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PROMOTING SIMULATION
IN MEDICAL EDUCATION

SIMGHOSTS

⁂ SUBMITTED ABSTRACTS

DESCRIPTIVE STUDIES — ORAL

00008

Pro-physiology On-the-Fly with LLEAP

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SingHealth Duke-NUS Institute of Medical Simulation (SIMS)

Introduction and Aim:
Research objectives were to develop a teaching skill with Simulation Based Learning and to study the effect of developing a teaching skill with Simulation Based Learning.
Description:
In view of not all of our manikin operators has clinical background, to preserve the suspension of disbelief for the simulation exercise, we adopted pre-programmed scenario and "on-the-fly" with SimDesigner (found in LLEAP). The programmed scenario allow smooth transition of parameters from stage to stage, while programmed "on-the-fly" allow ad hoc parameters change with less drastic, organised and pro-physiological fluctuation. The "on-the-fly" is programmed as five handlers, namely: airway, breathing, circulation, auscultation, &, checklist. These "on-the-fly" handlers can be linked to all 3G's scenario to meet to at scene parameter changes requirement. For instant, manikin operator can find "IV fluid w transient result", "VT-VF", "ROSC", "Cushing", "ECG artefact on" in circulation handler. In the option of "VT-VF", participants will see an R-on-T occur on current ECG waveform, which trigger a 20 sec of pulseless Ventricular Tachycardia, and follow by Ventricular Fibrillation.

Discussion:
To preserve the suspend of disbelief with or without clinical background, the programmed "on-the-fly" allows series of parameter changing commands take place with ease, faster and often with greater clinical sense.

00009

Enhancing Medical Simulation Training in the SAF Medical Training Institute

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SAF Medical Training Institute (SMTI)

Introduction and Aim:
The use of simulation and technology has been an integral part of training at the SAF Medical Training Institute (SMTI) for the past 20 years. From the use of simple part-task trainers to high-tech simulators, SMTI's medical simulation training has evolved over the years, with new advances in technology and training pedagogies. With increased experience in the field, SMTI has incorporated the use of new methodologies, techniques and tools to give trainees a positive training experience and improve the overall training effectiveness.

Description:
To revitalize how simulation is employed in SMTI so that it continues to provide a realistic, engaging and safe learning medium for trainees, leveraging on technology and re-calibrating the approach of the use of simulation are two main thrusts identified to achieve the goals. With the completion of the Medical Simulation Training Centre (MSTC) and acquisition of new simulators in 2012, SMTI embarked on a multi-year project to enhance its training capabilities with simulation as one of the key focus areas. The SMTI simulation roadmap is broken down into various milestones, each targeting a specific area to improve. The whole project is summarized into: 1) classification of simulation tools or capabilities, 2) curriculum transformation to review enhance

use of simulation, 3) incorporating the use of new technology to enhance training, 4) mixing different techniques to create new training experience and 5) increase realism through moulaging.

Discussion:
1) Classification of SMTI simulation tools. Before moving ahead, first we have to take stock of our current capabilities, classifying them to identify the pros and cons of each simulation tool, so that we can better recommend the appropriate tool for the intended learning objectives. 2) Curriculum transformation. As part of the SAF wide training transformation masterplan, we took the chance to review the curriculum to incorporate simulation training at different stages to reap maximum benefits. 3) Harnessing new technologies. Other than the use of the MSTC to improve simulation training, E-learning capabilities were also enhanced, such as the development of online learning platforms and e-courseware packages to allow learners to be better prepared for their practical lessons. 4) Introducing hybrid simulation. We assessed the possibility of improving training efficiency via the combination of different modalities to leverage on the advantages of each simulation tool. 5) Improving casualty moulaging. To enhance training realism and bring out the fear factor in the trainees, we see the need to further improve the standards of casualty moulaging yet at the same time to ensure that it is cost and time effective and sustainable in the long run. The introduction of the various initiatives has refreshed how simulation is utilized in SMTI, making training more interesting and engaging, especially for the new generation of soldiers. This has led to more experiments on how simulation training can be executed, breaking out of the confines of the simulation. Since the roll out of these initiatives four years ago, there has been renewed enthusiasm and increase creativity in the conduct of training. This is reflected in the positive feedback received, and led to the increase in our medical personnel's competency and confidence.

00012

Initial Impression of Breathing 3G with ASL5000 Lung Kit

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Introduction and Aim:
Integrating SimMan3G with mechanical ventilation is a challenge. A main technical hurdle is to synchronize the simulated breath, chest movement, breath sound, parameters and ventilator findings without ventilator modification.

Description:
Lack of inspiration flow limits any patient simulator's role in clinical simulation which required mechanical ventilation. With emergency, intensive care and anaesthesiology are the common users of our simulation services, we have explored six devices in an attempt to meet the needs of simulation training with ventilator. The Lung kit by Ingmar Medical is the latest breathing simulator that we had try to incorporate with SimMan3G and had an initial technical trial run. In this trial, 3G & ASL5000 is tested with: 1) ability to generate spontaneous breath with and without ventilator support; 2) ability to breath with Pressure Support with several flow trigger and PEEP adjustment; 3) ability to breath with alternate volume and pressure targeted ventilation support mode, i.e. SIMV+PS; and, 4) ventilator adjustment with simulators with severe asthma settings.

Discussion:
Simulator(s), with physiological and pathological breathing ability, has/have the potential to become a standard training tools for simulation exercises in critical care, anaesthesiology and emergency environment.

00018

Redesigning the Suturing Workshop for General Surgery House Officers

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Introduction and Aim:
Suturing workshops for General Surgery House Officers (GS HOs) were previously conducted on an ad-hoc basis every few months, and plagued by poor attendance. Uncertainty regarding its utility due to erratic teaching content, as well as competing service demands were cited as reasons for lack of participation. This year, the Post Graduate Year 1 (PGY1) Committee has mandated compulsory attendance for all GS HOs. In line with the new directive, the curriculum was redesigned with emphasis on clinically relevant knowledge and practices, and the workshop restructured to enhance its efficacy, including a component of assessment using task trainers.

