

THE PREVINF MODEL FOR THE NURSING CURRICULUM OF HEIS IN ASIAN COUNTRIES

BACKGROUND

The study results reported that the prevalence of healthcare associated infections (HAIs) from hospitals in Southeast Asian countries is quite high (Thu, 2011). The overall prevalence of HAI is 9.0% (7.2%–10.8%), which is higher in less developed countries. Particularly high in high-risk care settings such as the ICU with a rate of 20 cases per 1000 ICU-days (Navoa-Ng, 2011).

There were several educational models that aimed to promote success in infection control education, such as the Health Belief Model. These models prepared and designed interventions based on a clear understanding of the principles of decision-making to perform a particular behavior in a particular situation (Mohseni, 2015; Asadpour, 2020). However, these models were diagnostic in nature in that they focused deeply on and analyzed learners' behavior without focusing on analyzing the teacher's behavior and learning environment's challenges. Characterized by the long-standing cultural traditions of Asian countries, a model that analyzes and discusses current challenges facing HEIs, teachers and learners to guide the improvement of quality and consistency of teaching practices, furthermore, a representative education model that is universally applicable to HEIs in several Asian countries is needed.

A good example used in European countries was the InovSafeCare Model, which was developed to suggest steps that often focus on basic structures, processes and methods, allowing for the integration of perceive strategies and the learning process (Pinto et al, 2020). This Model initially demonstrated the advantages of developing students' competency associated with HAIs-PC. This model facilitated skill improvement, clinical decision-making capacity building, integrating theoretical knowledge, and filling theoretical and practical gaps in infection control education.

As future healthcare professionals, nursing students make up the most significant portion of every country's medical workforce. Research results indicated that healthcare associated infections prevention and control (HAIs-PC) education is very important in laying the foundation for nursing undergraduate students to improve their HAIs-PC practice skills (Magill, 2018). Infection control education improves nursing students' adherence to standard precautions

(Moralejo, 2018). From there, strengthen the prevention of nosocomial infections and reduce the infection rate. Therefore, an effective infection control education model may help to improve the infection control activities of nursing students throughout the undergraduate program in the implementation and practice of infection control techniques from the moment they begin to study. beginning of clinical practice. Finally, a well-educated nursing student can influence the quality of future care delivery (Ward, 2011).

The PrevInf Model

HAIs-PC education in HEIs in some Asian countries currently does not have uniformity between universities and countries regarding the contents and structure, as well as assessment and accreditation (Tsioutis, 2020). Moreover, the research results showed that there were theoretical and practical gaps in nursing education program in general and HAIs-PC module in particular. Learners had difficulty building capacity to provide safe care practice. The contributing factors to these negative outcomes included traditional educational methods lacking interaction, motivation, unsupportive environment study from schools and hospitals. Therefore, an educational model that includes a solution guide is needed to effectively design and implement HAIs-PC education for nursing students.

In the context, the HAIs-PC education Model (PrevInf) will be developed based on the InovSafeCare Model with the aim of designing an HAIs-PC educational theoretical framework specific to HEIs in Asian countries. The PrevInf Model will have operational structure stemming from a student-centered premise, resolving current challenges related to the academical and clinical environments in these HEIs. Moreover, the Model will involve the institutions and faculty to improve active teaching and learning strategies, which will facilitate the process of capacity building of learners. Finally, the Model will ensure the safety of HAIs-PC among nursing students during patient care practice.

Objectives:

The main purpose is to develop a comprehensive Model for HAIs-PC education in nursing curriculum of HEI in Asian countries. The following specific objectives were applicable to achieve the above.

- To review literature regarding models on HAIs-PC education in nursing curriculum.

- To explore and describe the perceptions of the nurse educators, nurse managers regarding HAIs-PC education in nursing curriculum.
- To develop and describe the PrevInf Model for HAIs-PC education in nursing curriculum.
- To test the PrevInf Model for HAIs-PC education in nursing curriculum.

METHOD

Design

The model development consisted of four phases. In which, phase one reviewed literature to describe models on HAIs-PC education in nursing curriculum from previous studies. Phase two conducted empirical study using focus group to obtain the opinions of nurse educators and students on PrevInf model. Phase three used a four-phase approach described by Chinn and Kramer (2011), namely concept analysis, construction of relationships, description and evaluation of the model. Phase four will be conducted to test the effectiveness of PrevInf Model in the nursing curriculum in some HEIs in Asian countries.

1. Phase one - literature review

1.1. Search procedure and database

An integrated assessment approach was implemented and PRISMA was used to improve rigor. The researchers conducted an extensive database search using Google Scholar, EBSCO MEDLINE, PubMed, CINAHL and ScienceDirect to search for related literature, using the keywords “education model/intervention”, “HAIs-PC” and “nursing curriculum”.

1.2. Inclusion criteria

The journal articles were identified according to the following criteria: (1) population were nursing institution’s managers and nurse educators; (2) the model was an educational model/intervention on HAIs-PC in nursing curriculum, elements of a model/intervention were examined; (3) Outcomes were the goals and structure of educational model/intervention; (4) The most appropriate study designs were mix-method study. The journal articles with population of hospital’s managers and nurses were excluded in the study.

1.3. Screening process and Data extraction

Three authors reviewed articles that used educational model as a focus, concentrated on articles among nursing faculty and managers. Reviewed journal articles published after 2000 were included in the study. The researchers then looked for citations in these collected studies. In addition, the researchers continued to check the list of references from the primary reviews to identify additional studies that were not identified in the previous electronic search.

1.4. Data extraction

The three researchers performed the data extraction independently, based on certain criteria for differences in variables such as study characteristics, population characteristics, model characteristics, outcomes and model/intervention effectiveness.

