Med & Health Jun 2019; 14(1): 53-67 https://doi.org/10.17576/MH.2019.1401.05

ORIGINAL ARTICLE

Influence of Simulation in Malaysian Healthcare Education and Research (ISIM-HERE): A Two-Decade Experience

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ABSTRAK

Penggunaan simulasi sebagai metodologi pengajaran di institusi kesihatan telah berada di Malaysia semenjak dua dekad. Kajian ini bertujuan untuk menilai kesan simulasi pada senario semasa dan penggunaan di Institusi Pendidikan Kesihatan (AHIs) di Malaysia. Kami telah menjalankan soal selidik ke atas semua populasi AHIs di Malaysia termasuk awam dan swasta. Kami menjalankan soal selidik secara atas talian diikuti dengan temubual secara bersemuka dan menilai jumlah institusi yang menggunakan simulasi, tempoh pengalaman, tujuan, pembiayaan, kategori pengguna dan domain kesihatan, aktiviti penyelidikan, kakitangan yang terlatih serta cabaran yang dihadapi. Daripada 75 insititusi kesihatan yang dihubungi, 38 telah bersetuju untuk mengambil bahagian dalam kajian ini. Dua puluh dua (57.9%) adalah institusi awam manakala 16 (42.1%) adalah institusi swasta. Tiga puluh lima (92.1%) daripada 38 institusi menggunakan simulasi sebagai kaedah pengajaran. Majoriti (15, 42.9%) mempunyai pengalaman kurang dari lima tahun, dan kira-kira satu per tiga (11, 31.4%) menggunakan simulasi untuk pengajaran, latihan dan penilaian prestasi. Jururawat (30, 26.1%) adalah pengguna utama diikuti oleh doktor dan paramedik (19, 16.5%). Perawat di hospital dan kumpulan yang menjalankan prosedur adalah dua domain utama sebagai penguna. Hampir tiga suku (25,

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71.4%) mempunyai kakitangan sokongan yang khusus untuk menguruskan pusat tersebut. Pembiayaan utamanya adalah daripada mekanisme sokongan dalaman institusi. Tujuh kategori cabaran berbeza telah dikenal pasti, di mana sokongan kewangan adalah yang terbesar. Kesimpulannya, walaupun simulasi penjagaan kesihatan telah berada di Malaysia selama dua dekad tetapi kesan paling besar hanya berlaku dalam tempoh lima tahun yang lalu. Penggunaan terutamanya adalah untuk pengajaran, latihan dan penilaian prestasi dengan minimum dalam penyelidikan.

Kata kunci: latihan simulasi, pendidikan perubatan, penilaian, skil klinikal

ABSTRACT

The use of simulation as a teaching methodology in medical institutions has been in Malaysia for over two decades. This study aimed to evaluate the current scenarios of simulation impact and utilization in Malaysian academic healthcare institutions (AHIs). We conducted a population-based survey on all AHIs in Malaysia including public and private. We performed an online survey followed by a face-to-face interview evaluating the number of institutions that used simulation, duration of experience, purpose, funding, users' category and healthcare domain, research activities, dedicated-trained staff and the challenges faced. Out of 75 healthcare institutions approached, 38 agreed to participate in this study. Twenty-two (57.9%) were public hospitals while 16 (42.1%) were private institutions. Thirty-five (92.1%) out of 38 institutions used simulation as a teaching method. The majority (15, 42.9%) had less than five years' experience, and about a third (11, 31.4%) used simulation for teaching, training and performance assessment. Nurses (30, 26.1%) were the main users followed by physicians and paramedic (19, 16.5% each respectively). In-hospital and procedural group were the top two domains of utilizers. Almost three quarters (25, 71.4%) have dedicated support staff to manage the centre. Funding was mainly from internal institutional support mechanisms. Seven different categories of challenges were identified, the biggest being financial support. In summary, even though healthcare simulation has been in Malaysia for the past two decades but the most substantial impact happened over the last five years. Utilization was mainly for teaching, training, and performance assessment with minimal use in research.

Keyword: assessment, medical education, simulation, simulation training, skills.

