Original Article

A Comparison between Efficacy of Tele-Simulation-Based and Traditional Simulation-Based Training of Private Hospitals Network in Thailand

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Abstract

OBJECTIVES: To compare efficacy of tele-Simulation-based (online) and traditional Simulation-based (onsite) training on **theoretical knowledge, practical skills** and **satisfied** domains during the COVID-19 pandemic for The Center of Excellence (COE) of a private hospital network in Thailand.

MATERIALS AND METHODS: 951 participants completed four courses in 2020 either through traditional (694 participants) or tele-based trainings (257 participants) with complete data were included, **theoretical knowledge** before and after training was assessed **by a standard multiple-choice questionnaire** while skills were assessed once using tools developed by an expert and specialist facilitator in a private hospital network to fit COE specific learners' performance checklist.**Satisfaction** was assessed by using a Likert scale questionnaire modified from the Simulation Effectiveness Tool-Modified (SET-M) of Oregon Health and Science University (OHSU).

RESULTS: The study showed most participants were female, working as nurses. 34.1% had worked for more than 7 years, and 25.5% had attended Simulation training more than 5 times. **The average theoretical knowledge** pre-tests and post-test scores of online training was 62.1 ± 18.9 and 82.5 ± 14.3. While the **theoretical knowledge** score of pre-tests and post-test of onsite training was 65.6 ± 19.0 and 79.6 ± 15.6, both were statistically significant ($p < 0.0001$). An evaluation of efficacies in practical skills and satistified domain in all training courses for COE either via the tele-Simulation-based training or the traditional Simulation-based training found that both methods were significantly increased. Also, **the participants' satisfied** outcome towards the training course was 'good' to 'very good' in every area.

CONCLUSION: The outcome of the study showed that the efficacy of online based training was not lower than onsite training.

Keywords: Efficacy, Tele-Simulation-based Training, Traditional Simulation-based Training

Simulation is a model that mimics the real system so it can be used to learn, to improve the performance of an existing system or, to evaluate an outcome of implemented strategies in a particular system.[1,2] There have been many studies on the use of Simulator equipment especially digital technology, see Rungroj Chiangthong, Teetut Tresirichod, and Krisada Chienwattanasook[2] using a Simulation program (Tecnomatix Plant Simulation) for analysis. First, the values from the real process were inputted into the model, then the model was validated reviewing the results of the real process simulation after having used the Experiment Manager, with the modeling elements mimicking the validation process and performance quality. From this initial inputting, it was found that 12 employees worked 70 lots in under 9 hours 42 minutes, resulting in a balance in the work process. The model projected an increase in work efficiency from 52.7 percent to 84.7 percent, reducing the number of employees by 6 people per shift.

In the healthcare sector, the Simulation technique has been applied to medical staff in medical schools such as the Siriraj Medical Simulation Center for Education and Training (SimSET) of Siriraj Hospital. SimSET had intentionally developed training programs for medical students for enhancing their skills in using life support medical equipment with models and cadavers.

The Simulation training has been carried out by highly experienced instructors before entering a real experience in treatment, life support, and delivery to patients outside the class.[3] The Training Center for Clinical Skills (Simulation Center) is a training center for post graduated physicians, nurses, and medical personnel of a **private hospital** headquarters and a **private hospital** network in Thailand. The simulation Center in this study has been established since 2015.