1.5. Data analysis

From the articles included, we perform content analysis to uncover topics relevant to HAIs-PC educational model for nursing curriculum. During the search process by the database originally had 179 articles potentially relevant was found, finally, 7 articles were identified that fully met the inclusion criteria. From the included articles, we performed content analysis to find the themes in regard to HAIs-PC education model. The most relevant model was the InovSafeCare, which was the parent model of the PrevInf model.

2. Phase two - Empirical study

2.1. Sample

In the explorative study, the focus group ($n = 32$) were used to collect data from purposively sampled students and nurse educators from four universities in Vietnam and Cambodia offering HAIs-PC education in nursing curriculum and be presented the PrevInf model.

2.2. Sampling

The following criteria were used to recruit participants: - the nurse educators were (1) working in the university or in the hospital and teaching contents related to HAIs-PC; (2) having at least a bachelor degree; (3) have at least five years' experience in teaching content related to HAIs-PC; attending in the PrevInf model presentation; - the students were learning in the

university contents related to HAIs-PC; (2) attending in the PrevInf model presentation.

2.3. Data collection

The focus group discussions were conducted from November to December, 2022. All contents group discussions were recorded via tape recorders and written notes. The group discussion took about 30 to 60 minutes in duration. Immediately after group discussion, the data analysis was conducted to ensure data saturation.

2.4. Data analysis

In this study, the statements from collected data were grouped and given codes for easy identification later in the study (Creswell 2014). These codes acted as guidelines for this study to help the researcher conduct data analysis simultaneously with data collection. Content analysis of Focus Groups were conducted to identify perception on the PrevInf Model, the discussion groups to analyze referred pedagogical concepts and models, and relationships between concepts from the parent model and explore additional concepts and relationships.

2.5. Ethical consideration

Ethical approval for the study was obtained from the Institutional Review Board of Asian partner universities. The IRB codes included ...For data collection, all participants were informed clearly about the purpose of the study, the data collecting procedure, risks that might occur and their rights. The participants were informed that their participation was purely voluntary and no compensation was given.

RESULTS OF LITERATURE REVIEW AND EMPIRICAL STUDY

In general, without a clear conceptual framework or model of HAIs-PC education were applied some of the models were used in a vague and inconsistent manner. Therefore, the feasibility and generalization of the models were not guaranteed and widely applied (Aboelela, 2006). Specifically, HAIs-PC educational models or interventions in the last decades mainly focused on providing information according to the traditional educational model of knowledge acquisition, with a commitment to apply modern but remaining ineffectiveness. There was limited application of active educational models, teaching and learning concepts, and instructional design

processes. During this decade there was some applied models suggesting educational methods more relevant to teaching and learning concepts. Therefore, HAIs-PC education gradually addressed the challenges identified in the literature and explored educational models, active teaching and learning processes, creative educational frameworks. Among them, there were some researches of educational model of ADDIE (Assessment, Design, Development, Implementation and Evaluation); the educational, behavioural or organizational change theories. The ISC model was successfully developed and tested in HAIs-PC education on nursing students in some European countries (Patel et al, 2018; Pinto et al, 2021).

1. Components of the models

In the past years, multimodal educational models were the type of intervention often applied to improve students' HAIs-PC practice competency. The exploration of single interventions increased in recent years, with a strong focus on simulation and online strategies. In which, the simulation strategy showed its high effectiveness in filling the theoretical and practical gaps in HAIs-PC practice. For e-learning, this method may represent increased interactivity, however, the educational model still followed a passive content delivery format.

The learning environment in which learners, teachers, teaching contents and methods applied were described rather sketchy and inconsistent across studies. Little information was provided regarding the needs, experiences, involvement, motivations or roles of learners as well as teachers or instructors. The academic environment was well described in simulations or online educational studies, but the clinical setting was rarely mentioned. The concepts of teaching strategies were mentioned in a number of studies including critical thinking, problem-based learning, interactive lecture rather than how these concepts might be applied to facilitate teaching and learning (Eccles, 2004).

2. The most relevant models

The results indicated that the most relevant educational models were the educational model of ADDIE and ISC. In which, the ISC model provided a clear guiding framework for implementing HAIs-PC educational delivery, and concepts to facilitate teaching and learning in achieving the desired educational outcomes. The components of ISC education model included Evidence-based practice, working and learning, Interactive lectures, Lab training, Problem-based learning, Online

learning, Simulation activities, Tutorials, Clinical practice, Clinical case discussion, In-service training participation, Professional education, Real case discussion.

The ISC model is an open, dynamic, and interactive system, developed to promote a student-centered pedagogy that enables nursing students to acquire and develop their cognitive, technical, and communication skills. This model can be applied in HEIs in Asian countries when modifying some culturally specific concepts such as active citizenship and entrepreneurial spirit. Moreover, with the long-standing traditional educational method, the addition of the concepts in the ADDIE model includes Assessment, Design, Development, Implementation and Evaluation concepts to ensure the successful achievement of students' competencies in HAIs-PC practice.

3. Model development (Proposed PrevInf Model)

The phase aimed the development of a model of the infection and prevention education model in nursing curriculum. The method of theory generation as explained by Chinn and Kramer (2011) was adopted and used in this study. The described sequence of four phases was followed, namely concept analysis, construction of relationships, model description and evaluation of the model.

3.1 Concept analysis of the proposed PrevInf Model

A broad search of dictionaries, subject textbooks and research publications was performed. The researchers conducted an extensive database search such as MEDLINE, PubMed, CINAHL and ScienceDirect to search for relevant literature, using the keywords “HAIs-PC”, “education”, “model” and “nursing curriculum”. The publication should be in English and published after 2000. There were 795 full-text articles and abstracts were retrieved, and then adding 93 articles potentially relevant from reference lists of the original articles have been selected for review. After eliminating the duplication in excel, 82 potentially relevant articles were identified for inclusion in the evaluation. After conducting screening of the title and abstract of the articles, 32 articles were selected to be read in full. Finally, there were 27 articles from nursing were included in the final analysis of the concept of HAIs-PC education. The purpose of this concept analysis was to better understand and define collaboration as it relates to HAIs-PC education in nursing curriculum.