INTRODUCTION

The use of simulation in teaching and learning activities was not only practiced in healthcare education but also in several other disciplines

including the aviation industry, military training, and economy. Its ubiquity in healthcare education lies in its ability to provide a safe environment for learners to learn and practice without jeopardizing patient care (Ziv et al. 2005). The first ever recorded use of simulation in healthcare practice dates back to the 1700's when Gregoire invented obstetrical manikins to teach midwives how to conduct vaginal delivery (Buck 1991). Prior to that, there was documentation that during the Song Dynasty in China the imperial physician Wang Wei-Yi (987-1067) used simulation to teach acupuncture (Owen 2012).

Healthcare simulations generally have four main purposes: i. Education, ii. Assessment, iii. Research, and iv. Health System integration in facilitating patient safety (Society for Simulation in Healthcare, 2017a). Teaching-learning through simulation provides added advantage such as individualized learning, allowing repetitive practice, deliberate practice and increased safety through a controlled environment (Issenberg et al. 2005) and leading to mastery performance (Motola et al. 2013) there has been an exponential and enthusiastic adoption of simulation in healthcare education internationally. Medicine has learned much from professions that have established programmes in simulation for training, such as aviation, the military and space exploration. Increased demands on training hours, limited patient encounters, and a focus on patient safety have led to a new paradigm of education in healthcare that increasingly involves technology and innovative ways to provide a standardized curriculum. A robust body of literature is growing, seeking to answer the question of how best to use simulation in healthcare education. Building on the groundwork of the Best Evidence in Medical Education (BEME).

In healthcare education, simulation has been used as a teaching tool across a large spectrum of healthcare education such as pharmacy (Tofil et al. 2010), nursing (Cant & Cooper 2010) and dentistry. Students can learn life-saving skills such as cardiopulmonary resuscitation (CPR), defibrillation, intubation, (Mohd Saiboon et al. 2014) and intraosseous cannulation skills (Bala Krishnian et al. 2016). Simulation was also used to teach less invasive skills like phlebotomy, Ryle's tube insertion, intravenous cannulation, or urinary catheter insertion. Pharmacy education programs have reported using simulation to enhance critical thinking skills or critical assessment performance (Seybert 2011).

In Malaysia, healthcare teaching institutions have been using different types of simulation modalities in their curriculum. Some of the modalities include part-task trainer manikins (Bala Krishnian et al. 2016) standardized patients, screen-based simulations and electronic high fidelity simulation (Ismail 2015). However, there is limited data regarding the number of institutions engaged in simulation, and the types of simulation used. Despite the proven advantages of simulation in healthcare education, its usage is somewhat limited primarily due to cost, and inadequately trained lead

staff, causing poor institutional buy-in.

Passiment et al. (2011) in his survey of the Association of American Medical Colleges (AAMC) in 2010 found that amongst its 133 AAMC-member medical schools and 263 teaching hospitals, more than 80% of the medical schools used simulation to teach medical students while the usage of simulation amongst teaching hospitals varied according to year of residency with figures ranging from 22 to 69%.

To date, there is still dearth of information regarding simulation usage in Malaysian healthcare institutions. Therefore, the aim of this study was to ascertain the status of simulation-based healthcare education (SBHE) in Malaysian educational institutions. This study aimed to determine the utilization of simulation as a teaching and learning modality, duration of experience, purpose of using simulation, funding, categories of simulation user, health care domain that utilized simulation, and presence of research activities in healthcare education institutions. In addition, we also explored the presence of dedicated staff, the training they received, and the challenges faced.

MATERIALS AND METHODS

This was a cross-sectional study looking at the status of simulation usage in Malaysian healthcare education, both in public and private institutions. It utilized convenience sampling where all academic healthcare institutions (AHI) were invited to take part in this study, from 1 November 2016 until 30 April 2017. The study was approved by the Universiti Kebangsaan Malaysia Research and Ethics Committee (Project Code FF-2016-378). The inclusion criteria were all teaching healthcare institutions that operated during the period of study, including public and private institutions that were registered with either the Ministry of Higher Education or the Ministry of Health. Institutions that were not registered with any of the ministry, agency or any authorized agency were excluded.