The Covid-19 pandemic in Thailand and the world lasted for more than 2 years and created multiple challenges to everyday life. Conferences or meetings increased the possibility of virus transmission and spread, going against health safety law and regulations in response to the pandemic.[9,10]. The pandemic limited the hospital's Simulation training program. However, during this difficult time, **private hospital** medical personnel still needed to provide excellent care to their patients. It is of the utmost importance that skills and competencies meet the standards and need to be developed in accordance with the work in each area of continuing specialized patient care for patient safety. Thus, Simulation-based training of personnel must be continued in order to comply with precautions to reduce the spread of pathogens. This led to a transformation of some training programs from onsite training (traditional Simulation-bases training platform) to online training (tele-Simulation-based training new platform) or Teletechnology. The John Hopkins University Department of Anesthesiology and Critical Care Medicine has adapted resident education using teleSimulation. Specifically, they began to use high-fidelity immersive case-based Simulation scenarios for teleSimulation by using the virtual meeting platform Zoom to meet residents' curricular needs. Within the article "The Sim must go on: adapting resident education to the COVID-19 pandemic using teleSimulation," leaders of the John Hopkins University teleSimulation explained, "Two cohorts of anesthesiology residents participated [in the teleSimulation] 2 weeks apart. All learners were located at home. Four faculty members conducted the teleSimulation from different locations within our Simulation center in the roles of director, Simulation operator, confederate anesthesiologist, and confederate surgeon. The anesthesiologist performed tasks as directed by learners." The scenario was divided into four scenes to permit reflection on interventions / actions by the learners based on the clinical events as the Simulation scenario progressed, to facilitate intermittent debriefing and learner engagement. All residents were given a medical knowledge pre-test before the teleSimulation, a post-test and learner satisfaction survey at the conclusion. According to the teleSimulation leaders, the scenario was authentic and immersive, represented an actual case, and provided the opportunity to practice lessons that could be applied in the clinical setting.[11] Tele-Simulation was an imitation of learning processes between learners and Simulation Facilitators (Sim Fa) via internet-based communication technology.[11] It was a concept that had been used to provide education, training, and assessment in health-related fields. It had many notable benefits such as providing convenience for learners who were unable to participate onsite, being able to evaluate training outcome and reducing time for travelling and training.[4]

The Center of Excellence (CoE) has been a driving strategy of this **Private hospital** network since 2018. The aim of the CoE is to ensure that the medical care of all network hospitals achieve the same standards. There are 11 hospitals assigned to CoE strategy. These hospitals have enhanced their medical practices in compliance with international guidelines, progressing in the same direction. Thus, they required many resources to drive their medical practices to be in line with international standards. Human resources are a key factor for driving CoE strategy. Therefore, their staff were required to exercise and train effectively and continuously to ensure that all medical staff remain competent and provide the best medical care. In 2018 – 2020, staff of CoE Heart, CoE Neuro, CoE Cancer and CoE Trauma & Orthopedic were required to attend training courses at Simulation Center. The training courses were carried out by Simulation-based training method to enhance and increase the competency of multidisciplinary staff (medical staff) of network hospitals for CoE. The participants of each CoE training course included physicians, nurses, and medical personnel. They would attend either the traditional Simulation-based training platform or the tele-Simulation-based training platform. This research aims to evaluate the efficacy of online based training compared to onsite based training, with the research hypothesis that there was no differentiation between online–based training and onsite-based training for the Simulation Center in this private hospital.

Evaluation and comparison included 3 domains as follows:

- **Theoretical knowledge:** It compared the overall scores of pre-tests and post-tests. It also compared the score of pre-test and post-test of each CoE.
- **Practical skills:** It compared the score of skills of both training platforms in each CoE.
- **Satisfied:** It compared the score of participants' satistified [6,7] of both training platforms in each CoE.

Materials and Methods

This was a retrospective study. This study was approved by the Institutional Review Board (IRB) of Bangkok Hospital Headquarters (Protocol ID: BHQ-IRB 2021-12-36, COA: Dated 12 April 2022). It was approved for data access and usage and was exempted for consent from information owners by the Hospital Director of Bangkok Hospital. The information of participants was not disclosed. The inclusion and exclusion criteria were as follows:

Inclusion Criteria:

1. Staff member of **private hospital** network
2. Age was equal to or greater than 22 years.
3. Completely attended the tele-Simulation-based training and/ or the traditional Simulation-based training carried out by **private hospital network** Simulation Center during 1 January 2020 – 31 December 2020.

Exclusion criteria

The participants who did not fully complete both pre-test and post-test.

