarios were invited to participate in this study as part of their curricular activities. Before participating in this study, the students participated in theoretical and practical studies on intravenous administration, surgical hand washing, nursing airway management, and medical instrument disinfection.

Data Collection

The data were collected in August 2022 in participating universities, and the focus group interviews were conducted and led by each university with the researchers' instructions. The research and data collection instructions were given by the PrevInf-project to all project members to ensure the unity of the implementation of data collection and analysis. All researchers were PrevInf-project members. First, the researchers invited all volunteering students to participate in this study. Then, a first draft of the PrevInf-model was presented to all of them. All volunteering students signed the consent form at the end of the PrevInf-model presentation. The focus group questions about the students' HAI-PC experiences are presented in Table 1. In addition to employing open-ended questions, focus group facilitators probed the students' responses to delve further into their past learning experiences related to HAI-PC.

Table 1: The focus group interview questionnaire.

No.	Structured Questions
Q.1	What are your experiences concerning your preparation regarding HAI prevention and control?
Q.2	What strategies would you improve in the learning process of HAI prevention and control?
Q.3	How can your entrepreneurial skills be enhanced in HAI education?
Q.4	Based on your experiences, what dimensions should be included in a PrevInf model focusing on developing HAI prevention and control-related education (theoretical and practical) at your HEIs?
Q.5	Are there any aspects of HAI-PC that we did not talk about and that you think are essential for us to know?

Data Analysis

The Graneheim and Lundman (2004) inductive content analysis approach was used for the data analysis. The content analysis methodology, the categories, and the subcategories were a display guide for explaining the nursing students' learning experience with HAI-PC in Asian countries [34]. The answers of all the students were analyzed and classified into sub-, main- and comprehensive categories in a step-by-step process. The same data collection methods were systematically implemented in all four universities. In addition, the selection criteria for the participants in the study were the same. The research groups transcribed the focus group interviews, and the coding books from each university were computed by grouping them into subcategories and categories. The data were reconstructed

from each university's coding books by reducing, conceptualizing, and grouping the content regarding their meaning. The data were reconstructed from each university's coding books regarding their meaning, categories, and themes.

Ethical Considerations

The Ethics Committee of the Health Sciences Research Unit: Nursing of the Nursing School of Coimbra approved the research proposal, number P761-3/2021. Informed consent was obtained to ensure the subjects voluntarily participated in this study. The students who participated in the study were provided with complete information about the study, including the purpose, research methods, and rights when participating in the study. Students were informed of their right to withdraw from the study without consequences.

The focus group interviews were facilitated by the trained lecturers in simulation scenario protocol from the Europe team, and currently working in the PrevInf-project. This ensured that the students felt comfortable in the focus group interviews. The data were collected orally, and the interviewer made notes. All interviews were audio recorded. The students' names were coded using numbers to secure anonymity, and the students were allowed to check the notes and transcripts afterward to ensure that the ideas were accurately presented. The data from the focus group interviews were complemented by students with anonymously written expressions of their learning experiences.

Results

Four major categories emerged from the data: i) students' HAI-PC competence; ii) students' current learning methods in HAI-PC education; iii) the HAI-PC teaching and learning environment; and iv) the students' capacity and entrepreneurial skills in HAI-PC development (Table 2).

Table 2: Overarching theme, main categories, and subcategories.

