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Simulation as a vehicle for interprofessional education

A collaborative research project involving academics from the School of Biomedical Science at Charles Sturt University, Beyond Medical Education (BME), funded by General Practice Education and Training Australia (GPET)

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Executive Summary

Simulation based medical education (SBME) is a highly effective tool that provides opportunities for students to practice clinical skills and decision making, in a safe environment, that enables them to learn from their achievements as well as their errors (Bandali, Parker, Mummery, & Preece, 2008; Berkenstadt, Erez, Munz, Simon, & Ziv, 2007a; Lewis & Vealé, 2010; McGaghie, Issenberg, Petrusa, & Scalese, 2010; Ziv, Ben-David, & Ziv, 2005). Simulation as a teaching tool can be used at multiple levels in medical education. The most fundamental use of simulation, for the safe practice of psycho motor skills that require repetition for mastery, has been well evaluated (McGaghie, et al., 2010). Simulation answers some of the problems of limited clinical placements, the risks of practicing on patients, and the structural and financial pressures of meeting medical education needs in Australia today. Although student cohort sizes are, by necessity, limited in simulation laboratories, clinical simulation can still provide opportunities to learn a range of frequently needed clinical skills. Simulation is a solution to educational issues such as a decrease in patients who are available for student practice, a decrease in societal acceptance of students learning on patients, and the challenges of finding clinical education sites appropriate for student learning (Bandali, et al., 2008).

Interprofessional education (IPE) is an education initiative involving members of two or more health professions who come together in a learning environment for the purpose of improving health care services and patient safety (Bandali et al, 2008; Barnsteiner et al, 2007; Bridges, 2011). Learning between members of the interprofessional team is interactive and fosters collaborative practice, communication, and teamwork. It supports the development of students to become professionals who are committed to collaborative patient centred practice (Bridges, 2011; Robertson & Bandali, 2008). IPE is a necessary educational initiative because '[e]vidence indicates that teamwork and collaboration skills are not intuitive or always learned "on the job"'(Barnsteiner et al, 2007, p. 144). Health care workers may also define teamwork and collaboration differently. Without IPE health care professionals risk undervaluing and misunderstanding the roles and contributions of others. IPE can 'bridge the differences created by the separate socialization of health professions' (Barnsteiner et al, 2007, p. 144 & 145).

This report documents research conducted by the School of Biomedical Science at Charles Sturt University and Beyond Medical Education (BME). The research consisted of two parts; the first part was a pilot study that was conducted by academics in the School of Biomedical Sciences with the assistance of a GP medical educator from BME. The pilot trialled and evaluated the simulations that were later used in the main part of the research. The main study was a one day research workshop that used simulation as a tool for IPE. Scripted scenarios that required psychomotor skills and clinical decision-making were

operationalised in a high intensity environment. General practitioner (GPs) registrars, paramedic and double degree paramedic/nursing students worked together, with supervisors in attendance, in the simulated settings and participated in three levels of evaluation: practice, reflection and observation. Within the scenarios items of potential social conflict were introduced in a random sequence as a stressor on the team. These scripted events provided opportunities for interprofessional learning and tested the focus, leadership and teamwork of the participants.

Simulation as a tool of IPE was found to be a labour-intensive but effective framework that facilitated multiple levels of learning and cooperation between professions. The video observations in real-time and video recorded simulation, when utilised by students, supervisors and the academics who had participated in the pilot study, were found effective in exploring and developing both clinical and team skills. Those who participated in the research expressed increasing confidence, respect, empathy and understanding of each other's role. In addition to enhancing interprofessional understanding participants reported a constructive exchange of skills and knowledge - both clinical and cultural. Collaboration in IPE was found to effectively expose each professional group to the others' knowledge, strengths, limitations, educational processes and professional challenges.