This framework was used to clarify the critical attributes of collaboration, identifying elements needed to be present (antecedents) for the concept to occur, distinguishing the concept

from the multitude of related terms and consequences and to assist in the development of a comprehensive understanding to facilitate the application of the concept in nursing education practice (Petri 2010).

3.2. Construction of relationship statements the proposed PrevInf Model

A relationship statement links two or more concepts together. Polit and Beck (2010) refer to a relationship as a bond or association between two or more variables. The relationship statements formulated for PrevInf model in nursing curriculum are given below:

- The HAIs-PC education in nursing curriculum is influenced by the learning environment wherein HAIs-PC education is occurring, namely school settings and clinical settings.
- The assessment, monitor and evaluation facilitate the success of implementing of the model. These are the important components of the model as a cultural characteristic of Asian countries.
- Successful HAIs-PC education is dependent on basis of self-directed learning, reflective and critical thinking, entrepreneurial spirit and active citizenship.
- Students are center of the model with prevention, control, safety and HCAs, in which, students are learned in the active learning environment through Interactive lectures, with various learning resources, using Evidence-based practice, Problem-based learning methods.

3.3. Description of the proposed PrevInf model

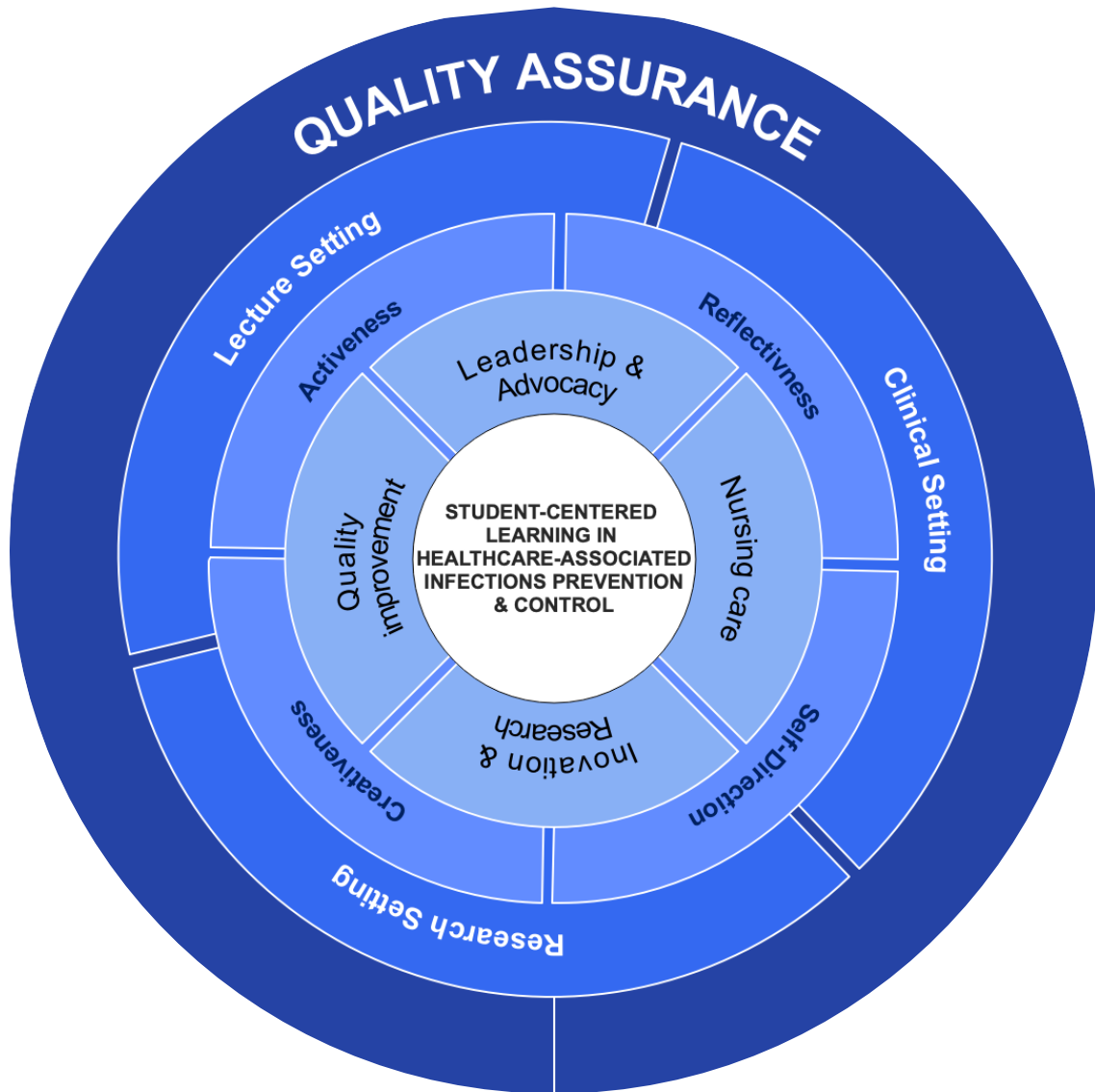


Figure 1 – PrevInf model in HAIs-PC education

The PrevInf model has five main elements with 5 layers:

- Students-centered learning in HAIs prevention and control.
- Learner's areas of core competencies: Nursing care, Leadership and Davocacy, quality improvement, and innovation and research.
- Core behaviors: self-direction, creativeness, activeness and reflection

- Active learning environment: lectures and lab setting, clinical setting and research setting
- Quality assurance of the teaching and learning process: program evaluation, design and implementation, monitoring progress, and then ongoing program evaluation and evaluation
-

The PrevInf model has five key elements: (1) Students-centered learning in HAIs prevention and control. On process of acquiring knowledge and skills on HAIs-PC, learners gain competencies in HAIs HAIs-PC including (2) Nursing care, Leadership and Advocacy, quality improvement, and innovation and research. The competencies are presented by their core behavior (3) of self-directed learning, activeness, creativeness and reflectiveness. The learners are experienced in a variety of (4) Learning environments including classroom and lab settings; clinical settings and research settings. The learners experience a diverse learning environment including interactive lessons that convey knowledge through case discussion for solving the evidence-based problem and simulation scenarios and real cases at bedside. At the same time, educational institutions provide learners with a variety of theoretical and practical learning resources. With a long-standing traditional culture in Asian countries, a (5) quality assurance process is essential to promote the successful implementation of a HAIs-PC modules in higher education institutions. This process is a continuous loop from design, implementation, monitoring and evaluation.