Nursing Students' Learning Experience with HAI Prevention and Control in Asian Countries	
Categories	**Sub-Categories**
Students' HAI-PC competence	▪ The importance of HAI-PC in the healthcare setting ▪ Students' concerns after completing the HAI-PC lectures
Students' current learning methods in HAI-PC education	▪ Limited learning opportunities and content ▪ Lack of link between theory and practice
HAI-PC teaching and learning environment	▪ Content of HAI-PC in the curriculum ▪ Lecturer, clinical preceptor, and instructor competency ▪ Teaching and learning materials ▪ Active teaching methods
Students' capacity and entrepreneurial skills in HAI-PC development	▪ Self-direction and critical and reflective thinking ▪ Mentoring, guiding and receiving feedback from teachers ▪ Confusion regarding the term "entrepreneurial skill"

Students' HAI-PC Competence

The students' HAI-PC competence category was associated with the current student's competence of the HAI-PC to further experience/develop their skills with HAI-PC. The topic of preventing and controlling health-associated infections was not new to students but the new introduced learning method required clarification. The PrevInf-model was introduced to the participants, as part of the Infection prevention and

control subject. In addition to that, all the students who participated in the study, were at least second-year nursing students and all of them had studied infection prevention and control. The main category was created based on the subcategories integrating the importance of HAI-PC in healthcare settings and the students' concerns after completing the HAI-PC lectures.

The Importance of HAI-PC in Healthcare Settings

The students agreed that HAI-PC knowledge/strategies help healthcare providers and patients prevent infection, and they realized the importance of HAI-PC education in the clinical field, especially at the hospital. The students noted that HAI-PC was connected with the recovery rate and the risk of infection complications, and the students elaborated on the usefulness of clinical practice regarding the risk of infection, the chains of infection, and ways to avoid HAIs and how to integrate Infection Prevention and control knowledge.

> "When I studied theory, I felt that this lecture was not very important because I only learned about how to do it, not talk much about the consequences of healthcare-associated infections (HAIs). However, when I took clinical placements, I realized that the consequences of HAIs are terrible. Then I realized that this lecture is essential" (HMTU).

Students' Concerns After Completing the HAI-PC Lectures

After completing the HAI-PC lectures, the students' concerns resulted in concern regarding their competence level. They thought that their level of knowledge was low, their attitude towards the topic was negative, and they did not receive skills from the study. The students suggested that the required skills should be added to the nursing education program so that they could perform better in the clinical setting.

> "When I was in the first year, I found that I was very afraid of the lectures because the results of the final exam were quite low, and there were a lot of students who failed the lectures" (HMTU).

Students' Current Learning Methods in Hai-Pc Education

The category of the student's current learning methods in HAI-PC education was associated with the current teaching and learning methods. The main category was created based on the subcategories integrating the limited learning opportunities and content and the lack of a link between theory and practice.

Limited Learning Opportunities and Content

Limited learning opportunities and content included a lack of diversity in teaching, less-used reality case studies, and textbooks that need to be updated. The students were expected to be trained in using infection prevention and control equipment at universities, like those used in clinical practice and after graduation for employment. Accessibility to such hospital infection prevention and control equipment makes students more confident using the equipment and not have to re-train after graduating from university.

The theoretical teaching methods lacked diversity, and the textbooks failed to present logical information on HAI-PC. The students wished to learn new protocols in their language during their studies and later in real clinical situations in a given situation. The language used in education should be updated to utilize the national potential, ensuring accurate student and nurse clinical performance evaluation.

> "It would be more beneficial if we had all these materials in Khmer" (IU).

Lack of a Link Between Theory and Practice

The lack of a link between theory and practice included limited feedback, organizing pre-clinical practice, and a connection between theory and case studies. These issues raised the fact that the practice in the practice labs only focused on hand skills but did not integrate them into clinical situations, which was the reason for confusing clinical practice and the simulation scenarios. The students understood self-protection and prevention during clinical practice, both in terms of clinical knowledge and skills related to HAI-PC. Still, they experienced a shortage of HAI-PC materials during their clinical practicum, while the learned theories and clinical procedures were not feasible to apply in actual clinical practice. Therefore, there was an insufficient simulation of clinical practice and

insufficient theoretical class. The students obtained clinical skills and knowledge from their clinical practice, which is not taught in nursing school.

> "The contents of infection prevention control should emphasize and integrate into nursing care activities in the ward. For example, the lectures and pre-clinical practice should emphasize cross-infection prevention during nursing care activities, the suitable distance between patient beds, and issues associated with cleaning, disinfection, and sterilizing respiratory devices" (HMTU).