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The **private hospital network** Simulation Center arranged the Tele-Simulation-based Training platform, according to the methodology with 2 parts. The first part is the Owner Site Simulation Center (Sim Fa) where the center releases the scenario flow and oversees three periods of training flow (prebrief-in theatre-debrief). The second part is the Learner Site, an outside location where the participants organize everything as onsite, but they do not control the Scenarion Flow by the learner site as their own Sim Fa and the capability and fidelity of the manikin may be of a lower specification when compared to a Simulation Center with more investment (Owner Site).The release of the Scenario Flow parameter (vital signs) through the local host signal via the Microsoft Team program, enables participants in theatre (during patient care experience Simulation training (in theatre) period) to measure blood pressure by themselves. The traditional Simulation-based training contains the same periods as the international three periods of training flow (prebrief-in theatre-debrief) with the learner or participant together onsite at Simulation Center.

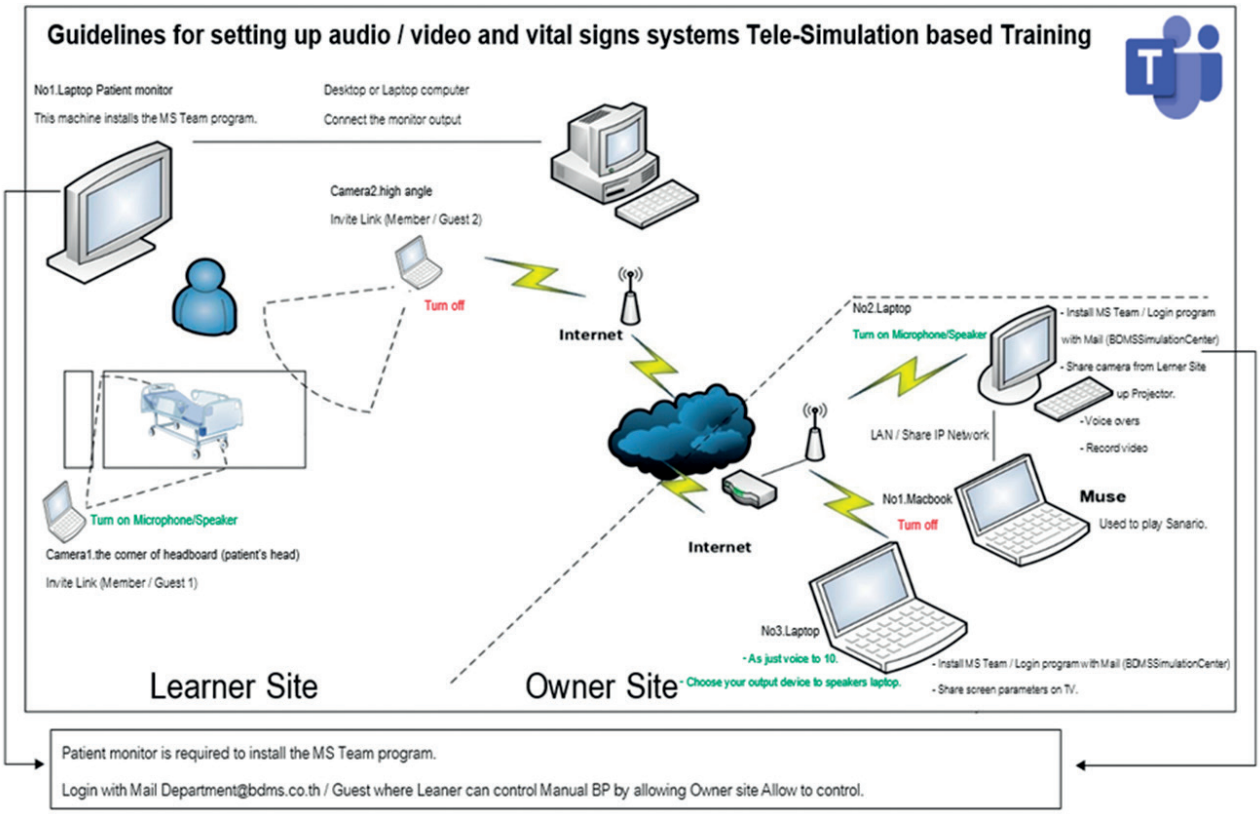
CoE curriculum collaborates continuously between each CoE Chief of Faculty and Sim Fa standardized content, course material (pre-post test questionnaire, performance checklist, prerequisite content) and modality to ensure the learning objective is reached.