Description:
The workshop now happens more frequently, to keep class sizes small, and ensure that PGY1s with shorter 3-monthly rotations are able to attend. Dates are announced before their start with the department, so that leave projections and call schedules can be planned ahead. For those absent due to illness, they can come for the next session even if they have moved on to other postings, and a letter of explanation to the next department head is supplied. It is held on a weekend afternoon, to ensure sufficient time to settle changes after morning rounds. Reminders are sent to the department the week preceding the workshop and also a day before, so adequate manpower can be mobilized for each team. A consistent group of PGY1 GS Core Faculty conduct the teaching, which now has an added component of lectures on basic surgical skills theory, and also both videos and live demonstration of suturing techniques, before the attendees have hands-on practice sessions followed by an individualized skills evaluation station. Another feature is the introduction of summative assessment tools in the form of pre- and post- workshop quizzes, comprised of MCQs and extended matching questions, to objectively track their progress.

Discussion:
To garner feedback about the revamp, a questionnaire on needs assessment was distributed during the session. We enjoyed good response rates and results were heartening. A vast majority felt that the workshop was necessary, despite all having had some form of exposure to basic surgical skills and suturing practice previously (eg. Medical school, attended courses, taught during other postings). Most voted that it should be made compulsory, and HOs were unanimous in their agreement regarding its usefulness. In response to suggestions received, the timing of the workshop was progressively shifted to start later on a weekend morning, then subsequently moved to the afternoon. At the start of the session, they were asked to rate their subjective confidence about their current ability to perform basic suturing against a 10-point Likert scale. At the end of the workshop, this question was posed to them again, and mean scores rose from 5.57 to 7.91. Objectively, there was also improvement in their quiz marks from 80.67% to 92.78%. In terms of suturing skills evaluation, four-fifths were able to achieve a "satisfactory" grade at first-pass. Grading was done by an independent consultant surgeon who was not a Core Faculty member involved in the teaching. The Kirkpatrick training evaluation model was adapted in the curriculum redesign, to help measure the effectiveness of our teaching in a step-wise manner across several levels – gauging the reactions of the attendees, analyzing their scoring patterns, and finally, evaluation and grading by a credible external source as a judge of successful behavioral change. The restructured GS HO Suturing Workshop has yielded early encouraging findings, and continues to be an evolving educational platform to enhance the PGY1s learning experience in a surgical rotation. Feedback received will be used to modify subsequent workshops to enhance its validity and value to the participants.

00036

Organised Chaos: A Descriptive Study of Simulation in the Resuscitation Area through a Board Game for Nurses

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Introduction and Aim:
The Department of Emergency Medicine (DEM) is a challenging place where its staff needs to be proficient to deliver safe and quality care despite limited time and resources. Clinical skills were learnt but leadership, role delegation and communication is infrequently cultivated and exercised. Simulation in DEM is extremely challenging due to limited resources, high acuity and unpredictable influx of patients. This study aims to hone leadership and role delegation and improve confidence and communication during crisis. A board game was created to simulate a busy resuscitation area which assess participants on leadership, role delegation, communication and prioritization of their patients.

Description:
The resuscitation area was simulated using a large board and paper pieces. 11 nurses who are trained in emergency nursing participated. Players are required to complete scenarios with actions that were typically carried out on clinical areas. A minimum of three players are required and each player is represented with their name tag that is placed on the board. The board cannot be left without any player. Nurses take turn to be team leader (N1) with two team members (N2 & N3). Only N1 makes decisions and set priorities based on the given scenarios. Players could discuss; but only N1 can delegate the tasks. However, each player can only carry out one action at a time. Actions requiring them to leave DEM would be equivalent to the player sitting out of the game for a few minutes. Their absence would challenge N1 further as she would have less members in her team. The game ends when N1 has successfully completed all tasks and decant her patients out of the resuscitation area. Game would also cease if the board is left without any player present due to all players carrying out actions as this represents compromise in patient safety.

Discussion:
Players were assessed through peer review. They gave feedback to each other based on leadership, role delegation, communication and prioritization of their patients. They also shared their emotions, stress level and opinions as the team leader (N1) after the game. The game was incorporated in a structured orientation program for the 11 nurses. Through peer review and reflection and discussions; participants could evaluate on their own and their peers' performance, leadership, delegation and resuscitation management. Diverse styles of leadership and conflicting management were observed during the game. Nevertheless, eight participants provided positive feedback that the exercise allowed them to have a bird-eye view of a busy resuscitation area that test their situational awareness, leadership and role delegation. They were also more confident in their skills and team management after the program. This study is the first of its kind in the department and could be followed up with a bigger population by repeating the game to assess for improvement and further assessment and observation the nurses in real time in the actual resuscitation area. The board could be a robust tool for healthcare team to use to improve team dynamics, responsiveness while still sustaining the functionality of DEM. It could effectively enhance communication within team members and allows areas for improvement without compromising patients' care and safety.

DESCRIPTIVE STUDIES — POSTER

00004

Getting the Grip! The Usefulness of the Integrated Resuscitation Drill in Preparation for Clinical Practice

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Introduction and Aim:
The Integrated Resuscitation Drill (IRD) is an interactive instructional course for junior doctors and nurses to practice challenging acute medical scenarios in a simulated environment. Feedback from learners is important for the maintenance of quality and standards, and to inform how the experiences for future learners can be improved.

Description:
Four scenarios, each with 4–5 nurses and junior doctors, were simulated on high-fidelity simulation manikins. Trained facilitators conducted the simulation exercise followed by debriefing. Feedback was rated on Likert Scale, and spaces were provided for written comments. The feedback from 44 doctors and 59 nurses was analysed. The majority of the learners (83%) reported that the case scenarios/simulation sessions reinforced their knowledge and skills in acute medicine, and helped them improve on communication skills with fellow doctors and nurses. Some themes include Learning under stress, Understanding better, Working with other healthcare professionals and Reflection.

Discussion:
Being in the hot seat challenged the application of knowledge, and practicing helped them to drill in the protocols. They appreciated the hands-on experience and suggested that it might be helpful to take turns in leading scenarios. The debriefing also helped them to reflect on their performance for future improvement. The learners appreciated the opportunity to practice and learn from mistakes in a simulated environment. Their feedback provides insight to their preferences during the IRD and enhances understanding of learners' experiences for future considerations on how IRD sessions can be further improved for learners.