Simulation is an important activity, a guideline for the implementation of the PrevInf model in HCP training at higher education institutions in the health sector in general and nursing in particular. This activity helps learners become familiar with realistic care scenarios and improve their ability to practice safe care before entering the clinical settings. At the same time, clinical practice through discussing clinical cases at the bedside or through daily briefings with classmates, lecturers and medical staff helps students improve their safe care practice in clinical settings.

3.3.1 Purpose of the model

This proposed model will be used as a frame of reference to facilitate the design of HAIs-PC education in nursing curriculum in some Asian countries.

3.3.2 Assumptions of the model

The assumptions underlying the main concept (HAIs-PC education) and other concepts used in the model are explained here under:

- HAIs-PC education bring different skills, knowledge and talents.
- Components of the HAIs-PC education are driven by the nursing curriculum in the institutions, and this needs to be carefully crafted to align the learning and teaching activities.
- Learning environment of nursing education institutions can influence the HAIs-PC training activities.

The HAIs-PC education in nursing curriculum is dynamic and brings up changes in the quality of care.

3.3.3 Definition of concepts

1. Students-Centered Learning is a teaching method to improve cognitive ability development on students. Students Centered Learning has defined as a wide teaching method that comprises active learning, students' responsibility, and cooperative learning. The purpose of this method is to make students become lifelong learners that is continuing learning either inside or outside of formal education (Amri, 2018). The Student-Centered learning is a way of teaching that mostly used for students. It can improve students' learning development by looking some aspects such as developing thinking skills, cooperative learning, and learners' responsibility that could effect on cognitive abilities. Students-Centered Learning in HAIs prevention and control help nursing students to learn and practice HAIs-PC on their own that force themselves to think creatively and effectively while facing and figuring out problems on HAIs-PC and provide the safe care to the patients (Sautelle, 2015). Some students have varied problems during learning or studying, this is because they cannot think critically, creatively, and effectively. Many factors might affect them, but the main factor that has high probability to be the source of this case is having lack cognitive ability (Sautelle, 2015). Putting students as a center of leaning process will force students to improve their own learning which stimulates the brain to think creatively, effectively and critically. By using this method students are able to improve their cognitive ability gradually to have sufficient cognitive ability in order to be good learners.

Student-centered learning refers to a wide variety of educational programs, learning experiences, instructional approaches, and academic-support strategies that are intended to

address the distinct learning needs, interests, aspirations, or cultural backgrounds of individual students and groups of students. The active learning classroom is one that de-emphasizes lectures and other teacher-centered forms of instruction in favor of engaged class environments that are learner-centered. The students read and learn information on their own, with their instructors acting as coaches and mentors. Asian culture in learning patterns can impact the engagement of students with Student-centered learning (Huang, 2020).



Figure 2 – Sub-structure of the first layer

2. Core competencies refer to the knowledge, skills and attitudes required for HAIs-PC professional to practice with an in-depth understanding of situations, using reasoning, critical thinking, reflection and analysis to inform assessment and decision-making in the prevention and control of health care-associated infection and antimicrobial resistance. For nursing professional, the core competencies are defined for infection control and hospital hygiene professionals. The term “core” indicates that the competencies should be a minimum pre-requisite, common to nursing professional. It is acknowledged that professional expertise grows in a continuum where speed of acquisition and completeness of knowledge depend on many different variables such as local culture (e.g. expectations that the infection control nurse will chair the infection control committee), the existence of a professional profile for infection control/hospital hygiene professionals in a given country, the level of administrative support or resources, the presence of audit/patient safety departments, attitudes, preferences, and previous experience (e.g. when newly hired infection control nurses already have considerable management experience/transferable

skills in other specialties before embarking on their new infection control and hospital hygiene career).

Core competencies of learners for HAIs-PC include nursing care, leadership and advocacy, quality improvement, and innovation and research. The learners provide their safety nursing care by Elaborating infection control interventions, implementing infection control healthcare procedures, contributing to reducing antimicrobial resistance, advising appropriate laboratory testing and use of laboratory data, Decontamination and sterilization of medical devices, and controlling environmental sources of infections. The learners' leadership are presented by Elaborating and advocating an infection control programme; and Management of an infection control programme, work plan and projects. Besides, the learners have competency of quality improvement by Contributing to quality management, contributing to risk management, performing audits of professional practices and evaluating performance, and Infection control training of employees. Moreover, the learners may have competency of innovation and research by contributing to research, designing a surveillance system, managing (implementation, follow up, evaluation) a surveillance system, and identifying, investigating and managing outbreaks.

Moreover, students may develop the other competency of evidence-based practice and Problem-based practice. Evidence-based practice is an active education method which provides nursing students with a method to use critically appraised and scientifically proven evidence for delivering quality health care to a specific population. Despite abundant clinical and health services research production, the translation of research findings into practice remains slow and haphazard, resulting in a so-called "research-practice gap". As a profession dedicated to the front lines of healthcare, nurses are uniquely situated to close this gap by harnessing and contributing to knowledge in the scientific literature. Nurses in Asian countries are facing a number of significant barriers in research utilization. Enhancing managerial support might be the most promising facilitator, given Asian traditional culture and existing health care system (Wang, 2013).