RESEARCH TOOLS

This study was carried out using a validated questionnaire (Appendix 1) with/without telephone interview. The questionnaire was developed based on Gaba's suggestion on the 11 dimensions of simulation (Gaba 2004). However, it was modified and expanded from 11 to 15 dimensions of simulation application. A local expert panel in the field of simulation reviewed the questionnaire. A pilot study was carried out to validate the questionnaire among the 'resource persons'. The 15-dimensional questionnaire consisted of 26 questions that required close-ended and open-ended responses. These 26 questions covered usage of simulation, challenges, aim of participants, healthcare domain, type of learning domain address used with the simulation, age group, site, type of simulation, duration of usage of simulation, technique used, feedback methods, funding, and simulation center issues (human resource and staff development and research based

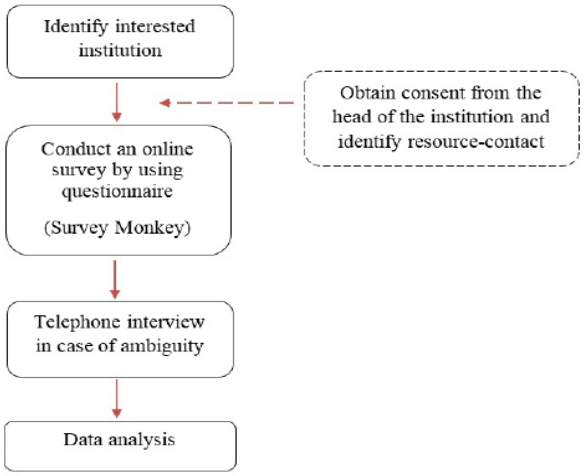

Figure 1: The flowchart of data collection

simulation).

DATA COLLECTION

This study was initiated by sending out letters and emails of enquiry to all healthcare education institutions in Malaysia that fulfilled the inclusion criteria, simultaneously. The letter and email content was similar. This was to ensure that the target institutions were reached. The email/letter consisted of a few basic questions to ascertain the usage of simulation activities and the resource-contact person for simulation education in their institution. It served to gauge the institutional interests to participate in this study as well as the details of the 'resource person' to be contacted. Once interest to participate in this study was indicated, a consent form and a study information sheet were sent out to the institution.

Institutional consent was obtained from the respective head of institution through an official letter. The questionnaire was delivered via SurveyMonkey® (San Mateo, CA, USA; https://www.surveymonkey.com) to the resource-contact person of the institution. Upon return of the questionnaire, a telephone interview was conducted to further clarify any ambiguous response. Non-responders were also contacted by telephone to elicit the reasons for not responding, as shown in Figure 1.

DATA ANALYSIS

Data collected was tabulated and entered into IBM SPSS Statistics Software version 23. A descriptive analysis was done on the data obtained where the calculation of frequency and mean was derived. The analysis also included the relationship between AHIs years of experience against the types of simulation modalities used. The sources of funding between public and private AHIs were also compared.

RESULTS

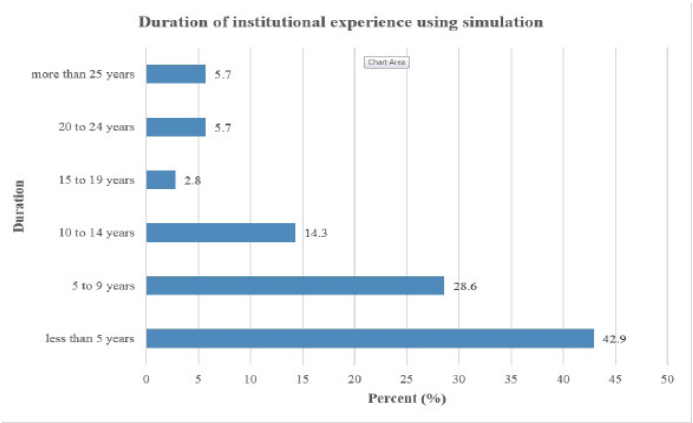

Figure 2: Duration of institutional experience using simulation

A total of 75 health care education institutions were identified for involvement in this study, out of which 41 were public and 34 private AHIs. Half (38, 50.6%) of the institutions agreed to participate in this study with a total number of 115 resource-person response to the survey. However, those who did not participate, did not indicate any specific reason.

