

THE EXPERIENCES OF COMMENCING AN IN SITU SIMULATION EDUCATION PROGRAMME IN AN ACUTE AND CRITICAL INPATIENT HOSPITAL ENVIRONMENT

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INTRODUCTION

Simulation-based experiences (SBE) are being utilised increasingly within healthcare environments worldwide (Motolo, Devine, Chung, Sullivan, & Issenberg, 2013). SBE may improve a learner's technical and non technical skills (Abe, Kawahara, Yamashina, & Tsuboi., 2013) which includes their knowledge, confidence, teamwork, communication, and the understanding of healthcare professionals' roles. Improved team work, interprofessional collaboration, communication, and co-ordination that can lead to an increase in the quality of patient care and ultimately improved patient outcomes (Weller & Civil, 2017; Decker, et. al., 2015). In situ SBE refers to an educational opportunity which occurs within a patient care setting where healthcare professionals would normally provide their services (INACSL Standards Committee, 2016a), allowing teams to test their own effectiveness as well as hospital processes (Spur, Gatward, Joshi, & Carly, 2016).

This paper will reflect on the experiences of the first two years of an in situ SBE programme which commenced in October 2017. The in situ SBE described predominantly occurred within a coronary care unit, on cardio-thoracic, respiratory, cardiology and renal wards as well as a cardiac catheter lab. The authors also extended their in situ SBE into other specialist areas within the tertiary hospital they work in. The content will reflect on the impact upon clinical practice, latent safety risk identification, the challenges experienced and interprofessional as well as interdepartmental SBE.

METHOD

About the environment

Dunedin Public Hospital (DPH) is situated in the lower South Island of New Zealand. The hospital is a 388-bed tertiary facility employing over 3,000 staff and servicing the Otago and Southland population of around 300,000. The cardiology department is the regional centre for myocardial infarction management, as well as being a cardiac surgical centre.

The in situ SBE programme

The Otago Simulation Interest Group (OSIG) was formed in 2017 to provide an organisation wide SBE network, to assist in establishing and maintaining SBE within differing clinical areas. OSIG established standards and encouraged the sharing of resources and ideas between those undertaking SBE within the Otago and Southland areas. With the advice and encouragement of OSIG we commenced an in situ SBE programme in the cardiology/respiratory/renal wards.

The framework of SBE usually consists of; pre-planned, measurable objectives; a comprehensive pre-brief; the simulation scenario; and a reflective and structured debrief to conclude the learning experience (INACSL Standard Committee, 2016b). Using this structure, the in situ SBE sessions were devised and run.

Within our clinical environments, over 30 in situ SBEs were undertaken during the first two years (Table 1). These in situ SBE usually took place over the 30 minute period of handover time between the morning and afternoon shifts for nurses. The timing was to allow for maximum participant attendance and allowing an increased chance to undertake SBE repeatedly. The scenarios utilised included; cardiac arrest (ventricular fibrillation (VF), ventricular tachycardia (VT) and pulseless electrical activity; anaphylaxis; hypoglycaemia; airway management; opioid induced ventilatory impairment (OIVI); and a deteriorating patient scenario. The majority of in situ SBE were VF or VT cardiac arrest scenarios. The educational objectives of the cardiac arrest SBE were to provide exposure to the New Zealand Resuscitation Councils (NZRC) algorithm for Advanced Cardiac Life Support (ACLS) (New Zealand Resuscitation Council, 2016), resuscitation drugs, and resuscitation equipment. Staff were asked to simulate how they would respond to an inpatient who went into a cardiac arrest. Equipment included a low fidelity mannequin, real drugs, real documentation, and a device which allowed an altered heart rhythm to be displayed on the M4735A HeartStart XL Defibrillator/Monitor (Phillips Healthcare, Andover, MA) or Phillips HeartStart FR2 Defibrillator (Phillips Healthcare, Eindhoven, The Netherlands).