00005

Picture Perfect Learning – Using Visual Work Instructions for Operations Staff Development

Sharon Yap
Changi General Hospital

Introduction and Aim:
Changi Simulation Institute (CSI) started operations in 2013 with 2 simulation technicians to assist our simulation instructors in course setups, manikin operations and video recordings during simulation sessions. Each of the 2 simulation technicians handled a portfolio of courses independently. Training was done on the job through trial and error and by learning from the simulation instructors. As CSI begun to see greater demand for simulation training, we started a project in 2015 to develop and use visual work instructions to capture this collective knowledge for operations staff development, collaboration and continuity planning in the institute.

Description:
In 2015, the simulation technicians started a pilot project to develop visual work instructions for selected courses under their charge. These visual work instructions documented the operations workflow and critical process steps for performing manikins, medical equipment and room setups and for the running of the scenarios during simulations using extensive visual representations. Their graphic nature showed what the end product looks like through the use of photos, videos, flowcharts, checklists etc. The

visual work instructions were then used as training aids during the cross trainings for the simulation technicians. Following these cross trainings, self assessment surveys were used to rate their knowledge, skills and confidence in managing each other's courses. Feedback was also sought from the various simulation instructors on the setups and operations of their courses.

Discussion:
Overall, the survey findings showed that the implementation of visual work instructions (VWIs) had increased the confidence levels of the staff from 43% to 71% when managing each other's courses. The results also rated the VWIs as useful job aids during the cross-trainings, which had reduced the time required by the staff to learn new work operations during course handovers. They were also able to achieve reductions in pre-course preparation times and incidences of error and rework, as there was less reliance on memory and past experiences. Positive feedback gathered from the various instructors of these courses had also collaborated these findings. Research had shown that the standardisation of work processes often leads to a reduction in variability and errors for the same task done by different individuals. These documented work processes will form the standard workflows for the running of simulation courses in CSI. VWIs will thus lead to increasing the flexibility of staff allocation, eliminating unplanned downtime and reducing the errors for repetitive tasks. Qualitative feedback gathered from the surveys also showed that post-course reviews and discussions between the simulation technicians had contributed to more in-depth understanding of the courses managed and the generation of new ideas for improvement. The development of VWIs had provided a starting point in the creation of a knowledge management repository in CSI. This project had provided some insights into the positive effects of identifying, retaining and harnessing the collective knowledge of individuals. By consolidating the VWIs online, we were able to direct individual skills, experience and norms into a shared platform for knowledge sharing and collaboration. As individuals continuously contribute towards the improvement on "best practices", it creates an iterative process for re-engineering of the internal operational processes as well as for individual learning and growth.

00006

Manikin Airway Assessment with Video Laryngoscope

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Introduction and Aim:
Endotracheal intubation is a popular practical skills training in Institute for Medical Simulation and Education (IMSE), with Advance Cardiac Life Supports (ACLS) course is a popular class with practical skills, an estimation of five-six hundreds endotracheal intubation attempts is expected monthly. The airway maintenance of ACLS manikins is a challenge to the Simulation Operation Specialist (SimOps) to meet the demand of intubation training needs.

Description:
Due to multifarious, airways feature of manikins will breakdown and require technical maintenance, hence, monthly needs of five to six hundreds numbers of intubation attempts is a challenging task for SimOps. Frequent airway screening is a method the SimOps adopt to ensure these manikin meet the training requirement. Nevertheless, SimOps have realized the weakness of manikin's airway assessment with laryngoscopy and tactile exploration. With occasional video laryngoscopy assessment, we realized that about a third of ACLS manikins suffered from various degree of damage airway. These damages could not be detected with usual laryngoscopic and tactile exploration.

Discussion:
In consideration that not all clinical training facility has video laryngoscope. For a SimOps, who is looking after manikin for frequent practical airway intubation training, can adopt assessment method(s) that suit the settings of individual training facility. Video laryngoscope is a useful tool to broader airway assessment for these manikins.

00007

Darkroom a Retro Technology for a Safer Simulation Control Room

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Introduction and Aim:
For better concealment and simulation observation, the control room of the simulation lab is often hidden behind one-way mirror and in a dim environment. Yet, faculties, manikin operator, simulation operation specialist (SimOps) need lights to read scenario script and to be able to maneuver safely in the control room that laid with Audio Visual system, communication & power cables, and gas piping. Hence, Institute for Medical Simulation and Education (IMSE) explored alternative lighting that ensures the needs of control room and not to break the concealment of the control room.

Description:
In the survey of alternative lights, SimOps learnt photographer, astronomer and military use red light as a controlled visual aids while it minimally disturb the works or atmosphere. SimOps has turned a few reading lights into red light source and tried in a few simulation exercises. We realized that red lights has following advantages: 1) It enable reading in darkness 2) It ease of keyboard use and cable manipulation in darkness 3) It preserves faculty's observation of the on-going simulation 4) It reduces transient flash blindness, and 5) it allows the person in the control to see while not being seen from simulation laboratory.

Discussion:
Red lights in control room during simulation exercise is an essential visual aids with both operational and safety value.

00014

Simulation in Primary Care – Use of Independent Assessment Teams

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SingHealth Polyclinics

Introduction and Aim:
SingHealth Polyclinics conducts emergency simulations of collapsed patients twice a year under the purview of Code Blue drills. These are conducted by each Polyclinic's own emergency champions. The complexity and duration of the simulation is variable and prone to bias.
To adopt the use of independent assessment teams to ensure more accurate and standardized steps to assess the clinics' response teams during emergency simulations.

Description:
The use of independent assessment teams to conduct emergency simulations was piloted in 4 SingHealth Polyclinics in April 2017. Standardized scenarios were crafted using standardized victims and manikins. Each simulation had a fixed duration of 20 minutes.

Discussion:
Through the use of independent teams and standardized scenarios, a more realistic observation of actual practice was noted. Observations on reaction times, staff knowledge and system gaps were documented. Gaps identified were highlighted to the clinic management and emergency champions as learning towards better care for our patients.
The use of independent assessment teams managed to highlight gaps in the Polyclinics' emergency preparedness. This was seen at various levels from time to activation of the emergency team to staff knowledge and clinic processes.
Key words: Simulation, Primary care, Emergency, Independent Assessment team.