Problem-based learning (PBL) is a student-centered approach to learning which enables the students to work cooperatively in small groups for seeking solutions to situations/problems. Enhanced problem-solving ability affects the quality of nursing care and plays a vital role in the outcomes of the nursing care. In Asian countries, PBL has been slowly adopted in nursing schools since the early 2000s, The PBL was shown to result its improved learning outcomes in Korean

nursing students relative to traditional strategies, its adoption is ought to be continued or accelerated.

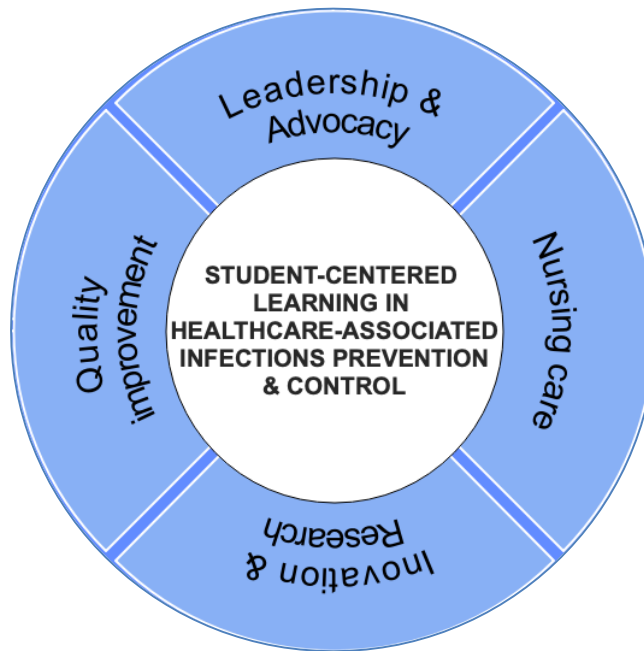


Figure 3 – Sub-structure of the second layer

3. Learner's behavior: self-direction, creativeness, activeness and reflection

Self-direction

A process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. In Asian countries, only half of the students had a high-level of self-directed learning readiness, in which, the proportion of students with a high level of self-directed learning readiness was lower in the senior students compared to more junior students. The problem based learning processes, assessments, learning environment, students' life styles, students' perceptions of the topics, and mood, were factors influencing their self-directed learning (Leatemia, 2016).

Creativity

Creativity is an important skill for problem solving and generating new ideas. Nursing is

a profession that often encounters unexpected situations and involves taking care of patients with different backgrounds and health conditions, hence nurses need to go beyond routine nursing and acquire creative thinking to make beneficial decisions. The nursing students while studying of HAIs-PC must embrace creativity to develop their critical thinking that can facilitate the growth of their competency on HAIs-PC and patient safety.

Activeness

Active is an umbrella concept regarding the rights and responsibilities of citizens. It urges people to be more engaged with the world around them. An education for active citizenship should also include opportunities for young people to develop their skills as agents of change and to reflect critically, especially, for the students in long traditional culture.

Reflection

Diverse learning is vital to higher education today and is increasingly being discussed, critiqued and improved with a variety of approaches to realizing the difference and creating positive change in the world. work, research, teaching, and learning (Byrd, Brunn-Bevel, & Ovink 2019). Students come to the classroom as a diverse mosaic with different cultures, talents, disciplinary backgrounds, and classroom orientations and expectations. Instructors can design diverse lessons for all classes of different levels of learners. Diversity in teaching and learning is often discussed at the principle and theoretical level, and it is important to put it into practice for all educators to implement and practice, including a useful teaching strategy to train qualified nurses to care for a wide variety of patients.



Figure 4 – Sub-structure of the third layer

4. Active learning environment

Active Learning Environments is a learner-centered environments where provide cooperative learning spaces that encourage students' collaboration and peer learning. In the cultural context of a strong hierarchical culture, the mechanisms of fear prompted students to be silent (outcome) and dare not give their opinions. In the training context of teacher-student familiarity alongside teachers' guidance, the mechanisms of learning motivation, self-regulation and enthusiasm were triggered, prompting positive learning outcomes and competencies (outcome) (Huang, 2020).

Students' engagement in academic-related learning activities in HAIs-PC is one of the important determinants of students' success for their future safety nursing care (Ghasemi, Moonaghi, & Heydari, 2020). Identifying the best teaching strategies to sustain and promote nursing students' engagement in academic, research and clinical settings has always been a challenge for nurse educators. Hence, it is essential to provide a set of strategies for maintaining and enhancing the academic, research and clinical practice engagement of nursing students. The nursing students obtain foundational knowledge and practice on HAIs-PC in the academic setting

and practice to taking care of the patients in the clinical settings. The patient care and critical thinking are evaluated in the clinical settings. For students to achieve learning outcomes, nursing programmes use outside agencies to provide patient care experiences. These settings, termed clinical setting, are vital to nursing education, with students spending approximately three times the number of hours in clinical environments compared to the classroom (Ghasemi et al. 2020). Clinical settings include simulation laboratories and hospitals, which allow students to care for simulated patients, or high-fidelity mannequins, as alternatives to direct patient care. With simulation, students have multiple practice opportunities, repetition of clinical scenarios and can immediately engage in reflection about decision-making (Park et al. 2013). Due to its importance, both the school setting and the clinical setting must include meaningful learning opportunities. Research conducted in multiple countries indicates negative learning environment experiences interfere with achievement of learning outcomes, aggravating an international nursing shortage (Babenko-Mould & Laschinger 2014).

Simulation

Simulation is defined as activities that mimic the reality of a clinical environment and are designed to demonstrate procedures, decision making, and critical thinking required in routine patient. The simulation method was an excellent teaching method for health care education adopted in Vietnam and Cambodia recently. The simulation method could be beneficial for improving prelicensure nursing students' confidence and competence; however, improvements to simulation realism and engagement are needed to maximize user satisfaction and performance (Kim, 2021).