The students elaborated on their concerns about the HAI-PC learning process strategies based on the nursing care protocol, procedures, and group discussions of the actual case studies. The theoretical and practical lessons on HAI-PC, the student suggested there, should be matched and integrated with evidence-based practice, including the applicable case studies, which were obtained during the clinical practicum. The students stated that HAI-PC should be combined between theory and clinical practice. The theory of HAI-PC should include procedures for preventing infections in the clinical setting. The students noted that the mentors' guide to HAI-PC procedures in the clinical setting is crucial.

> "There are no real case studies, and some are not relevant to real nursing in the hospitals. It would be good to have more clinical cases during the studies to improve the infection prevention skills" (BNI).

HAI-PC Teaching and the Learning Environment

The content category of enhancing teaching and the learning environment was associated with the study program designed for each lecture in the bachelor nursing curriculum. The main category was created based on the subcategories integrating the content of HAIs with the curriculum, lecturer, clinical preceptor, instructor competency, teaching and learning materials, and active teaching methods.

Content of HAI-PC in the Curriculum

The students suggested that a particular lecture on HAI-PC in the nursing curriculum should be added, as long as continuous learning is essential, especially in the new pandemic, such as using PPE and other medical equipment, and comprehensive theory should be taught before practicing in the hospital. The students elaborated on their concerns about the HAI-PC learning process strategies based on the nursing care protocols and procedures and group discussions on the actual simulation cases. The students feel that they need more theories and clinical practice from their foundation year or at a specific time for their clinical practice at the hospital and more practice in the lab.

> "To improve the learning process of nursing students in the prevention and control of hospital-acquired infections, it is first necessary to develop a training program on hospital control. Infection control updates new knowledge and is relevant to infection prevention and control in Vietnam" (NDUM).

The students also stated that continuous training and an update of the medical care procedures and protocols related to HAI-PC are needed, especially in clinical practice. The students also suggested adding separate HAI-PC lectures to the nursing curriculum. More hours should be added to HAI-PC theoretical and clinical practice, and the timing of HAI-PC learning should be before practicing in clinical settings. It should be continuously supplemented during clinical learning by clinical instructors and preceptors.

> "I think a separate infection control lecture should be added to our studies" (IU).

Lecturer, Clinical Preceptor, and Instructor Competency

The students needed support from senior nurses for their practicum in healthcare facilities regarding HAI-PC. The clinical skills must be improved in both lab practices and clinical settings. During lab practice, some performance techniques should be added and modified in response to the current need by the lecturers who are well-equipped with HAI-PC knowledge and technical competence. The students stated that the teachers need to improve their HAI-PC teaching methods and quality and give special consideration to enhancing the content regarding infection and prevention control in each lecture, and skilled lectures should be employed to diversify

the teaching; the contents of HAI theory and procedures should be guided or taught by experienced and knowledgeable teachers. The teaching content is a priority task to be improved.

> "Teachers frequently used PowerPoint presentations to teach students. There was no group discussion or other active activities in class" (HMTU).

> "Regularly educate and train, inspect, supervise, and evaluate nursing students' hospital infection prevention and control procedures. Adding more information exchange channels between learners and lecturers to help students interact with lecturers from which lecturers will answer, guide and evaluate their mastery of infection prevention and control hospital" (NDUN).

Teaching and Learning Materials

Video clips on HAI-PC education should be proposed and applied in theory classes. Lectures should be translated and explained in the student's own language, and poster pictures of HAI-PC should be used. The students suggest having an available learning package to educate patients and families about HAI-PC. Insufficient equipment for teaching HAI-PC utilities and a proper learning environment and materials are needed in student clinical practicums at public hospitals. The students stated that educational posters should be applied in areas of infection control and should be involved in healthcare facilities and classrooms. In the posters, the written expressions should be explicit to make communicating information about HAI-PC more informative.