00017

Sustainable and Cost Effective Moulage

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Introduction and Aim:
Creating realism in simulation training is one of the essential goals of moulage. The demand of quality moulage amongst simulation faculty has increased. Moulage creates a sense of urgency amongst learners to provide care and management to the patient. There are moulage products on the market however they are expensive and are not available in local stores. We realized it was unsustainable to support the faculty training using these costly moulage kits. On this basis, we determined it was a necessity to find alternative and inexpensive household products with similar high quality moulage outcome.

Description:
We have narrowed down two methods using low cost household products in creating a quality moulage. Non-toxic clear glue is able to recreate the same burn effect as compared to using Liquid Latex. Another example is a simple recipe for making superficial skin (SuperSkin) to substitute with putty. Moulage: Create realistic burns on manikin Household product: Non-Toxic Clear Glue Method: 1) Apply and spread non-toxic clear glue generously on affected areas. 2) Allow the glue to become tacky. Gently rub the tacky glue to create peeling effect. 3) Finish off by applying red, brown, pink and black makeup to complete burn effect. Price difference: Liquid Latex– SGD $12 Non-Toxic Clear Glue– SGD $1 Moulage: Superficial Skin 'SuperSkin' Household product: 1) 2 table spoons of Petroleum Jelly 2) 4 table spoons of Glutinous Rice Flour 3) 10mls of warm water 4) Brown Water Colour Paint Method: 1) Double boil the petroleum jelly and slowly add the glutinous rice flour with warm water. 1) Add brown water colour paint according to the patient skin tone. 1) Knead the mixture to desired texture. Price difference: Putty– SGD $22 'SuperSkin' –SGD$10.

Discussion:
Both of the following methods were tested on a manikin. The non-toxic clear glue takes about 1 hour to set in which is 15 minutes longer than the professional Liquid Latex. This technique takes some time to create primarily due to the amount of time that needs to be allotted for drying. The 'SuperSkin' is just a basic technique and can be used in many ways. 'SuperSkin' can evolve to wounds and cuts. Matching the colour based on the manikin can be challenging and requires a few trials and errors. Both methods do not stain the manikin. We used wipes and baby oil to remove the moulage. After 24 hours, there is no difference in moulage appearance between store bought moulage and household products. Store bought products can be less time consuming because it is readily made as compared to household products which consumed more time during initial trail test. The putty comes in original one shade whereas the 'SuperSkin' can vary in different skin tone by adding brown water colour paint because the product starts as a white base. Liquid latex has shorter setting time however it requires more time to clean up as compared to using non-toxic clear glue. The price difference plays a huge factor between store bought products which cost more as compared to household products. After a few trial testing and proper application techniques, we conclude household products such as clear non- toxic clear glue, glutinous rice flour, and petroleum jelly can achieve the same moulage quality as compared to the store bought products. It is more cost effective to use household products in a long run and continue to support our faculty without breaking the budget.

00021

Comprehensive Checklist for Simulation Equipment

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Introduction and Aim:
The surgical simulation unit of SIMS has a wide range of training equipment, from manikin, task-trainers to high-fidelity simulators. Each training equipment may come with accessories and user manuals. The technical team often received queries on how to operate simple training equipment, such as manikin and task trainers. Without proper checklist, accessories were often missing. The team was unable to track utilisation of the equipment. Hence, the team implemented a 2-page user guide and checklist for each training equipment.

Description:
Prior to the implementation, the team relies on emails to track the usage of the equipment and their personal experience to ascertain the type of accessories required per equipment. The comprehensive checklist comprises of 3 components: (i) Itemised checklist per equipment - The checklist stipulates all the items tagged to the equipment and there was a checkbox per item. - When the user wants to borrow the equipment, the user has to check each item together with the technical staff (ii) 2-page user guide —This is a step-by-step guide on how to use the equipment — It includes information such as refilling liquid in central line manikin, the position to adopt when filling the liquid (manikin), proper ways to switch on and off the simulator, how to access the modules (simulator) (iii) Picture asset tag — for easy identification of asset. For instance, the lab has 4 airway manikins. Previously, we have to open each manikin box to identify the manikin. We have included a picture asset tag on each box, which reduces unnecessary steps and increase efficiency.

Discussion:
The comprehensive checklist is useful in the following aspects:
— The user guide complements orientation for staff who is unfamiliar with the equipment. — Staff who borrow the equipment can gain a greater understanding on the proper use of equipment. — Missing accessories was replaced and reports of such incidents have reduced. —Tracking of equipment is easier as the checklist also serves as a tracking log.

00022

Weekly Simulation Teaching to Enhance Competency in Laparoscopic Skills

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Introduction and Aim:
SIMS organised the Basic Laparoscopy Workshop since 2012. Following a half-day workshop, residents are given 6 months access to the Surgical Simulation lab to practice on their own. The results was discouraging. Lab utilisation was low. Residents were not skills competent when they exited the Residency Programme. In February 2016, SIMS started a 3-month pilot scheme with General Surgery Residency Programme to introduce the weekly simulation teaching session to provide guided-supervision to residents in improving their skills competency. The pilot scheme has been extended and it will be a full-fledged programme in July 2017.

Description:
The Basic Laparoscopy Workshop comprises of half-day introductory session to the use of simulation-based training equipment and 6 months lab access for self-practice. Residents were not skills competent when they exited the Residency Programme. To address this issue, a 3-month pilot scheme to conduct a 1-hour weekly teaching session was implemented in February 2016. The task kits and simulation activities were set up based on reference to the FLS guidelines. The setup is as below:
— 5 laparoscopic box trainers — 3 basic suturing & knots tying — 2 laparoscopic VR simulator. In each session, there is a faculty to supervise and provide guidance to the residents. Each resident was given

a skill checklist, to assess their competency and identify areas for improvement. Due to the positive feedback given by the residents and Programme Director, the pilot scheme extended further and it will be a full-fledged programme from July 2017.

Discussion:
Weekly Simulation Teaching session is effective as it provides additional platform for the enhancement of residents' skills competency through guided-supervision. Lab utilisation has increased as more residents are using the lab more regularly for self-practice.