Simulation is a field-reproducible method of teaching that uses an environment similar to the actual clinical situation. It allows for safe and effective repeated learning, as desired. Conducting a simulation using standardized patients who are well-trained in expressing their disease and emotional state, similar to the real world, would allow students to realize the patient's thoughts and feelings by interacting with them and have more realistic and concrete experiences. Another practical education method is peer role-play, which is a low-cost tool that can be quickly incorporated into practice. It allows for the switching of roles to experience both health provider and patient perspectives.

Simulation utilizes artificial representation of real-world processes to allow for learning with approximation of practice. It is an educational technique, not a technology, that facilitates learning through immersion, reflection, feedback, and practice in a controlled environment with minimal risk to patients. Common root causes of preventable medical errors were communication breakdowns, faulty systems of care, lack of standardization in practice, and insufficient knowledge. By allowing practice in a realistic and interactive setting with minimal risk to patients, simulation can help the nurses acquiring clinical skills through practice, improving communication skills, defining team structures, and refining protocols.

According to the CDC, 1 in 31 hospitalized patients developed at least 1 healthcare-associated infection (HAI) in 2018. Most HAIs are related to invasive devices or procedures: catheter-associated urinary tract infection, central-line-associated bloodstream infection, surgical site infection, and ventilator-associated pneumonia. Evidence-based prevention strategies can reduce HAIs but are insufficiently implemented. Education is a key component of infection prevention efforts and traditional methods of teaching include lectures, videos, and fact sheets with some opportunities for hands-on practice. With growing recognition of simulation in nursing education, simulation can also be used as an important adjunct to traditional teaching and assessment methods in HAIs-PC. In this model, the simulation pedagogy will be used in HAIs-PC education and highlight the importance of simulation as an educational tool in HAIs-PC.

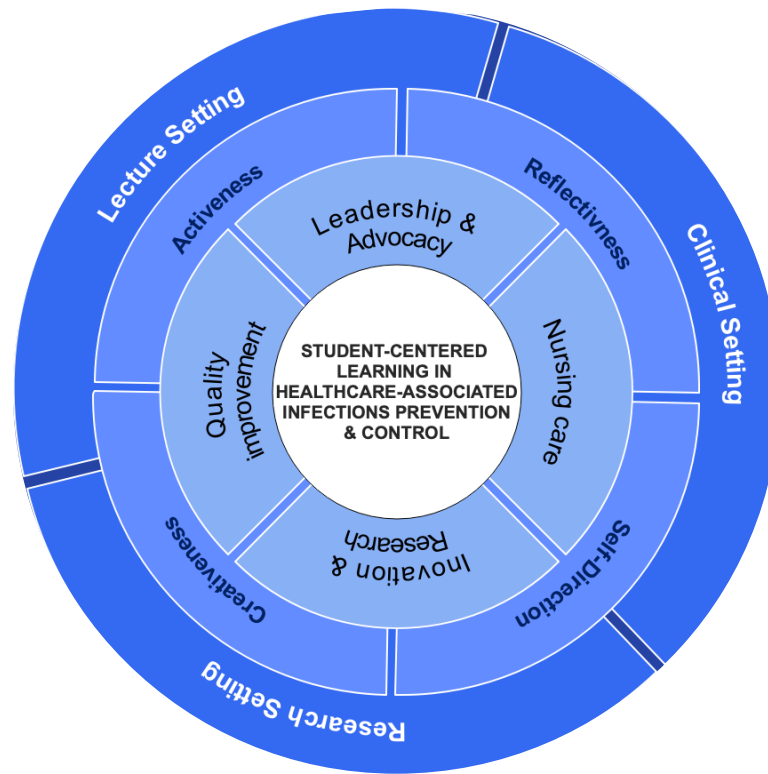


Figure 5 – Sub-structure of the fourth layer

5. Quality assurance (QA) is one of the mechanisms developed by educational institutions to ensure that graduates attain adequate standards of HAIs-PC education (Ryan, 2015) and consists of both internal and external QA processes (Van de Mortel, Bird, Holt, & Walo, 2012). Internal QA refers to the curriculum and/or program review processes carried out by the organization or program themselves, whereas external QA refers to review processes performed by an assessment team from outside the organization (i.e., professional nursing body or program accreditation team). Program enhancement and higher student satisfaction levels are some of the primary goals of both internal and external QA measures commonly used in health-care education programs (Begg, Galea, Bayer, Walker, & Fried, 2014). The professional nursing self-regulation and program accreditation are both approaches to QA in nursing education. The accreditation process provides an objective method to assess professional nursing education programs, identifying strengths and opportunities for improvement in addition to information on program areas that require development, modification, and/or resources (Canadian Association of Schools of Nursing, 2012). Internal review processes put more QA responsibility on the nurse educators within a nursing education program, augmenting the objectivity of external review processes with

program insights gained from internal program review.