Out of the 38 participating institutions, 22 (57.9%) were public and 16 (42.1%) private. Thirty-five (92.1%) used simulation as part of their teaching tools. Among these simulation users, 21 out of 22 (95.5%) were from public AHIs while 14 out of 16 (87.5%) were from private AHIs.

Figure 2 showed the duration of experience using simulation among the institutions. The majority (15, 42.9%) had less than five years' experience. Only five (14.3%) institutions had more than 15 years' experience.

In terms of simulation purpose, the majority (11, 31.4%) utilized simulation for education, training & performance assessment. Five (14.3%) institutions

Table 1: Purpose of using simulation

No	Purpose	Frequency	Percent (%)
1	Education	3	8.6
2	Training	1	2.9
3	Education & Training	3	8.6
4	Education, Training & Performance Assessment	11	31.4
5	Education, Training, Performance Assessment & Clinical Rehearsal	10	28.6
6	Education, Training, Performance Assessment, Clinical Rehearsal & Research	2	5.7
7	Education, Training, Performance Assessment & Research	2	5.7
8	Education, Clinical Rehearsal & Research	1	2.9
9	Training & Performance Assessment	2	5.7
	Total	35	100.0

Table 2: Type of simulation modalities

No	Type of simulation modalities	Frequency	Percent (%)
1	Verbal / Role playing	1	2.9
2	Part task trainers	1	2.9
3	Verbal / Role playing, Standardized Patient & Part task trainer	7	20.0
4	Verbal / Role playing, Standardized Patient & Electronic patient	1	2.9
5	Verbal / Role playing, Part task trainer, Computer patient & Electronic patient	3	8.6
6	Verbal / Role playing, Part task trainer & Computer Patient	1	2.9
7	Verbal / Role playing, Standardized Patient, Part task trainer & Electronic patient	6	17.1
8	Verbal / Role playing, Standardized Patient, Part task trainer, Computer Patient & Electronic patient	9	25.7
9	Verbal / Role playing, Standardized Patient, Part task trainer & Electronic patient	1	2.9
10	Verbal / Role playing & Electronic patient	2	5.7
11	Verbal / Role playing & Part task trainer	2	5.7
12	Computer Patient & Electronic patient	1	2.9
	Total	35	100.0

used simulation as part of research activities (Table 1).

Of the six modalities of simulation, 12 combinations of simulation usage modalities were derived as shown in Table 2. A combination of Verbal / Role Play, Part Task Trainers, Standardized Patient, screen-based simulation and electronic-patient simulation was the most popular simulation modality. Screen-based simulation and electronic-patient simulation were considered high technology while the others were considered low technology. Most AHIs with less than five-year experience (12, 80%) utilized high technology simulator (Figure 3). Those AHIs with more than five-year experience have almost equal share of both high and low technology

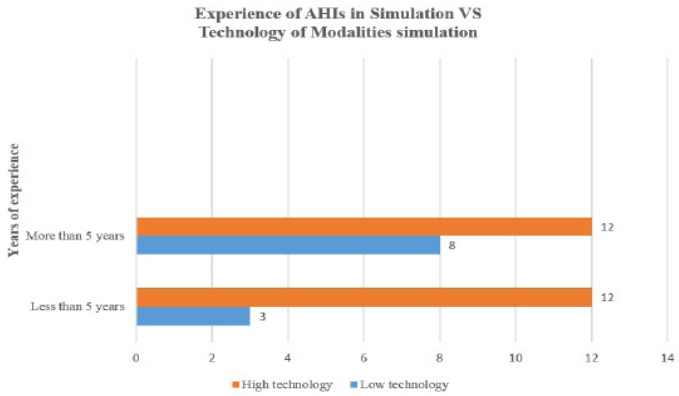

Figure 3: Experience of AHIs in simulation between Technology of simulation (High / Low)

Table 3: Funding for simulation centers

No	Sources of Funding	Frequency	Percent (%)
1	Institution	27	77.1
2	Corporate Sector	0	0.0
3	Research grant	0	0.0
4	Institution & Corporate Sector	2	5.7
5	Institution & Research grant	2	5.7
6	Corporate sector & Research grant	0	0.0
7	Institution, Corporate Sector & Research grant	0	0.0
8	Not sure	4	11.5
	Total	35	100.0
No	**Total Funding**	**Frequency**	**Percent (%)**
1	RM50,000	1	2.9
2	RM 100,000	1	2.9
3	RM 500,000	1	2.9
4	RM15,000 excluding equipment's & infrastructure	1	2.9
5	RM 1 million	1	2.9
6	> RM2 million	1	2.9
7	RM20,000 every 2 years	1	2.9
8	Not sure	28	80.0
	Total	35	100.0

simulations. However, there was no significant difference between years of experience and the simulator technologies used (p = 0.207).