In 2020, the total number of participants who qualified for this study were from 4 CoE: CoE Heart, CoE Neuro, CoE Cancer and CoE Trauma & Orthopedic. There were a total of 951 participants: 257 participants from the tele-Simulation-based training and 694 participants from the traditional Simulation-based training.

The key outcome variable was the efficacy of each training course. The outcome was measured by the comparison of test results of both training platforms. The evaluation and comparison included 3 domains:

1. The comparison of **theoretical knowledge** domain between pre-test and post-test from the tele-Simulation-based training courses and the traditional Simulation-based training courses.
2. The measurement and comparison of **practical skills** domain of each training course during tele-Simulation-based training courses and traditional Simulation-based training courses (the score of learners' performance checklist).
3. The measurement and comparison of **satisfied** domain of each training program during the tele-Simulation-based training courses and traditional Simulation-based training courses (**participants' satisfied** about three period of training flow).

Tele-Simulation-based Training platform layout



Note

- Camera used to view leaner must have at least 2-3 cameras.
- WI-FI signal to connect must be good and stable (Hospital Network)

Instruments

The principal investigator created forms to record data from each training course. The forms included:

1. **Theoretical knowledge Test Form:** The participant received a score of 1 when the answer is 'true' and received a score of 0 when the answer is 'false'. The test is a multiple-choice questionnaire and is the same as the original post-test questionnaire.
2. **Practical skills Test Form:** The participant received a score of 1 when the Sim Fa observed the leraners' performed action complied with the performance checklist was 'true' and received a score of 0 when the action performed, or non-action was 'false'.
3. **Participants' satistified Record Form:** The participants of all training courses would do the post Simulation **satisfied** survey in the same form. The required information in the form included gender, age, position, working experience related with training courses, hospital (learner site), type of current Simulation-based training platform and the **satisfied** attainment of realistic of scenarios and confidence to care for the patient with the promotion of safety after training. The form used a Likert scale where 5 was 'highly agreed' and 1 was 'highly disagreed'.[7,8]

After receiving the answer sheets no.1, 2 and post Simulation **satisfied** survey forms, all answers were rechecked to assess the following content:

1) the completeness of information and answer
2) the correctness of information.

The Principal Investigator would record and first verify all data in the form and the Co-Principal Investigator would verify its correctness and upload it into the statistical software.

Data Analysis

Data were analyzed using Statistics Package for Social Sciences (SPSS) PC version 23 (IBM SPSS Statistics 23). Continuous variables were presented as mean and standard deviation (SD).

Categorical variables were presented as frequency and percentage. Comparisons of continuous data were conducted using paired t-test while comparisons of categorical data were conducted using Chi-square. The significant level of the statistical test was set at $\alpha = 0.05$.

Results

The total number of participants from all CoE was 951. The participants who completed 3 instrument forms totalled 572 (60.1%). 487 participants were female (85.1%). 511 participants were nurses (89.3%) and 195 participants had working experience related to the training courses of more than 7 years (34.1%), 146 of participants (25.5%) had previously attended the Simulation training courses more than 5 times. **The demographics of Online and Tele-Simulation participants were statistically different but did not affect this study because the measurement and comparison between pre-test and post-test were in same group (Dependent).** All details are shown in Table 1.

Table 1: Demographics of participants divided by gender, position, working experience and Simulation training experience (n = 572)

Demographics	Onsite	Online	*p*-value
Gender			0.001
Male	72 (84.7%)	13 (15.3%)	
Female	324 (66.5%)	163 (33.5%)	
Position			0.003
Physician	20 (87%)	3 (13%)	
Registered Nurse	343 (67.1%)	168 (32.9%)	
Practical Nurse	4 (80%)	1 (20%)	
EMTB	28 (93.3%)	2 (6.7%)	
Patient Escort	0 (0%)	2 (100%)	
Pharmacist	1 (100%)	0 (0%)	
Working Experience (Years)			< 0.001
<1	19 (70.4%)	8 (29.6%)	
1-3	72 (54.6%)	60 (45.5%)	
3-5	86 (66.2%)	44 (33.9%)	
5-7	68 (77.3%)	20 (22.7%)	
>7	151 (77.4%)	44 (22.6%)	
Simulation Training Experience			< 0.001
No	69 (50%)	69 (50%)	
Yes	63 (59.4%)	43 (40.6%)	
1 time	51 (66.2%)	26 (33.8%)	
2 times	43 (65.2%)	23 (34.9%)	
3 times	34 (87.2%)	5 (12.8%)	
4 times	136 (93.2%)	10 (6.9%)	