Date	Type of SBE and location	Attendants
20/10/17	VF arrest	Nursing (10) Student Nurses (2); Facilitator (1)
30/10/17	VF arrest	Nursing (9) Student Nurses (2) Facilitators (3)
07/12/17	VF arrest	Nursing (8) Facilitators (3)
14/12/17	VF arrest	Nursing (8) Facilitators (3)
01/02/18	VF arrest	Nursing (5) Medical (3) Facilitators (2)
15/02/18	*VF arrest	Nursing (6) Facilitator (1)
15/02/18	VF arrest	Cancelled due to patient acuity
15/03/18	VF arrest	Nursing (7) Facilitators (2) – moved to 7th floor seminar room due to patient acuity. (Medical Ward Clinical Nurse Educator present to learn)
29/03/18	Hypoglycaemia	Cancelled due to staff sickness
05/04/18	Hypoglycaemia	Nursing (13) Facilitators (3)
23/04/18	VF arrest	One SBE after the other with senior nurses from throughout the hospital
30/04/18	VF arrest	Cancelled re: acuity
09/05/18	VF arrest	Medical (6) Nursing (18) Student Nurse (1) Faculty (2)
15/05/18	VF arrest	One SBE after the other with senior nurses from throughout the hospital.
23/05/18	VF arrest	Nursing (16) (7 from the medical ward). Facilitators (3)
31/05/18	VF arrest	Cancelled due to staff sickness
18/06/18	* VF arrest – Surgical floor	Nursing (13) Student nurse (1) Facilitators (2)
20/06/18	VF arrest	Medical (5) Nursing (17) Facilitators (3)
30/10/18	VF arrest	Medical (9) Nursing (14) Allied (2) Student Nurses (4) Student Allied (1)

12/11/18	*Anaphylaxis Radiology Department	Medical (4) Nursing (3) Medical Imaging Technologist (MIT) (7) Faculty (3)
16/01/19	*Anaphylaxis – Oncology Day Unit	Nursing (12 – 4 participants 8 observers) – Faculty (2)
29/01/19	PEA Arrest	Nurses (7)
23/02/19	Anaphylaxis	Nursing (9) Medical (3)
28/02/19	Anaphylaxis	Nurses (8)
26/03/19	VF arrest	Medical (2) Nursing (8) Student Nurse (1)
02/04/19	VT arrest (Cath Lab)	Nursing (5) Allied (4) Student Allied (2) Facilitators (2)
04/04/19	VT arrest (Cath Lab)	Nursing (3) MIT (3) Physiologist (5) Trainee Physiologist (1) Facilitators (3)
04/04/19	VT arrest (Cath Lab)	Cancelled – Facilitators (3)
04/04/19	VF arrest with airway management	Nursing (18)
20/06/19	Airway management	Nursing (9) Physiotherapists (3) Facilitators (2)
31/07/19	VT arrest (Cath Lab)	Cancelled – Facilitators (3)
31/07/19	VF arrest	Medical (2) Nursing (9) Student Nurse (1)
15/08/19	VF arrest	Nursing (9) Student Nurse (1) Physiotherapist (1)
29/08/19	Deteriorating Patient – Interdepartmental Cardiology / renal ward and ICU	Medical (5 – 3 Ward; 2 ICU) Nurses (7 – 5 Ward; 2 ICU) Charge Nurse (1) Clinical Team Co-ordinator (1)
19/09/19	Opioid Induced Ventilatory Impairment	Nursing (12) Charge Nurse (1) Physiotherapist (1)
24/10/19	VF arrest	Nurses (1) Charge Nurse (1) Physiotherapists (10) Occupational Therapist (1) Facilitators (2)
30/10/19	VF arrest	Medical (3) Nursing (11) Physiotherapist (2) Pharmacist (1) Social Worker (1)

Table I. Summary of simulation-based educations undertaken until from October 2017 to October 2019 .

*Other areas outside of the 7th floor DPH

In the early days of facilitating in situ SBE the cardiac arrest scenarios generally continued until the SBE mannikin simulated a return to a normal sinus rhythm, to make the participants feel a sense of success. Once the participants were more confident with the programme, and the whole process of the SBE, we changed some outcomes to be negative for the patient (if this was clinically appropriate) depending on the scenario and the learning points envisaged.