Research findings indicate that two key elements of IPE are addressed by simulation: the opportunity to gain inter-personal and interprofessional confidence in a complex and collaborative health care situation and the transfer of knowledge between health professionals. At another level, the research process demonstrated a web of post-simulation learning opportunities for all professions through personal and group observation of the video recordings, reflection and further instruction for the refinement of clinical skills. However, simulation for IPE is such a time and labour intensive practice that it can only be justified by its capacity to continue delivering potent clinical education at multiple levels, both to the immediate participants and future observers. To achieve its full potential future IPE simulation would need to be paired with instructional clinical workshops for the practice and evaluation of skills, and close collaboration with the participants' own medical educators or supervisors for a critique of their leadership, team and communication skills.

Background: Project Rationale

Inter-professional Education (IPE) is an emerging field in Australia which attempts to: " bridge the differences created by the separate socialisation of health professionals", (Barnsteiner, Disch, Hall, Mayer, & Moore, 2007 p. 144, 145). Without the complex higher order learning of IPE health care professionals risk undervaluing and misunderstanding the roles and contributions of others which can lead to communication breakdown. Miscommunication between health care practitioners is generally accepted as being a main cause of patient injury (Berg, Wong & Vincent, 2010). Simulations that focus on skills acquisition alone do not include the multiple random factors that surface in real emergencies. Paediatric medical emergencies fall into the category of events where opportunities to participate are rare (Adler et al., 2009; Gordon, Wilkerson, Shaffer, & Armstrong, 2001). For general practitioners, the clinical skills needed to resuscitate a child or treat anaphylaxis are rarely called upon. Therefore, simulated scenarios are an effective way of exposing GPs to rare events and allow them to practise or test their skills. For successful medical intervention to occur in an emergency, competencies such as communication, understanding the roles of others, collaboration and inter-personal and interprofessional confidence are required. Medical emergencies make strong demands on clinical decision-making. GPs need to be able to work with other health care professionals during emergencies which may occur in unfamiliar and resource limited environments. A variety of stressors can side track professionals into loss of focus, conflict and blame, potentially leading to medical error and sentinel events (Berg, Wong, & Vincent, 2010; Makary et al., 2006; Robertson & Bandali, 2008; Valentin et al., 2006)

Reduction of mistakes is a central goal of both SBME & IPE. Within a simulated environment there is safety to learn from mistakes or to think through and rehearse rare critical events without danger to patients. With the addition of facilitated debriefing SMBE can become a powerful learning experience that trains professionals to become accountable for acquiring new knowledge and skills and to confront errors. Error management involves identifying and acknowledging mistakes, analysis of errors; determination of corrections; and reflection (Ziv, et al., 2005). This level of simulation is being increasingly used in medical education. In Chicago, for example, the curriculum at Children's Memorial Hospital utilises instructional and practice paediatric emergency simulation that allows participants skills to be rigorously evaluated and systematically improved (Adler, et al., 2009).

Authenticity in simulation

Higher order learning in simulation can be defined as those more complex scenarios in which performance anxiety is increased through time pressure and changing patient needs. Through the use of

programmable high fidelity manikins, students are exposed to the unfolding deterioration or recovery in a patient's condition as it might occur in genuine clinical emergency settings.

Ziv et al (2005, p. 194) proposes that successful assessment and development in simulation training begins with an authentic environment, in which the students can immerse themselves as though it is real. Therefore the simulation must include three integral aspects of authenticity: an appropriate physical environment; a human environment that includes diverse staff, patient and family members; and clinical pathologies that are effectively simulated. A fourth factor that Ziv advocates is encounter with error, such as surgical injury, drug reactions, wrong diagnoses, non-optimal patient care (Ziv et al, 2005, p. 194). The authenticity of the high fidelity simulation needs to be evaluated in tandem with components of the scenario such as teamwork, leadership and communication.