00024

Virtual Reality Simulator for Cleft Lip and Palate Surgery

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Viswire Pte Ltd

Introduction and Aim:
Cleft Lip and Palate is a common birth defect. Every 3 minutes a child is born with a cleft condition that affect his facial development, functionality and appearance. Though the condition can be repaired by surgery, it requires specialized skills as one is operating on the delicate tissues of a child. No good virtual reality (VR) surgical trainer exists at present for this procedure, which means that learners have to practice on real patients most of the time. We describe the development of [CleftSim], a VR cleft lip/palate surgical simulator designed to shorten the learning curve of these procedures.

Description:
[CleftSim] utilizes VR simulation to offer close-to-reality graphics, realistic haptics and a safe environment to teach the necessary skills for cleft surgeries. In its first training module, the system focuses on Total Cleft Palate surgery using Bardach's two-flap technique. The VR simulator aims to be a holistic training program with a courseware to guide the trainee through the procedure step-by-step. To best replicate the look and feel of a real-life cleft surgery, the simulator is developed with reference and feedback from surgeons to capture the valuable clinical details. In the case of young children, it is not ethical to acquire CT Scans to build the virtual model. In order to achieve high graphic realism, a detailed 3D model of a 6-month-baby with Total Cleft Palate was built in close consultation with an experienced plastic surgeon. The VR model behaves realistically under real-time simulation, allowing the trainee to interact with the model using both hands, with appropriate tools. The haptics technology incorporated in the simulator allows the trainee to learn psychomotor and tactile skills as adequately as on physical models or cadaver, but more cost-effectively. Moreover, these interactions can be measured to evaluate the trainee's performance in both speed and precision.

Discussion:
With the high prevalence of Cleft Lip and Palate, and an overwhelming number of children that lack surgical intervention worldwide, the need for a more effective medical training program is clear. Institutions, organizations and corporations have recognized this need and developed different simulation models, both mannequin-based and VR-based, to better teach the techniques of cleft surgery. These current solutions, although do allow a safer learning environment than the traditional 'See One- Do-One- Teach One' method, still have room for improvement in realism and tactile training. VR simulation with haptics technology offers a stress-free training environment to develop psychomotor skills, and has been shown to enhance patient safety and reduce medical errors in the operating room. While the current focus of VR simulators in medical training is on minimally invasive surgeries, there are a huge number of open surgeries that could benefit from VR simulation training. Cleft surgery is an impactful one among them. Nevertheless, the intrinsic challenge of building a VR simulator for open surgeries is the large surgical site, where the undesired interactions with the surrounding structures could be distracting or even largely reduce the realism of the simulator. Another area of difficulty in developing [CleftSim] is the significant soft tissue deformation in plastic surgery. With these challenges, it requires huge effort for the simulation to appear lifelike. Hence, by tackling these issues with [CleftSim], the research effort opens the door for future development of VR simulators for plastic surgeries as well as other open surgeries.

00029

Multidisciplinary *In Situ* Simulation: The Singapore General Hospital/Sengkang Hospital Experience

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Introduction and Aim:
In situ simulation (simulation that occurs in the actual clinical environment) provides a method to improve patient safety through experiential learning. Our multidisciplinary in situ simulation (ISS) program was launched in December 2014 and is now an established program.
Its objectives are:
1) To allow multidisciplinary healthcare teams to rehearse for infrequent or high-risk scenarios in their usual clinical environment, thus identifying gaps in knowledge, technical proficiency and crisis resource management skills.
2) To identify and mitigate latent threats in the healthcare delivery system.
3) To test run newly established healthcare facilities.
4) To improve protocol, systems and infrastructure.

Description:
We now conduct regular workshops at various locations within the SGH and SKH hospital campus, involving doctors from Anaesthesiology, General Surgery, Obstetrics and Gynaecology, Neurosurgery, Neonatology and Emergency Medicine, as well as operating theatre and ICU staff. Trained faculty are divided into two workgroups, one in charge of the Operating Theatre ISS program, and the other, the ICU ISS (CCRISS – Critical Care and Resuscitation *In Situ* Simulation) program. So far we have conducted 8 perioperative ISS workshops (8 at SGH, 1 at SKH) and 17 ICU ISS workshops (10 at SGH, 7 at SKH) up till June 2017. Examples of perioperative scenarios include ventricular fibrillation in iMRI necessitating transfer to induction room for defibrillation, eclamptic parturient requiring crash Caesarean section with delivery of premature infant, and massive bleeding from duodenal ulcer in endoscopy suite necessitating transfer to EOT for laparotomy. Examples of ICU scenarios include major burns resuscitation, management of arrythmias, and blocked tracheostomy tube. We have trained 345 staff to date in the application of crisis resource management skills e.g. teamwork and communication. We have also uncovered latent threats in our healthcare delivery processes and clinical environment, and implemented measures to remove or mitigate these hazards.

Discussion:
We evaluated the value of our program in two main ways: 1) Qualitative feedback from our participants using evaluation forms The overall rating of our workshops was 4.4 out of 5 for our perioperative ISS workshops and 4.3 out of 5 for our ICU ISS workshops. Many indicated that they found the scenarios realistic and learnt important lessons — how to communicate in a crisis and how to be an effective team member. 2) Latent threats identified in our clinical systems and the measures taken for remediation. Three examples of latent threats we uncovered: a. Rapid fluid and blood infusor was previously parked in the storage area in PACU and obstructed by other equipment, preventing rapid access in an emergency. The device is now relocated to the corridor outside the emergency operating theatre for easy access during emergency situations requiring massive transfusion. b. Healthcare attendants or OT technicians were not trained in basic cardiac life support (BCLS) so they could not render assistance during patient resuscitation. They now undergo BCLS training so they can perform chest compressions, freeing other medical/nursing staff to perform other vital tasks. c. There was no separate difficult airway cart so staff had to scramble to find various airway equipment when an unexpected difficult airway was encountered. A difficult airway cart is now available, and is stocked with various airway adjuncts and equipment to facilitate intubation/ ventilation, including a surgical cricothyroidotomy set. Although our program has numerous benefits, we face many challenges. These include: a. Technical issues b. Logistics and impact on patient care c. Cultural obstacles d. Medico-legal concerns e. Funding considerations Nevertheless, we should strive to overcome these challenges, as evidence suggests that *in situ* simulation is a valuable tool that can enhance the competencies of healthcare teams and ultimately improve patient safety.