The facilitators involved in the SBE programme on the 7th floor of Dunedin Public Hospital (DPH) during this time included a Clinical Nurse Educators (CNE); a Cardiologist, an Associate Charge Nurse Manager (ACNM) who covered the respiratory/cardiothoracic ward and the coronary care unit, and an Enrolled Nurse (EN). The Cardiologist was a NZRC Core Advanced Rescuer Course instructor, the CNE, and ACNM had completed the NZRC CORE Advanced Rescuer Course. The CNE, Cardiologist and EN had participated in formal education on simulation delivery.

Impact on practice

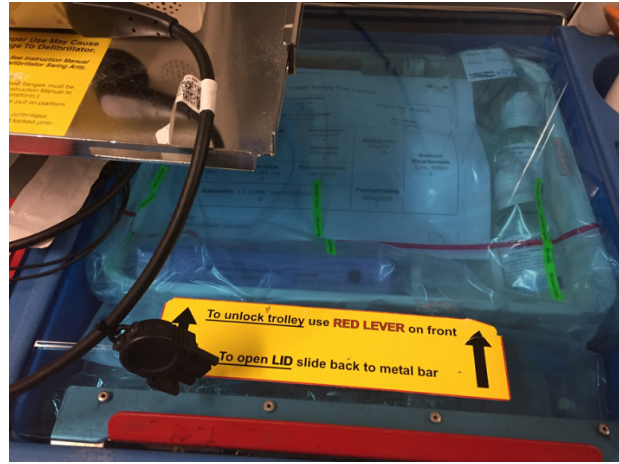
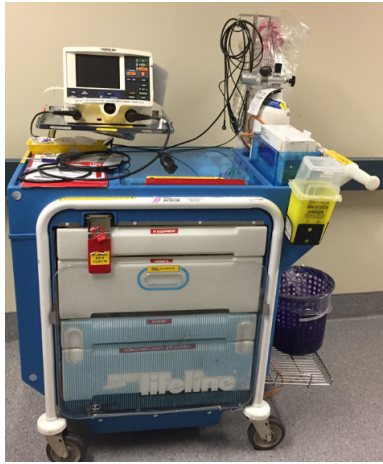
Latent risk category	Examples of risk	Corrective action
Equipment	<ul style="list-style-type: none"> • AED set to wrong program (three stacked shocks) • PEEP valve fell apart • Defibrillator placed on bed for transport, easy to knock off 	<ul style="list-style-type: none"> • Incident report and updated program immediately • Incident report and ordered new style of PEEP valve • Tray recommended and able to be sourced from central area.
Environment/staffing Knowledge and skills Recurring risks	<ul style="list-style-type: none"> • Delayed chest compressions or application of defibrillation pads • Unaware where anaphylaxis box is stored • Bag-valve mask left on bed with defibrillation • Medication not checked • Unfamiliar with NZRC ACLS flow diagram or not used • Not transferring NZRC CORE training into clinical the environment • Uncertainty of roles • Unfamiliarity with emergency drugs • Closed loop communication absent and/or participants quietly spoken. • Team Leader/Leadership not apparent (not transferring NZRC CORE Advanced Rescuer training into clinical environment) • Unfamiliar with resuscitation documentation 	<ul style="list-style-type: none"> • SBE reports circulated and education added to yearly CPR updates for nurses • Staff to re-familiarise (already in nursing orientation checklist) • Reminder to remove • Reminder during debrief to check medications • Education and familiarisation via team meetings and other opportunities as able • Yearly updates became in situ SBE involvement • Education and discussions occurred • Education undertaken immediately with teaching tray • Discussed in debrief • Asked NZRC CORE Advanced Rescuers to role model resuscitation leadership role • Education given as able and advice to familiarise self in own time

Table 2. Latent safety risks discovered as well as solutions utilised during in situ SBE programme.

Knowledge deficits revealed

Our in situ SBE program showed that participants of differing professions, as well as experience levels, asked questions and requested clarification of our clinical guidelines. These factual knowledge questions included how and when to give resuscitation medications (adrenaline and amiodarone).