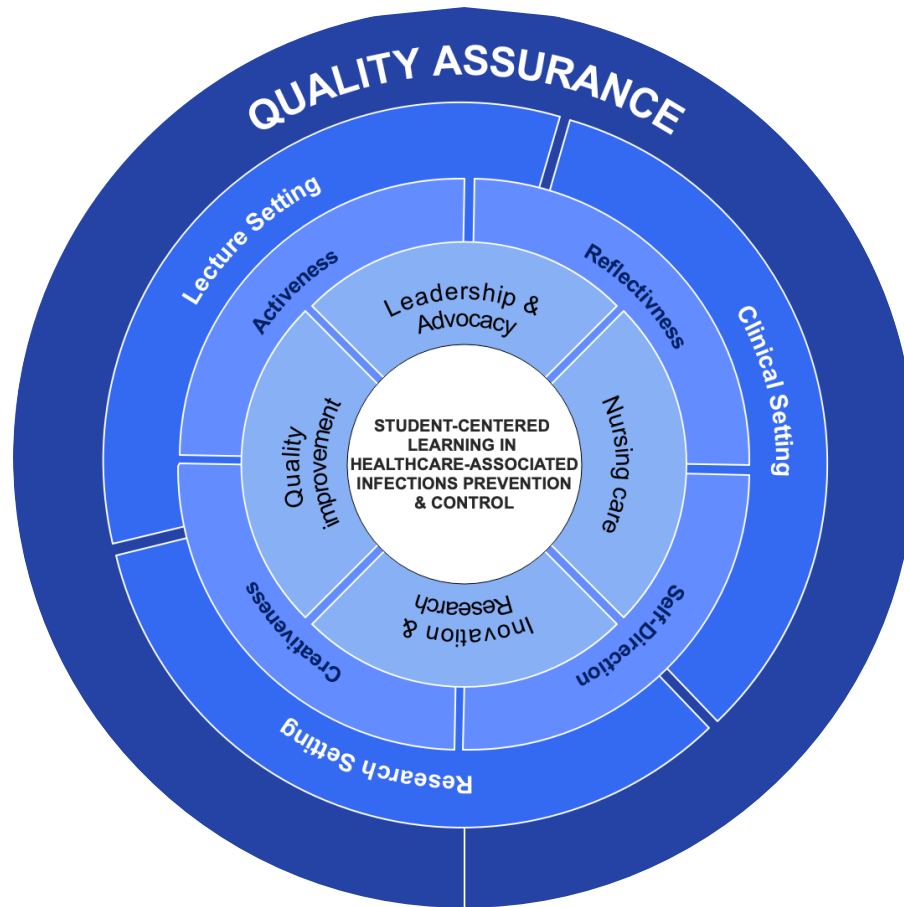


Figure 6 – Sub-structure of the fifth layer

4. Apply the PrevInf model in HAIs-PC education

INPUT	Lecturers	Pedagogy approach in HAIs-PC
	HEIs	Content and approach of teaching, training and facility support
	Student	Readiness of adherence to HAIs-PC
	Concept of teaching and learning in HAIs-PC	– Students-Centered Learning – Core competency in HAIs-PC education – Learner's behavior
	Active learning environment	Classroom and lab settings; Clinical settings

INTERVENTION		Research settings
	Quality Assurance	Internal and external QA processes of program evaluation, design and implementation, monitoring progress, and then ongoing program evaluation and evaluation
	Simulation pedagogy	Simulation teaching process: - Design simulation scenarios - Briefing - Run the scenario - Debriefing
OUTPUT	Students	Adhere to HAIs HAIs-PC procedures
		Satisfied with the results of learning and practice
		Maintain compliance with HAIs HAIs-PC procedures in practice
		Integrate HAIs HAIs-PC procedures into routine nursing care plan
	Lecturers	Capacity to support the students in complying with HAIs HAIs-PC procedures
		Satisfaction with teaching and students' hospital HAIs-PC results
		Maintain compliance with hospital HAIs-PC procedures in clinical practice
		Integrate hospital infection control procedures into routine nursing care plans

	University	Satisfaction
		Teaching materials for HAIs HAIs-PC
		Simulation scenarios
		E-book for HAIs HAIs-PC training

Table 1 – Applying the PrevInf Model in HAIs-PC education

3.2.4 Evaluation of the model

The model will be evaluated by pilots in this project. The critical reflection of this model will be done according to Chinn and Kramer (2011) to help clarify the ingredients for evaluation: clarity, simplicity, generality, accessibility and importance (Chinn & Kramer 2011).

References

- Aboelela SW, Stone PW, Larson EL. Effectiveness of bundled behavioural interventions to control healthcare-associated infections: A systematic review of the literature. *J Hosp Infect.* 2007;66(2):101- 108. doi: 10.1016/j.jhin.2006.10.019.
- Amri, F., & Ekaningsih, N. (2018). Enhancing students' cognitive abilities through students-centered learning (SCL). *Kajian Linguistik dan Sastra*, 2(2), 141-146.
- Asadpour, M., Nasirzadeh, M., Pourhashem, N., & Peimani, A. (2020). Effect of education based on health belief model on observation of standard precautions by dental students in Rafsanjan in 2019. *Journal of education and health promotion*, 9, 349. https://doi.org/10.4103/jehp.jehp_255_20
- Babenko-Mould, Y., & Laschinger, H. K. (2014). Effects of incivility in clinical practice settings on nursing student burnout. *International journal of nursing education scholarship*, 11(1), 145-154.
- Begg, M. D., Galea, S., Bayer, R., Walker, J. R., & Fried, L. P. (2014). MPH education for the 21st century: design of Columbia University's new public health curriculum. *American journal of public health*, 104(1), 30-36.
- Canadian Association of Schools of Nursing. (2012). CASN and accreditation. Retrieved from <http://www.casn.ca/accreditation/>. Canadian Nursing A
- Chinn, P.L. & Kramer, M.K., 2011, Integrated theory & knowledge development in nursing, 8th edn., Elsevier-Mosby, St Louis, MO.
- Eccles M, Grimshaw J, Walker A, Johnston M, Pitts N. Changing the behavior of healthcare professionals: The use of theory in promoting the uptake of research findings. *J Clin Epidemiol.* 2005;58(2):107-112. doi:10.1016/j.jclinepi.2004.09.002.
- Huang, C. D., Tseng, H. M., Jenq, C. C., & Ou, L. S. (2020). Active learning of medical students in Taiwan: a realist evaluation. *BMC medical education*, 20(1), 487. <https://doi.org/10.1186/s12909-020-02392-y>
- Kim, M. J., Kang, H. S., & De Gagne, J. C. (2021). Nursing Students' Perceptions and Experiences of Using Virtual Simulation During the COVID-19 Pandemic. *Clinical simulation in nursing*, 60, 11–17. <https://doi.org/10.1016/j.ecns.2021.06.010>
- Ghasemi, M. R., Moonaghi, H. K., & Heydari, A. (2020). Strategies for sustaining and enhancing nursing students' engagement in academic and clinical settings: a narrative