00033

Training Roadmap for Nurses in Acute Care Clinic

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Introduction and Aim:
Establishing a training plan for nurses in highly specialised departments is often challenging and complex. With large number of nurses coming from varied skill-mix and experiences, Clinical Instructors (CIs) take great attempt to organise a distinct learning journey for each batch of nurses with common profiles. In the acute care clinic (ACC), the training roadmap starts the moment a new nurse joins the department. The training team developed a structured orientation programme to help all newly joined nurses feel less overwhelmed with the new environment.

Description:
This orientation programme is a systematic induction curriculum equipped to provide them with the training to practice independently and facilitate in completing their probation period successfully. Nurse are closely guided throughout this transition to ensure patient safety and quality standards are not compromised. One of the key focuses in the month long programme is to create opportunities for specific skills practice such as blood-taking venepuncture and administration of intravenous medications. Task trainers are often used in the initial stage for gradual transition to the real clinical setting. This creates an optimum learning environment as nurses feel safe and subsequently acquire the confidence in performing procedures. After one year of clinical exposure, nurses will be scheduled for a series of in-house courses to equip then with critical knowledge and skills relating to emergency nursing. This is to allow the nurses to get a firm grasp of the department's workflow and basic nursing knowledge before advancement. These courses are spread over a period of two year, to commensurate their knowledge into practice on the clinical ground.

Discussion:
The Basic ECG course aims to introduce the fundamentals of ECG interpretation for nurses to identify life-threatening arrhythmias such as ventricular fibrillation and ventricular tachycardia. The course teaches them to systematically interpret a 12-lead ECG, allowing them to distinguish rhythms such as AV blocks and myocardial infarcts. The ability to interpret basic ECG is a pre-requisite requirement for nurses to undergo Emergency Medical & Trauma Course. In this course, the nurses will learn pathophysiology, pharmacology and nursing management of medical and trauma emergencies through didactic lectures. Case scenario simulations are used in practical sessions to provide safe space for the nurses to apply what they have learnt throughout the course into practice. Triaging is a skill that is unique to the emergency department. At this point of their training roadmap, the nurses would have at least two years of experience in ACC. This, together with the prior courses, provides the nurses a reservoir of knowledge and experience that is essential for the Basic Triage Course. Nurses are trained to critically assess and triage patients according to their acuity and needs. To maintain nurses' competence in handling acute cases, *in situ* simulations are conducted weekly in the resuscitation room. Nurses and doctors are randomly selected from either morning or afternoon shift to participate in the simulation. This is usually an ideal group of participants to meet objectives relating to soft skills such as team work and communication. The case scenarios are usually reused from the case bank. Each case scenarios are prepared with 6 to 8 learning objectives ranging from medical knowledge to soft skills. Over the time, the case bank became more complex as the simulation faculty had to revisit the scenarios for advanced learners. This creates a strong foundation for simulation-based training for all grades of practitioner in the department.

00035

Interns Exit Evaluation Using Medical Simulation — Our Experience

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Introduction and Aim:
K S Hegde Medical Academy, under Nitte University, for the first time in any medical schools in India introduced the concept of exit evaluation for interns at the end of their one year clinical training as an indicator of the effectiveness of training and learning. This process was incorporated into the training as a part of the Continuous Quality Improvement Initiative (CQII) of the University.
To evaluate clinical skills among interns who completed one year training in various departments, using simulated clinical experience (SCE) and collect their feedback to improve and develop a robust system for this purpose..

Description:
All the interns of 2016-17 participated in this evaluation. They did not have prior exposure to medical simulation, but were given a familiarization briefing before the SCE. They were divided into 6 groups, each being evaluated on each of the six days and SCE was a part of 7 different evaluation modules. Different SCEs (Bronchial asthma, Trauma, Myocardial infarction, Anaphylaxis) were used on different days and each SCE had a set of pre-defined structured evaluation points like examination and clinical findings, abnormalities in the vitals displayed in the monitor, ordering important investigations and important steps in management which were assessed for individual interns by the facilitators. Those who did not score more than 50% were asked to undergo a remedial process and the test was re administered. At the end of the process, each learner had to fill up a uniform feedback form. The objective was to identify the strengths and weakness of the program and improve upon it.

Discussion:
A total of 138 interns participated. Of these 52% cleared (72) in the first attempt and remaining required remedial training and re-test. We noted that the interns requiring remedial failed mainly because they did not specify important steps in management of the particular SCE clearly. All of them cleared in second attempt. The feedback result indicated the overall experience as excellent by 64%; 27% and 9% gave a feedback as good and neutral respectively. Lack of prior exposure to actual simulation and the concepts of simulation were among the main factors hindering the performance of the trainees. Simulation based training was included to the next batch of interns following the feedback.

RESEARCH STUDIES — ORAL

00013

Integration of the Flipped Classroom in Simulation Scenario-based Learning

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Introduction and Aim:
The emergence of simulation based learning using high fidelity simulators has become a fast moving trend in health education. One of the advantages of simulation based learning is allowing the simulation activities to be captured through its audio visual system. Taking this into account, this study is aimed to establish the evidence of using the recorded video for a flipped classroom activity prior to the simulation session in improving both knowledge and competency. It is also aimed to explore the perception of learners of this form of combination learning pedagogy.

Methods:
Using a quasi-experimental design, the intervention group experienced the flipped model classroom teaching followed by the simulation session. Whereas the control group attended a normal didactic lecture followed by a simulation session. A total of 97 undergraduate students of year 2 from the paramedic, nursing and midwifery programs were randomly assigned to the intervention or the control group. One week prior to the flipped classroom session, students received an email of a video link, detailing a 10 minute recorded video clip of the selected scenario from a previous simulation session. Both groups of students were scheduled to demonstrate their competency in handling the selected scenario in a simulated environment after 2-3 days of the flipped classroom or lecture session. A pre and post test was conducted for both groups. In addition, for the intervention group, a perception questionnaire containing 5 Likert scale of agreement statements and free text responses was also delivered.