A further knowledge deficit noted was following a change in the way pharmacy stored the drugs within the emergency trolley. The SBEs regularly had some participants who were not aware of the contents of the emergency trolley's drug tray. This knowledge deficit was considered potentially related to a paper map cover being placed over the drug tray by pharmacy. The map indicated where the drugs were within the trolley. The sealed and dated tray meant that daily checks of individual drugs within the emergency trolley were no longer required, which saved time. However, this change has limited the staff exposure and familiarity to the emergency drugs. To resolve the lack of familiarity with emergency drugs, as well as the SBEs, mini education sessions occurred, utilising a teaching tray holding the real drugs during the clinical huddles, or as the opportunity arose.



Figures 1 & 2. Drug tray utilised for teaching purpose. A significant knowledge deficit was revealed and responded to.
Source: Joanne Robertson-Smith.

Significant knowledge deficits were revealed and resolved and knowledge transfer was reportedly occurring into actual patient care. The most significant feedback came from a member of the clinical leadership team who acknowledged the positive impact of in situ SBE translating into improved teamwork and understanding of roles during a cardiac arrest. This was revealed specifically during a cardiac arrest which occurred in the ward. The cardiac arrest could have been quite traumatic, but two members of the team reported feeling more positive than they expected due to the previous practice they had undertaken during SBE. Additionally, feedback was received from nursing leadership that teams appeared more confident with cardiac arrest scenarios in general.

From the CNE's perspective the initial learner responses to in situ SBEs appeared very positive and many staff reported that they intended to participate repeatedly as participating in the in situ SBE made them feel more confident, they valued it and saw benefit. These benefits included improved communication, teamwork, and an enhanced understanding of roles, including those of other healthcare professions. There was an acknowledgement from staff that it was valuable to practise clinical situations which do not happen very often, but when they do require a prompt and confident response. The feedback was similar to a Canadian paediatric acute inpatient study which discussed participants who valued interprofessional SBE, wanted more, and shared that SBE increased participant confidence, communication and their understanding of healthcare professionals roles (Kotsakis, Mercer, Mohseni-Bod, Gaitero & Agbeko, 2014).

During the second year of our in situ SBE program new defibrillators were introduced to our hospital. In situ SBE was utilised to assist with embedding the new device into clinical practice. Some participants reported that it was great to practise utilising the equipment (especially new devices like the defibrillator) and visualise and discuss the emergency drugs. Some participant reports stated that this familiarisation assisted with decreasing staff anxiety about patient resuscitation as well as highlighting aspects around performance which could be improved.

Value for new staff

SBE has noted to be value for our new staff members, specifically one new Registered Nurse (RN) who was involved in an in situ SBE described here. One of the advantages in situ offers is the ability to easily follow up with

staff after the SBE as the facilitator and participants share the same environment. The RN discussed the SBE with the facilitator and felt that the understanding she had gained from the SBE was very valuable. Later on that day the new RN was involved in the care of a patient who had a prolonged refractory VT/VF cardiac arrest. The next day the new RN shared that she was not sure how she would have managed had she not undertaken the in situ SBE the day before. During the cardiac arrest, the new RN competently and confidently undertook the airway management role within the cardiac arrest.

Latent risk identification

There are risks related to clinical practice and it is important to decrease errors and increase patient safety (Motolo, et. al., 2013). Healthcare is complex and latent risks can change suddenly. Sharing learning points around patient safety risks are important (Spur, et. al., 2016). Possibly, if we share our identified latent safety risks, these errors can be eliminated (Ma, Bunting, Avery, Fawcett & Carter, 2018) and sharing our findings inside and outside our organisations is subsequently of great benefit.

Our in situ SBE programme discovered a significant and surprising latent safety risk in May 2018. During an in situ SBE it was identified that the Philips Heartstart FR2 automated external defibrillators (AEDs) behaved unexpectedly. Upon investigation, the AED programme was set to an outdated programme based on the previous NZRC's ACLS algorithm. This pre-2010 algorithm recommended clinicians administered three stacked shocks in the presence of VF or VT, before users commenced chest compressions. In our simulation, there was confusion and delay in treatment as the device advised that chest compressions be delayed as the device attempted to deliver three shocks, whereas the staff expected a single shock. This was recognised as a serious patient latent safety risk and was escalated immediately to senior management and resolved. The FR2 AEDs throughout the hospital were updated very quickly.