Table 3 shows that funding of the simulation center mainly came from the parent institution. None was from the corporate sector or research grant alone. Further analysis showed that there was no significant difference in terms of source of funding between public and private AHIs (p= 0.570).

Out of the 35 responding institutions with 115 resource-person responders, there were nine different categories of job designations. The top three healthcare professionals reporting usage of simulation were nurses (30, 26.1%), paramedics (19, 16.5%) and physicians (19, 16.5%). They contributed more than 50% of utilization of simulation (Table 4).

A total of 115 users from the 35 institutions that responded were divided into six health care domains (Table 5). In-hospital and procedural health care domains (ward based) were the top two users of simulation, constituting more than 50%.

Twenty-five (71.4%) out of 35 simulation centres in Malaysia had dedicated staff (simulation technologist or technician) managing them (Table 6).

Seven categories of challenges were analyzed. The results showed that out of 64 total challenges reported, 19 (30.6%) faced financial challenges to

Table 4: Group of simulation user in Malaysia.

No	Job Designation	Frequency	Percent (%)
1	Lecturer non clinical	16	13.9
2	Allied health*	9	7.8
3	Clinical assistant	7	6.1
4	Nurse	30	26.1
5	Paramedic/AMO**	19	16.5
6	Physician	19	16.5
7	Manager***	5	4.3
8	Regulator / legislator	0	0
9	Science Officer	10	8.7
	Total	115	100

* Technician, physiotherapy, radiographer, dietician, EMT
** Assistant Medical Officer
*** Manager of simulation centre (e.g.: executive, trustee)

Table 5: Health care domain that utilizes simulation

No	Health care domain	Frequency	Percent (%)
1	Imaging (e.g.: radiology, pathology	4	3.5
2	Primary care (e.g.: psychiatry)	10	8.7
3	In-hospital (e.g.: ward based medical)	28	24.4
4	Procedural (e.g.: surgery, O&G)	25	21.7
5	Dynamic high hazard (e.g.: OT, ICU, OT)	16	13.9
6	*Others	9	7.8
7	No response	23	20.0
	Total	115	100.0

* Others include: diploma, undergraduate and post graduate student teaching, short courses and anthropometry measurement.

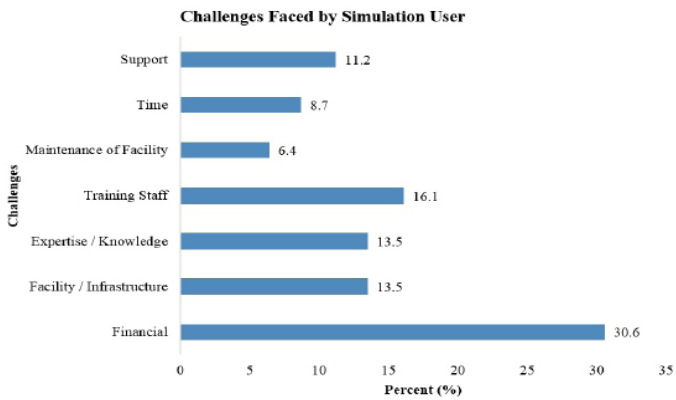

Figure 4: List of challenges faced by simulation user (Academic Health Institutions)

Table 6: Dedicated staff, training received and years of experience in handling simulation

Sources of Funding	Frequency	Percent (%)
Yes	25	71.4
No	8	22.9
Not sure	2	5.7
Total	35	100.0
Training received	**Frequency**	**Percent (%)**
Yes	25	71.4
No	10	28.6
Total	35	100.0
Years of experience	**Frequency**	**Percent (%)**
less than 5 years	15	42.9
5 to 9 years	10	28.6
10 to 14 years	5	14.3
15 to 19 years	1	2.8
20 to 24 years	2	5.7
more than 25 years	2	5.7
Total	35	100.0

run simulation activities (Figure 4).