Results and Discussion:
Statistically there is no significant differences in term of the pre-post test scores of study groups (p=0.698) and also their code blue simulation competency rating score and global rating scores (p=0.537 and 0.139 respectively). Nevertheless, in student perception the integration of flipped classroom in simulation has many positive values and rated highly in the 5 Likert scale items. From qualitative responses there were distinctive themes emerged from each of the study group, namely "preparedness and explorative learning" from the intervention group whereas "knowledge acquisition and teaching delivery" from the control group. Conclusion: Although this study did not provide concrete evidence of score improvement per se, the potential benefits of the flipped approach clearly seen in psychologically preparing the learners to embark in simulation session. Also pre-simulation knowledge is gained through explorative learning and student-centred learning activity prior to the simulation.

00016

Computerized versus Human Assessment of Technical Skills in Obstetrics and Gynaecology Trainees: A Pilot Study

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Introduction and Aim:
Selection for surgical residency programmes could potentially be improved through assessment of candidates' sensomotor skills. This study examines the validity of a computerized assessment tool against performance rating through human expert observation on a surgical skills station in junior and senior trainees.

Methods:

Thirty four trainees (15 medical students, 16 junior residents (9 in obstetrics and gynaecology, 7 in ophthalmology) and 10 senior residents in obstetrics and gynaecology) completed the Computerized Pilot Aptitude and Screening System (COMPASS). The outcomes were compared to Objective Structured Assessment of Technical Skills for Surgeons (OSATS) scores that were taken through human expert observation during a surgical skills station.

Results and Discussion:

Overall, Pearson's Correlation between COMPASS and OSATS was .332 (p=.034). Senior residents' performance scores as assessed by experts were higher than the computerized results. Performance ranges of junior residents, as assessed by human expert observation, were larger than in medical students (SD 2.40 vs 1.62). According to both assessment methods, ophthalmology residents scored higher on sensorimotor skills compared to obstetrics and gynaecology residents and medical students. We found a correlation between medical trainees' performance scores as assessed by a computer versus human expert observation. The self-administered computerized tool has potential to be used as objective, time and cost-effective assessment among medical trainees.

00019

Using Simulation and Interprofessional Education to Teach Infection Control during Resuscitation

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Introduction and Aim:

Adherence to infection control (IC) protocol is paramount to patient safety. However, during crisis e.g. cardiac arrest, health care professionals (HCP) find it difficult to balance out the need for urgent patient management and adherence of IC measures. In such situations, there may be conflicts between different HCP due to different priorities and roles in patient resuscitation. Interprofessional education (IPE) improves team dynamics and could resolve some of these conflicts. The hypothesis is "Learning IC through IPE and simulation will result in better IC knowledge retention in comparison with the standard online video IC education and better team work."

Methods:

HCP working in the SICU in Singapore General Hospital (SGH) were randomly allocated into control or intervention group. Intervention group attended one IC/IPE/in-situ simulation workshop in SICU. Two workshops were held. Pre- and post- workshop questionnaires derived from validated IPE questionnaires with 5-point Likert Scale were used to assess IC knowledge and interprofessional teamwork.

Results and Discussion:

Of the 41 HP consented, 29 responded (response rate 71%). There were no significant differences in demographics between cases and controls. Amongst the cases, there was a significant improvement after the workshop for the subcategories Team Structure (p=0.016) and Situation Monitoring (p=0.019), while IC knowledge also showed a percentage increase of 11.0% post-workshop. Between cases and controls, although there were no significant differences in improvement of scores post-workshop, for interprofessional teamwork the cases showed an overall percentage increase of 2.4% compared to -2.7% for controls. This is especially so in the subcategories Team Structure, Leadership, Situation Monitoring and Communication, which had differences in percentage change of 7.2%, 5.6%, 5.3% and 5.8% between cases and controls respectively. Conclusion IC/IPE/*in situ* simulation workshop improves IC knowledge and improves team working. Further follow up studies is required to investigate long term retention of IC knowledge and behaviour and practice change.

RESEARCH STUDIES— POSTER

00002

Application of Nurses' Resuscitation Skills after Crisis Management Training

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Introduction and Aim:
Simulation trainings have been studied and have demonstrated its effectiveness in ensuring learning in a 'safe' environment. It also been incorporated to provide with the opportunity in enhancing nursing skills in managing emergency situations. Although nurses have undergone these trainings, they have been observed to be unsure how to respond during an emergency situation. A new program, Crisis Management Training (CMT) was initiated and taught to enhance nurses knowledge in managing emergency situations. This study aims to examine the effects of (CMT) and whether it will help to improve the performance of nurses when responding to simulated emergency situation.

Methods:
Nurses whom had attended the Crisis management training were recruited to participate in a simulated emergency session. During the 2hours session, the participants completed a pre and post questionnaires and participated in a simulated crisis scenario. During the scenario, they were assessed with the skill performance checklist and followed with a debriefing session. During the debriefing session, questions were asked to elicit details on participants' feelings and their reflection on their performance.

Results and Discussion:
In this study 2/3 of the participants had a minimum of six years of working experience. 46% of the participants have not participated in an actual emergency situation. During the simulated emergency session, more than half of the participants were unable to assess that the circulation was compromised thus cardiopulmonary resuscitation was not initiated. Although, 96% of the participants has attended at least one crisis simulation training most of the participants reported that they were "stressed", "nervous", "tense" and "scared" during the debrief session. Given that there were no significant differences that crisis management training will help to improve the individual's performance, the authors suggest that there should be more training in clinical setting rather than a classroom teaching for emergency situation.

00023

Confidence Levels of OB-GYN Residents, Junior Doctors and Nurses in the Management of Obstetric Emergencies after Attending an Obstetric Emergencies Simulation Course

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Introduction and Aim:
To evaluate the confidence levels of OB-GYN residents, junior doctors and nurses in the management of acute labour ward emergencies after participating in PRactical Obstetric Multi-Professional Training (PROMPT)-based simulation courses.