A second important latent risk identified was that a PEEP valve was also used in an in situ SBE which came apart. Several different pieces of the valve ended up in different parts of the four bedded room. After this, another

style of PEEP valve was ordered for the clinical environment, which was subsequently successfully tested in an in situ SBE.

An additional latent safety risk was noted within the Cardiac Catheter Lab (Catheter Lab) environment. The risk involved the Catheter Lab team being led by the interventional procedure operator during ACLS, which is not best practice. Nursing staff, or not primary operator medical staff, should also be comfortable to lead an ACLS scenario within the Catheter Lab allowing the operator to focus on the procedure. A nursing 'team leader' role was created within the Catheter Lab, and rotated each

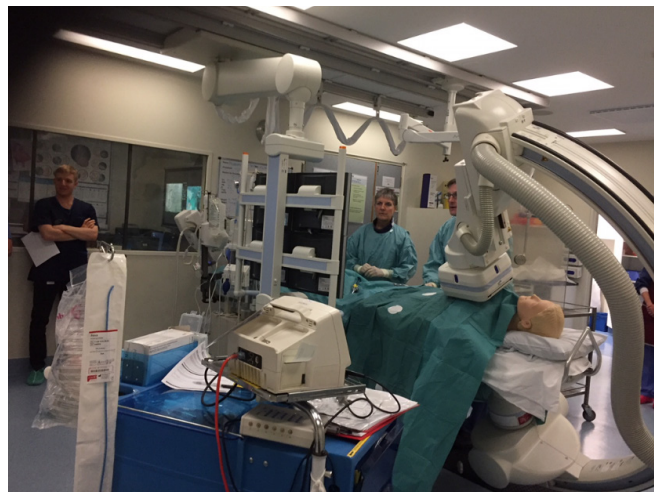


Figure 3. Catheter Lab in situ SBE which allowed staff to practice the newly created 'Team Leader' role. Source: Joanne Robertson-Smith.

day, to prompt staff to take this lead if required. This was a role that was then able to be practised again via in situ SBE.

Latent safety risk identification is one of the many good reasons to commence an in situ SBE programme (Garden, et. al., 2010). There are many publications on latent safety risk identification with in situ SBE, including conference proceedings in which the authors stated that they introduced in situ SBE to exposed latent threats within their healthcare environments (Ma, et. al., 2018; Thomson, Tan, Hellings, & Frys, 2016; Duffy, Brown, & Overly, 2012; Yajamanyam, Sohi, King, Wikey, & Sinclair, 2012). These presentations revealed concealed patient safety issues and one department identified 20 significant risks out of 54 SBEs (Duffy et al., 2012).

Garden et al, (2010) shared their initial observations of an in situ simulation training programme in Wellington Hospital, which focused on paediatric cardiac arrest scenarios. These authors identified many latent safety errors, the most significant was the inconsistency in the ability of staff to unlock and open their resuscitation trolley. Other studies shared that within 90 SBEs undertaken they identifying 73 latent safety threats (Patterson, Leis, Falcome, Le Master & Wears, 2013) and within 114 SBE undertaken just over one (1.1) latent safety threats were discovered per scenario they facilitated (Cauto, Bareto, Morcon, Matra & Acors, 2018). The highest proportion (41%) of Cauto and colleagues discovered latent safety threats were attributed to equipment failure.

Equipment failure findings serve to remind us of the importance of authenticity in our in situ SBE programmes, so we are aware of where the potential equipment failures exist. Authenticity, or maintaining normal departmental processes is more likely to reveal latent safety errors (Spur, et. al., 2016). In undertaking an in situ SBE within our Radiology department, one facilitator brought in equipment from another area, which Radiology would not stock. A co-facilitator who observed this reminded the facilitators of the importance of keeping the SBE authentic, to test the departments own processes. The additional equipment was removed from the SBE. Authenticity meant the clinical environment having only what the staff would normally use (not what we could bring in from elsewhere), therefore removing this equipemnt meant the Radiology department's systems were authentically tested.