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In 2021, the total number of participants attending the traditional Simulation-based training was 694 (73.0%) and the total participants of the tele-Simulation-based training was 257 (27.0%). The details are shown in Table 2.

The Comparison of Scores of **Theoretical knowledge, Practical skills** *and* **Satisfied***Domains*

The study showed that overall, of the 2 platforms of training courses theoretical knowledge scores after training, of both platforms, there was found to be a statistically significant increase in the score *p*-value < 0.001, as shown in Table 3.

Table 2: Number of participants by training method.

Traditional Simulation-based (onsite) n (%)	Tele-Simulation-based (online) n (%)	Total n(%)
694 (73.0)	257 (27.0)	951 (100)

Table 3: The theoretical knowledge score from pre and post-test classified by training method.

Test	Training Method	
	Traditional Simulation-based (N = 694)	TeleSimulation-based (N = 257)
Pre-Score	65.6 (19.0)	62.1 (18.9)
Post-Score	79.6 (15.6)	82.5 (14.3)
Mean difference (95% CI)	13.9 (12.6 to 15.2)	20.4 (18.2 to 22.6)
p-value	< 0.0001**	< 0.0001**

An evaluation on the efficacy of **practical skills** scores in every CoE showed that the participants of the traditional Simulation-based training and the tele-Simulation-based training were not statistically different in the **Practical skills** score.

An evaluation on the efficacy of **satisfied** score in every CoE showed no difference between participants between the traditional Simulation-based training and the tele-Simulation-based training; there were 2 top **participants' satisfied** scores (Score 4, 5) of prebrief, scenario and debriefing score, and these scored higher than 95% in all aspects.

Discussion

This study aims to evaluate the efficacy of online based training compared to onsite based training. The result of this study shows no significant difference between online–based training and onsite-based training for the Simulation Center in this private hospital in all 3 aspects: **Theoretical knowledge** domain, **Practical skills** Domain **and Satisfied** Domain. The Result was similar to a study in adapting resident education to the COVID-19 pandemic using telesimulation from John Hopkins University study[13] showing that participants reported feeling more engaged (p = 0.008) and stimulated to think critically (p = 0.003) with knowledge scores also improved in the telesimulation intervention (pretest mean = 61% [SD = 14%]; posttest mean = 78% [SD = 12%]; t (41) = − 7.89, p < 0.001). also similar to Chen &Jia study in 2016[12] in which 192 students learned face-to-face, and another 311 learners participated online, students' learning outcomes found that there was no significant difference between onsite and online learning (ρ = .881). According to the result of the study, the high satisfied score may be from the engagement in group activities and class discussions by learners in their face-to-face meetings and participants shared related observations. This is different from Gillani & Eynon14 who report that online learners did not lead to the building of meaningful relationships and the 'satisfied' score was due to short-lived communication.

Conclusion:

The tele-simulation-based training (online) had the same efficacy as the traditional Simulation-based training (onsite) in this study. The Theoretical knowledge domain outcome showed that the post-test significantly increased from the pre-test in both platforms and in every CoE. Moreover, the Practical skills domain and Participants' satisfied score in the satisfied domain in both platforms was not different. The study suggests that tele-simulation-based training format may be used in other distance learning situations.

Limitation:

The demographic of participants was statistically different, that said, this did not affect the study results as the measurement and comparison between pre-test and post-test were in same group (Dependent) and each learner site related to the equipped Simulator. The fidelity level or modality of Simulator that the learner site could provide did not affect a change of patient care performance based on the performance checklist. Under the tele-Simulation-based training platform, the participants still responded to patients and monitored vital signs during Simulation activities.

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