DISCUSSION

The findings of this study indicated that healthcare simulation has gained ground favorably in Malaysian AHIs over the past two decades. Simulation has been practiced for more than 25 years in this country. Interestingly, we noted that over the last decade, the usage of simulation in healthcare education has increased tremendously in Malaysia (Figure 2).

The majority of the institutions surveyed had less than five years' experience in using simulation for their teaching and learning activities. This is because simulation as a teaching tool is relatively new in Malaysia (Ismail 2015). Whilst the usage of simulation as a teaching tool has gained momentum over the last five to ten years in the global arena (Kneebone et al. 2005), in Malaysia it has only picked up in the last five years.

Simulation was used for Teaching-Learning (Education and Training), Performance Assessment, Clinical Rehearsal, and Research & System Integration (Society for Simulation in Healthcare 2017a). In our study, we found that the majority of the AHIs used simulation for education, training and performance assessment. Research and clinical rehearsal were the least frequent aims. Only five (14.3%) AHIs used simulation as part of research activities. Even though educators in Malaysia have been using simulation as a teaching tool mainly to teach physical skills like Basic Life Support (BLS), suturing technique, intra osseous cannulation (Bala Krishnian et al. 2016),

soft skills (communication, teamwork) and inter-professional training (Karim et al. 2014) the awareness of using simulation for research is still lacking. Nevertheless, this is a common finding in many other studies even in countries where the use of simulation is well established (Bradley 2006; McGaghie et al. 2010; McGaghie et al. 2011).

Simulation not only involves technique, but also technology. High technology electronic simulators (Gaba 2004) are expensive and require significant funding which includes not only purchasing but maintenance of the simulators as well as the simulation center itself. Based on our results, most of the funding of simulation centers in Malaysia was directly from the operational budget of the AHIs. Funding from the corporate sector or research grants were not commonly obtained. Possible reasons may be a lack of awareness of the importance of simulation amongst potential contributors in the corporate sector which was not explored. It is highly recommendable to venture into possible collaboration between AHIs and related corporate sector in the co-financing of a simulation center.

This study indicated that in Malaysia, healthcare education via simulation is dominated by the nursing profession. We also observed that simulation was not only focused on clinical knowledge and skills but was also used by the management team of an institution to evaluate management processes. These indicate that simulation is a versatile tool that can be applied to attempt to improve management outcomes. It also creates and enhances a good environment for team dynamics (Anderson 2005; Ismail et al. 2011).

In view of its versatility and the presently integrated medical curriculum, the preclinical and non-clinical medical lecturers adopt simulation in their teaching-learning delivery method. It exposes the preclinical students to the clinical environment early in the program. It is well accepted by students and provides an opportunity to learn without risk to patients. Among clinical students, simulation is not limited to bedside teaching activities, but extends to involve disaster education. Students who manifest good team dynamics during simulation training exercises were able to demonstrate good inter-professional team dynamics as well (Ismail et al. 2011)

Apart from educators and clinicians, we noted that science officers have begun involving themselves in simulation. However, the number was still small (10, 8.7%). Science officers appeared to work in simulation research areas towards improvement on its practices in the future.

The Procedural and In-hospital domains were the main contributors to the utilization of simulation in teaching-learning activities. Our results reveal that in Malaysia, the usage of simulation is still focused mainly on procedures and in-ward activities. This enhances our observation that the users were mainly from clinical backgrounds especially nurses, paramedics and physicians. Therefore, in Malaysia the emphasis on psychomotor skills was clearly important for healthcare providers, and this influences the

findings of the present study.

Our study revealed similar results as shown by Satava (1994), Satava (2001) and Bloom et al. (2003) whereby much of the attention on simulation focused on technical and procedural skills. On the other hand, the study by Gaba and DeAnda (1988), Gaba (2004), Hegarty and Bloch (2002) and Lighthall et al. (2003) found otherwise. They noted that utilization of simulation was more concentrated in the dynamic high hazard group. Perhaps, we should next focus on team training, communication or even inter professional training in future.