Methods:
Participants of three annual Singhealth OBSTETRICS (OBStetric TEam TRaining In Core Skills) Courses based on PRactical Obstetric Multi-Professional Training (PROMPT) 2 between 2014-2016 underwent identical questionnaire-surveys, one administered prior to the start, and the other immediately after the conclusion of each course. The questionnaire consisted of 30 statements relating each participant's confidence, knowledge, ability and appreciation of teamwork in the management of obstetric emergencies taught on the course including eclamptic seizure, breech/twin delivery, shoulder dystocia, post-partum haemorrhage, maternal sepsis, local anaesthetic toxicity, acute uterine inversion, neonatal

resuscitation and cardiotocography interpretation. A five-point scale was used to gauge the level of confidence (5 – strongly agree, 4 – Agree, 3- Neutral, 2 – Disagree, 1 – Strongly disagree). The pre- and post-course scores for each statement were compared and analysed statistically.

Results and Discussion:
A total of 74 participants responded to the questionnaire-surveys. Comparing the pre- and post-course results, there was a significant increase ($p < 0.05$) in the number of participants agreeing or strongly agreeing (score 4 and 5) that their confidence had improved versus those who were either neutral or disagreed (score 1, 2 and 3) in all of the 30 proposed statements.
The Singhealth OBSTETRICS Course is effective in improving the confidence level of participants in the management of obstetric emergencies. Attendances at such courses should be strongly encouraged under the Singhealth OBGYN residency programme. The results of the study can also be used to plan for improvements in the curriculum and programme for future courses.

00026

Interpillary Distance in Paediatric Patients

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Introduction and Aim:
Virtual reality is a means to engage children and has been shown to be useful in distracting children from unpleasant hospital procedures. Virtual reality headsets commercially available are created with an interpupillary distance adjustable from 55mm to 75mm which is ideal for adults. Prior to testing virtual reality applications in children, we aimed to evaluate the interpupillary distance in paediatric patients who have been imaged in the hospital prior to exploring its use in paediatric patients in the local hospital setting.

Methods:
This was an institutional board approved study of children who had undergone MRI head in KK Women's and Children's Hospital and whom consented in taking part in a trial looking at the effects of non-virtual reality videos in 2016. A senior MRI radiographer collated a list of those aged less than 21 years old. Axial images of the head with lenses of both globes visible on a single image were selected for analysis. The interpupillary distance for each child was measured as the distance between the centre of the right lens and the centre of the left lens.

Results and Discussion:
There were 116 children (58 boys & 58 girls) whom satisfied our inclusion criteria and had images suitable for analysis. Their ages ranged from 3 years to 20 years (mean age 11.8 years). The mean age for boys and girls were 12.0 years and 11.6 years respectively. The interpupillary distances of these children during the MRI range from 47mm to 69 m (mean interpupillary distance 59.5mm) with a positive correlation of interpupillary distance with age (r=0.87) observed. With the lower limit of 55mm cut off for the commercially available virtual reality headsets, virtual reality usage would be suitable for children aged 6 years and above. In a study conducted by the Department of Paediatric Dentistry in Iran1, 117 patients aged 4 to 6 years undergoing 2 separate dental visits were divided into two groups, one having virtual reality distraction in the first visit and the other group having virtual reality distraction in the second visit. Using the Wong-Baker FACES® Pain Rating Scale there was lower mean pain scores and mean anxiety scores with virtual reality in both groups. Mean pain scores were 3 without virtual reality and 2 with virtual reality. Mean anxiety scores were 13 without virtual reality and 18 with virtual reality. The decreased pain and anxiety scores in the context of virtual reality were statistically significant. From our study of interpupillary distance in children, there is a theoretical limitation of using virtual reality in our patients aged 5 years and younger as their interpupillary distance falls below the lower limit available on virtual reality headgear. However, virtual reality has been used successfully in Iran to reduce pain in children undergoing primary mandibular molar restoration, although the interpupillary distance was not reported, and this technique would be worth exploring in the local context.

00054

The Development of Simulation-based Learning

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Introduction and Aim:
The results of educational evaluation revealed that nursing students had required theoretical knowledge, could not apply their knowledge to nursing practice. The responsibility of nursing educators was to provide students applying their theoretical knowledge in to the clinical environment. The use of Simulation Based Learning in nursing education as a teaching strategy provides opportunities for students to apply their knowledge and participate in real life situation in a safe, risk-free environment.
The purpose of the study were to develop a Simulation Based Learning and to evaluate the learning outcome of Simulation-based Learning.

Methods:
The research design of this study was a research and development model. There were 4 phases to this research. Phase I: study on the state of teaching and learning and the need to teach with SBL. Phase II: SBL teaching development. Phase III: Develop teachers to teach with SBL and final phase: evaluate the learning outcome of Simulation-based Learning. The study was conducted in 54 teachers and 108 of the fourth-year nursing students.

Results and Discussion:
Simulation-based Learning included five steps: pre-pre-brief, pre-brief, simulation activity, debrief and reflective. These five steps were included with nursing educators to using a teaching module. The evaluation of using simulation-based learning was taken. The end of the course nursing educators' teaching knowledge was good (X=4.19) students' satisfaction with simulation-based learning was 80%. The mean score of nursing skill pre-post-test was significantly different at 0.05 (t=18.09).
Results of this study showed that simulation based learning developed students' potential of self-regulation and evaluation. There was clear evidence that nursing students gave their patients better quality of care.
For further study are to concern about students clinical judgment, problem solving, team work and effective communication.

00055

The Development of Teaching Skill with Simulation-based Learning

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Introduction and Aim:
On the evolution of learning, nurse educators are challenged to stimulate students to become critical thinkers who can function in a dynamic and complex health care delivery system. Teachers need to adjust and improve their teaching and learning skill in order to teach students to become qualified nurses.

Methods:
This research was a research and development model. There were four phases of research. Phase I was to study basic information and traditional teaching effectiveness. Phase II was to develop instructors to understand and be able to manage teaching and learning, development of simulation scenario design, teaching techniques, evaluation, and learning management plans. Phase III was quality improvement and validation and final phase was the implementing teaching with students and measuring and evaluating them. The study was conducted in 22 teachers.

Results and Discussion:

This study evaluated the simulation teaching performance. Pre-, post- test was significantly different at 0.05. The mean score of performances in the scenario design and teaching were 4.11 and 4.23, respectively. The development of SBL teaching model included six steps: teaching awareness, understand teaching methods, practice scenario designs and teaching processes, reflective process and improvement.

Results of this study showed that using the knowledge management and PDCA process were good for developing teachers. Teachers' attitudes are important for the development of teachers in the SBL.

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