- review. *Korean journal of medical education*, 32(2), 103–117.
<https://doi.org/10.3946/kjme.2020.159>
- Leatemala, L. D., Susilo, A. P., & van Berkel, H. (2016). Self-directed learning readiness of Asian students: students perspective on a hybrid problem based learning curriculum. *International journal of medical education*, 7, 385–392. <https://doi.org/10.5116/ijme.582e.021b>
- Lim, J. Y., Kim, G. M., & Kim, E. J. (2021). Predictors of Entrepreneurial Intention of Nursing Students Based on Theory of Planned Behavior. *Journal of multidisciplinary healthcare*, 14, 533–543. <https://doi.org/10.2147/JMDH.S288532>
- Magill SS, O'Leary E, Janelle SJ, Thompson DL, Dumyati G, Nadle J, Wilson LE, Kainer MA, Lynfield R, Greissman S, Ray SM, Beldavs Z, Gross C, Bamberg W, Sievers M, Concannon C, Buhr N, Warnke L, Maloney M, Ocampo V, Brooks J, Oyewumi T, Sharmin S, Richards K, Rainbow J, Samper M, Hancock EB, Leaptrot D, Scalise E, Badrun F, Phelps R, Edwards JR, Emerging Infections Program Hospital Prevalence Survey Team. N Engl J Med. 2018 Nov 1; 379(18):1732-1744
- Mohseni M, Mahboobi M, Sayyadi A, Shabani Z, Asadpour M. The Effect of an Educational Intervention Based on Health Belief Model on the Standard Precautions Among Medical Students of Rafsanjan University of Medical Sciences. 2015
- Moralejo D., El Dib R., Prata R.A., Barretti P., Corrêa I. Improving adherence to Standard Precautions for the control of health care-associated infections. *Cochrane Database Syst. Rev.* 2018;2:CD010768. doi: 10.1002/14651858.CD010768.pub2
- Navoa-Ng JA Berba R Galapia YA et al. Device-associated infections rates in adult, pediatric, and neonatal intensive care units of hospitals in the Philippines: International Nosocomial Infection Control Consortium (INICC) findings. *Am J Infect Control* 2011; 39:548–54.
- Park, M. Y., McMillan, M. A., Conway, J. F., Cleary, S. R., Murphy, L., & Griffiths, S. K. (2013). Practice-based simulation model: A curriculum innovation to enhance the critical thinking skills of nursing students. *Australian Journal of Advanced Nursing, The*, 30(3), 41-51.
- Patel, S. R., Margolies, P. J., Covell, N. H., Lipscomb, C., & Dixon, L. B. (2018). Using Instructional Design, Analyze, Design, Develop, Implement, and Evaluate, to Develop e-Learning Modules to Disseminate Supported Employment for Community Behavioral

- Health Treatment Programs in New York State. *Frontiers in public health*, 6, 113. <https://doi.org/10.3389/fpubh.2018.00113>
- Pinto, M.; Simões, J.; Reis, A.; Cunha, F.; Caseiro, H.; Patrzala, A.; Bączyk, G.; Jankowiak-Bernaciak, A.; Basa, A.; Picado, E.; Yurrebaso-Macho, A.; Guzman, R.; Méndez, J.; Ward, A.; Iglesias, J.; Canelo, J.; Silen-Lipponen, M.; Korhonen, U.; Koponen, L.; Myllymaki, M.; Santos-Costa, P.; Serambeque, B.; Fernandes, E.; Pardal, J.; Salgueiro-Oliveira, A.; Graveto, J.; Parreira, P. (2021) InovSafeCare Pedagogical Model. A defying glance to the educational approach of Healthcare Associated Infections in Higher Education. Active Learning in Higher Education. Manuscript ID: ALH-21-0781.
- Ryan, T. (2015). Quality assurance in higher education: A review of literature.
- Van De Mortel, T., Bird, J. L., Holt, J. I., & Walo, M. A. (2012). Quality assurance and quality enhancement of the nursing curriculum-happy marriage or recipe for divorce? *Journal of Nursing Education and Practice*, 2(3), 110.
- Salsali, M., Tajvidi, M., & Ghiyasvandian, S. (2013). Critical thinking dispositions of nursing students in Asian and non-Asian countries: a literature review. *Global journal of health science*, 5(6), 172–178. <https://doi.org/10.5539/gjhs.v5n6p172>
- Sautelle, E., Bowles, T., Hattie, J., & Arifin, D. N. (2015). Personality, resilience, self-regulation and cognitive ability relevant to teacher selection. *Australian Journal of Teacher Education (Online)*, 40(4), 54-71.
- Thu AT Hung NV Quang NN et al. A point-prevalence study on healthcare-associated infections in Vietnam: public health implications. *Infect Control Hosp Epidemiol* 2011; 32:1039–41
- Wester, E. R., Walsh, L. L., Arango-Caro, S., & Callis-Duehl, K. L. (2021). Student Engagement Declines in STEM Undergraduates during COVID-19-Driven Remote Learning. *Journal of microbiology & biology education*, 22(1), 22.1.50. <https://doi.org/10.1128/jmbe.v22i1.2385>
- Wang, L. P., Jiang, X. L., Wang, L., Wang, G. R., & Bai, Y. J. (2013). Barriers to and facilitators of research utilization: a survey of registered nurses in China. *PloS one*, 8(11), e81908. <https://doi.org/10.1371/journal.pone.0081908>

Ward D.J. The role of education in the prevention and control of infection: A review of the literature. *Nurse Educ. Today*. 2011;31:9–17. doi: 10.1016/j.nedt.2010.03.007