CHALLENGES

It is acknowledged that it can be difficult to establish a simulation programme within hospital clinical areas (Spur, et. al., 2016). Despite the positive outcomes mentioned above, there were many in situ SBE facilitation challenges. Our challenges included co-facilitator availability, a lack of realism, and some SBE participation aversion.

Colleagues (both facilitators and participants) were uncertain in their ability to participate in our planned in situ SBE. This is a reflection of the busy clinical environments in which healthcare professionals work in.

As noted previously, authenticity is an important aspect to our simulation programme. Making SBE as real as possible, utilising real clinical areas and real equipment, is beneficial not only for revealing latent safety risks but for also making the SBE realistic enough for the participants to engagement in it effectively. A lack of realism was consistently feedback in the early days of our in situ SBE programme, but improved with increased participant exposure. This change was not due to an increase the fidelity of the SBE undertaken, therefore we feel it is most likely due to participants having repeated exposure to in situ SBE. Realism became a regular discussion point during the pre-brief, and without this discussion the lack of realism experienced by participants would often become a major distractor for participants during the debrief.

The prebrief also involves creating a safe learning environment and our in situ SBE programme believes this is important as SBE scenarios tend to challenge participants and failures can be generated and consideration to the subsequent negative emotions and how to avoid them should occur (Rudolph, Simon, Rivard, Dufresne & Raemer, 2007). In addition to creating a safe learning environment for the participants however, the prebrief

also allows the development of a shared understanding with regard to the scenario and the fidelity, prior to commencing the simulation itself.

SBE participation aversion was noticed and it was disclosed by some individuals that they felt they had never been a part of in situ SBE before. Younger staff appeared more familiar and comfortable with SBE. In two of our SBE, a student nurse and newly practicing RN confidently took the first responder role. We considered it is likely this confidence is related to the undergraduate nursing education curriculum in which students undertake SBE. The SBE participation aversion appears to have decreased as SBE becomes more frequently utilised.

Interprofessional education

The in situ SBE programme has given the opportunity to engage in interprofessional education (IPE), which is when two or more professionals engage in a healthcare experience to achieve a shared outcome or objective. The World Health Organisation sees IPE as a key factor in obtaining complex healthcare goals now and into the future (Reeves, Perrier, Goldman, Freeth & Zwarenstein, 2013). IPE will assist healthcare professional's skills to work in a collaborative manner and this is critical to the provision of excellent healthcare delivery, especially to complex patients.

In October 2017 our in situ SBE programme commenced utilising nurses only. By February 2018 the inclusion of the medical profession occurred. The majority of medical participants were Trainee Interns and House Officers. At the end of the two year period described, our SBE programme began co-facilitating with a physiotherapist and had physiotherapy participants and occasionally members of differing healthcare professions (see Table 1).


Interdepartmental education


Our SBE programme extended to our Dialysis and Radiology departments where we facilitated SBE. We also assisted other departments by co-facilitating and sharing what we had learnt. Resources were shared between departments and this was encouraged by OSIG, saving time planning.

One of our most rewarding and challenging SBE was an interdepartmental SBE, which was undertaken between the cardiology and renal acute care ward teams and the Intensive Care Unit. The scenario was a cardiology patient who went into a sudden pulmonary odema. This gave the acute care area the chance to practise the newly established observation early warning score and escalation pathway. There was also a newly established Clinical Team Co-ordinators (CTC) role within Dunedin Hospital, which was a nursing leadership role to assist with patient deterioration situations. The SBE gave us an opportunity to practise and reflect upon this new role. This was the first time testing the new initiative and it was viewed very positively by most of the staff involved and the facilitators. The SBE highlighted the management of a patient who may imminently require a rapid sequence intubation and the use of high flow nasal cannula and other learning outcomes were noted. Interdepartmental SBE reveal wider organisational knowledge, understanding and risks. However, the time to create and organise the larger interdepartmental SBE, as well as facilitate them, is much higher than a SBE centralised to one area.

CONCLUSION

In our experience, in situ SBE is an educational modality which provided effective clinical learning. In situ SBE also revealed educational deficits and patient latent safety risks, which could be easily resolved, within our acute and critical care clinical environments. With perseverance and flexibility, the main hurdles of co-facilitator availability and realism can be overcome.

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