> "I suggest video clips, but my English language is limited, so I suggest Khmer language videos. The posters and video regarding HAI-PC should be used to support the learning process" (BNI).

Active Teaching Methods

Theory and the practice lab should be aligned, and the practice lab should be specific to infection prevention and control with proper teaching and learning methods and environment. The group discussion method should be applied in theory class.

> Therefore, I think the teachers should apply other methods such as group discussion to improve students' learning" (HMTU).

Simulation pedagogy is an active teaching and learning method and should be considered and clearly explained to the student. The students suggested elaborating with more details and separating the general HAI-PC delivery into specific simulation cases such as ER, ICU, PICU, OR, pneumonia units, and other places through simulation scenarios. The students noticed that the simulation pedagogy is a new learning method that is helpful for them to understand more about procedures, and they have learned more about infection prevention and control.

> "I like the way that all students and teacher participated in the simulation, which is a new learning method; I found that all of them are very well organized, they communicate with each other, helping, they have introduced the procedure, especially equipment, all well set, It was a new technique of simulation learning that encouraged the students took more active and attention on simulation performance" (IU).

The students felt that a new approach to nursing education kept all involved students concentrated and active, and they were encouraged to express their ideas and feedback. They thought that the simulations improved their competencies in HAI-PC and were excited and happy to be a part of them. Students expressed a feeling of joy and willingly participated in the simulation for the first time to hear and participate in the project. Many ideas and comments emerged as questions about this new learning method.

> "I am so happy to join the simulation; though I do not know much about this, I find that this is good, and given chances to get all the information in the simulation, I think this will be very helpful to us in our clinical practice, especially it easy to understand and we can see every aspect and steps from the preparation to the end" (IU).

Students' Capacity and Entrepreneurial Skills in HAI-PC Development

The students' capacity and entrepreneurial skills in HAI-PC development were associated with their interaction and problem-solving skills in the clinical setting. The main category was created and categorized into subcategories such as integrating self-direction, critical and reflective thinking, mentoring, guiding, and giving feedback from teachers, as well as confusion regarding the term "entrepreneurial skill".

Self-Direction and Critical and Reflective Thinking

Self-direction and critical and reflective thinking reflected students' interaction motor skills for problem-solving in the clinical setting and interpersonal skills in obtaining the skill and knowledge. Competency standards regarding infection control practices should include hospital infection prevention and a control training model. When there is a set of criteria for HAI-PC practice standards, it will help students self-assess their capacity and improve their skills.

All students mentioned that a suitable and effective study plan was needed to study the hospital infection prevention and control programs, and the students indicated that learning goals and methods must be set to achieve the goals before beginning the lectures. In the learning process, the students wanted to self-assess to determine whether their results were consistent with the objectives. The students preferred communication, teamwork, and problem-solving skills to enhance their critical thinking. Nursing students also suggested that the PrevInf model be introduced in healthcare facilities. In contrast, the Vietnamese nursing students mentioned that the concept may be appropriate for the Vietnamese culture of learning and teaching.

> "The pre-clinical practice helped us a lot before the clinical placement and enhanced our confidence (HMTU).
>
> "To improve our skills in HAI-PC, we need a good study plan which helps us to learn HAI-PC" (IU).
>
> "We need more knowledge and skills of communication, teamwork, and problem-solving" (NDUM).
>
> "The HAI-PC content should also be introduced to the hospital health care workers" (BNI).

Mentoring, Guiding, and Receiving Feedback from Teachers

Mentoring, guiding, and receiving feedback from teachers were the most important for students to evaluate their competence in their actual performance of HAI-PC. The detailed and brief discussions on learning and teaching methods were crucial regarding the competence of HAI-PC and should be applied in theory classes and practical labs. The students need feedback on what was performed correctly or what needed improvement after every practice session. This will motivate the students to learn.