Twenty-five (71.4%) out of 35 simulation centers in Malaysia have dedicated staff (simulation technologist or technician) to manage them. However, most of them have less than five years' experience. In terms of training received by the institutional staff, all these 25 AHIs reported that the staffs were trained. Training programmes included Mannequin Handling Course, Basic Knowledge of SIMMAN 3G, Simulation Technology, Simulation Technician/Specialist Development Programme, company/ complimentary or inclusive workshop upon purchase of manikin, NHET-Sim, Graduate Certificate in Clinical Simulation, Simman/ SimNewB/ SimBaby Programming by company and CAE Healthcare's METIman Nursing Basic Education Course. Overall, the training received were more focused on the development of technician skills and maintenance of the simulation equipment. These were acceptable. However, simulation educators training was still lacking and needed some encouragement. Currently two such courses that promote simulation educator training and faculty development in Malaysia are Simulation Practice and Learning for Teachers (SimPLe Teach) course developed by Faculty of Medicine Universiti Kebangsaan Malaysia (UKM) and Improving Simulation Instructional Methods (iSIM) developed by WISER University of Pittsburgh.

Sustainability and good quality in teaching-learning depends on good preparation of the scenarios, proper planning of its delivery, debriefing, as well as appropriate and fair assessments. These can be accomplished by having a good grasp of the knowledge and skill in the subject matter and proper understanding of the simulation technique as an educational tool. Apart from the educators, the simulation center manager/administrator may also need training on these specific issues on the proper management of a simulation center. It is now time for us to develop our own module on simulation teaching and learning. This will equip the junior and inexperienced simulationist with common well-accepted standard of simulation knowledge and skills in Malaysia.

The cost of using simulation in delivering education can be varied and range from small to considerable. An important challenge in using simulation is having sufficient financial support. According to Gaba (2004), the main contributors to the financial issues in simulation were the simulation community, objective of the session, and also the technology involved. In the current study, financial issues were

found to be the most challenging. This supports previous studies by Qayumi et al. (2012) and Wier et al. (2017) which reported financial issues as the main problem plaguing the use of simulation especially when it involved advanced technology, which incurs higher expenses.

Another important challenge in simulation is the facility. A previous study by Qayumi et al., (2012) found that facility or infrastructure was an important aspect as it creates impact on the fidelity of certain scenarios and of course, it is crucial for accomplishment of the learning outcomes. The high or low fidelity was associated with the cost of running the simulation session. Maintenance of the facility is another vital consideration that directly affects the operational cost. In order to manage the facility well, the institution needs proper planning and appropriate budget allocation for maintenance. However, in our finding there was no significant difference in the source of funding between public and private AHIs where most of the funds were from the institution themselves.

Contributions of academic and non-academic staff are important in simulation as it helps promote a conducive learning environment for the students (Summers & Kingsland 2009). Training of the staff was the second most important challenge in our study. These findings were similarly reported earlier by Nuzhat et al., (2014) who found that staff training was one of the challenges in establishing a simulation center. Another study carried out by Qayumi et al. (2012) revealed that a paucity of trained staff was one of the top challenges that the simulation users had to overcome.

Training of staff and time of simulation are related as simulation users need to be compliant with time allocation in order to track the training session. Our study showed that time was one of the least challenging factors. This was contrary to a study by Fernandez et al. (2010) which found that if time were compulsory, the simulation session would be successful. According to Fernandez et al. (2010), simulation could serve as a motivating factor for students if the schedule did not impinge on their study time and they were willing to participate (Ker et al. 2003).

Nuzhat et al. (2014) found that institutional support was the main challenge encountered in running simulation activities. On the contrary, we did not observe such findings. The respondents felt they received good support from their respective institutions.

CONCLUSION

In conclusion, healthcare simulation has been gracefully embraced into the fold of our Malaysian health care education scenario over the past decade. The majority of institutions used it as a teaching-learning tool that is internally financed. The main users of simulation were nurses, physicians and paramedics. The majority have dedicated staff of various job descriptions to manage the simulation centers. Most of these personnel had attended technical training, often provided by the simulator

manufacturer. However, they lacked proper educator training or teaching faculty development.

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Received: 24 April 2018
Accepted: 10 Jan 2019