> "I think that before and after the lab, there should be a session with the teacher to go through the learned tasks and how to improve" (IU).
>
> "The feedback is important for us, and the more feedback we get, the more it motivates us to learn more about HAI-PC" (BNI).

There Is Confusion About the Term "Entrepreneurial Skills."

Entrepreneurial skills seem to be a new concept and paradigm for young Asian nursing students. The students expressed their misunderstanding of entrepreneurial skills in nursing, which are usually used in business or management.

> "It seems like we are trying to make a new business skill in nursing care and HAI-PC" (IU).

Discussion

This study explored students' experiences with HAI-PC education programs in two Vietnamese and two Cambodian universities to understand the current HAI-PC education status and the need for curriculum enhancement using the PrevInf-model. The results of this study revealed the implications and actions needed to be taken in curriculum development related to HAI-PC education.

Students' HAI-PC competence was linked to their ability to develop skills and gain experience with HAI-PC during their education. Like a study by Alshammari et al. (2019), this study also focused on nursing students' possibilities to adhere to standard precautions during their clinical practice. HAI-PC knowledge was highlighted as crucial in preparing students to prevent infections during clinical practice, ensuring patient safety, and reducing HAIs [31]. The study by Abdelaziz et al. (2019) mentioned the necessity of HAI-PC education in the nursing curriculum and the professional nursing career. Still, the result of the study identified that almost 50% of the students had poor clinical practice skills, and more than 50% had poor knowledge of HAI-PC, along with non-relevant and specific training in the curriculum [32].

This study's teaching methods were associated with students' ability to gain knowledge and retain their motivation in HAI-PC learning. The limitations have been based on teaching methods in Asian countries previously found on the slow progress of the healthcare system development and advancement. Especially in Cambodia and Vietnam, prospective HAI-PC education and practice must be improved in the overall healthcare system [35]. It is crucial for teachers to be well-prepared and to follow updated HAI-PC regulations when teaching students who are practicing their clinical skills. Accepting the reality of the actual work setting and taking necessary actions to meet the learning outcomes can help develop the capacity for preventing and controlling HAIs.

Simulation pedagogy can potentially improve nursing students' HAI-PC competence [36]. In this study, there was a positive connection between theory and clinical practice if the primary objective of the simulations was to provide students with an opportunity to apply their knowledge to practical situations. However, the students complained that the teaching at the university needed to be better integrated with current hospital practice. The PrevInf-model has the potential to foster the development of a comprehensive HAI-PC education model for nursing curriculums in higher education institutes across Asian countries. A complete IPC model would enhance the development of common principles for educational institutions and healthcare organizations.

It is necessary to develop simulation pedagogy and educational seminars on HAI-PC with the participation of students and staff members from universities and healthcare organizations. Students can stay updated with new knowledge by participating in educational sessions and forums and taking the initiative to discover academic documents, particularly in simulation scenarios. These scenarios are crucial in demonstrating the effectiveness of simulation, case-based simulation, and evidence-based practice to students.

Universities have a crucial role in curriculum development and endorsement [4], and the curriculum should include more HAI-PC content, covering both theory and clinical practice from the first academic year onwards. Lecturer and clinical preceptor competency, instructor proficiency, teaching and learning materials quality, and active teaching methods emerged as the core values for the HAI-PC teaching and learning environment in this study. Limitations in organizing pre-clinical practice to meet the contents of HAI-PC education were present in all Cambodian and Vietnamese universities. Therefore, due to their having no pre-clinical practice, some contents related to HAI-PC, such as clinical waste management and laundry management, were taught by observation in the hospital.

Developing students' capacity and entrepreneurial skills was associated with student interaction, problem-solving, and interpersonal skills in obtaining HAI-PC competence. Students' ability to adapt, be flexible and self-directive, and possess critical and reflective thinking skills are crucial in HAI-PC competence. For example, the unavailability of hospital equipment can prevent them from applying what they have learned in the classroom. The term "entrepreneurial skills" includes creative thinking, time management, networking, and communication

[33], and can be confusing for Asian nursing students as it is a new concept for them. Therefore, it is essential to clarify entrepreneurial skills in HAI-PC education in order to enhance students' understanding of the term and required nursing skills. In this study, entrepreneurship in nursing refers to nurses working autonomously and professionally.

Limitations

The limitations of this study relate to HAI-PC education in the Asian universities' curricula and the research methodology. This study introduced the new HAI-PC pedagogical content, methods, and the PrevInf-model to Asian universities and nursing students. The topic was introduced to the participants during the first or second academic year, who may have needed more clarification of the HAI-PC topic [38]. Additionally, the data collection and management may have limitations, as there are no universal rules for analyzing large quantities of qualitative data from different universities. Even though common instructions were drawn up for the analysis, there may have been some differences between the partners when doing the analysis. The analysis process requires creativity and solid inductive skills, mainly since the data collection was conducted separately by four universities (two from Cambodia and two from Vietnam), which could have interfered with the equivalence of the distribution of the research tools and instructions [39].

Conclusion and Recommendations

This study provided evidence to enhance nursing education programs in HAI-PC in Asian countries. The main results elaborated on the difficulty of practicing HAI-PC in clinical practice due to the nursing curricula' lack of proper infection control content. HAI-PC education should be implemented in the nursing curricula and clinical placements. The teachers must be competent of teaching infection prevention and control, as teaching requires theoretical, clinical, and pedagogical skills. Hence, the teachers need to reflect on their own practice, pursue professional development, experience with the new methods, evaluate the impact and keep learning and growing.

The results of this study lead to the recommendation of the following methods for nursing education regarding HAI-PC. Various teaching methods should be implemented, as this motivates students to learn HAI-PC skills. Further, applying scenario-based simulation in the nursing curricula so that students can practice infection prevention control will improve students' competence with HAI-PC and create excitement about new learning methods. Also, updated textbooks and current IPC guidelines in teaching will enhance the student's knowledge of HAI-PC.

Clinical practice is the most crucial element for learning practical nursing skills, and therefore, well-planned pre-clinical practices at universities should be arranged. HAI-PC methods, procedures, and equipment should be similar in both learning environments to foster learning. Adding more equipment for teaching about hospital infection prevention and control aligns with reality, and providing feedback for students in pre-clinical practice should be a regular part of the pedagogical method.

Further, dialogue sessions should be organized with students to listen to their thoughts and aspirations about hospital infection control training. This may provide a variety of channels to receive feedback from learners to inform institutions on how to solve existing problems promptly.

As a recommendation, HAI-PC education could be enhanced by implementing the PrevInf-model in Asian universities to foster the thoroughness and effectiveness of healthcare education. The current model comprises four main layers: the learner's core competency areas, core behaviors, an active learning environment, and quality assurance of the teaching and learning process.

Declaration

Disclaimer for Scientific Papers

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use that may be made of the information contained therein.

Ethical Considerations

This study was approved by the Ethics Committee of the Health Sciences Research Unit: Nursing of the Nursing School of Coimbra (P761-3/2021).

Acknowledgments

The authors would like to thank all participants for their significant contribution and the value of their time participating in this study. Special thanks to the four partner universities for their time and effort in manuscript construction and their crucial results. This paper can't be published without the PrevInf-project, thanks to the PrevInf-project and sponsors, also co-funded by the Erasmus+ Program of the European Union; it's a great honour to assist and help Asian university partners.

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Declaração Ética

Conflito de Interesse: Nada a declarar. **Financiamento:** This study was carried out within the scope of the PrevInf Project (618396-EPP-1-2020-PT-EPPKA2-CBHE-JP), co-funded by the Erasmus+ Program of the European Union.

Revisão por Pares: Dupla revisão anónima por pares.