To create an authentic interprofessional collaboration it was useful to bring together professional groups that might encounter one another in patient care, but were not overly familiar with one another. The relationship between GPs and paramedics does not have the strict limitations of established hierarchies, because their encounters are only occasional. The nurses in this project had a less traditional relationship to doctors because the Interprofessional Simulation Centre at Charles Sturt University is used in educating both paramedic and nursing students, some of whom are completing a double degree in both disciplines. These professional groups are a study in contrasts. Chaotic public spaces are the milieu of paramedics, whereas GPs control their own spaces where they use a suite of inter-personal skills in disease prevention and management. The advanced life support skills that GPs find hard to acquire and maintain are also the core business of paramedic practice, yet on the other hand paramedics often have poor communication skills (Lazarsfeld-Jensen, 2010; Willis, O'Meara, Lazarsfeld Jensen, & McCarthy, 2009).

In this research project pairing these professions in a simulated paediatric emergency provided an opportunity to evaluate simulation as an IPE tool for GPs. It was assumed that understanding and knowledge exchange could be readily observed where two of the three professions had such diverse strengths. Although the high tech setting is unfamiliar to GPs it was stripped down for some of the scenarios to simulate doctors' surgeries, to achieve an environmental authenticity for them.

Project approach: An interprofessional challenge

A pilot workshop of IPE paediatric emergency simulations was trialled and evaluated by academics and refined with the assistance of a GP medical educator. After an exhaustive search of the literature[1] it was decided that each scenario would include an interprofessional challenge developed out of the known elements of interprofessional competencies[2], most of which centre on communication (Bridges et al, 2011, p. 6; Buring et al, 2009, p. 5; Bandali et al, 2008, p. 182). Whilst evaluative frameworks of IPE skills have been well described (Barnsteiner, et al., 2007) these were found to be too narrow in focus to capture the complexity of the learning experiences. Attempts to develop tools have resulted in validated schedules of up to 56 items over multiple domains (Paterson et al., 2007; Schroder et al., 2011; Verma et al., 2009), which were not suitable for this project. For the purposes of this research project IPE simulation needed to explore communications in the presence of authentic demands on clinical skills to capture the impact of an emergency environment and the competencies brought to it by all the clinicians.

For the actual workshop paramedic practitioners and paramedic and nursing students were scripted as actors to work alongside four participating GP registrars. The scenarios allowed the doctors to practice assessment and history taking for paediatric emergencies occurring in both a GP surgery and emergency department settings. They were further challenged to perform a wide range of clinical treatments including airway management, intravenous access, intraosseous needle placement, fluid resuscitation, medication administration, and management of cardiac arrest. The GPs were expected to perform while under pressure, to prioritise and delegate tasks to unfamiliar team members working together in relatively unfamiliar environments. Throughout each scenario, the GP team leader needed to provide effective leadership, interprofessional communication, and team management skills in order to meet the clinical objectives. Sound clinical judgement, along with the ability to make difficult critical decisions, was paramount to the successful progression of each scenario. The ambiguous stressors, intended to elicit a reaction from the participants, included a nurse performing a near miss drug error and subsequently being unable to function; impatient paramedics; disgruntled and obstructive colleagues, as well as a clinically trained 'actor' who played a family member who made inappropriate treatment suggestions. Lastly, the scenarios introduced a cross-cultural challenge and put the GPs in a position of having to deal with the unexpected death of a child.

[1] See appendix 1

[2] See appendix 2

Research design

The research called for an inductive methodological approach. Inductive methodologies enable exploration of events from various perspectives. A single simulation scenario developed by a trained instructor using programmable high fidelity manikins can be manipulated in many different ways through the use of actors and role play. Furthermore, the outcome of a staged simulation is unpredictable. With stressors and potential for inter-personal conflict scripted into each scenario, it was possible that clinical interventions might be mitigated by the spontaneous reactions of the team. Multiple levels of observation were implemented to capture the nuances of each scene.

Heisenberg principle in methodological practice

IPE simulation is an event involving actors and observers, which makes it subject to the *Uncertainty Principle* first articulated by the physicist Werner Heisenberg (Heisenberg & Eckart, 1930) and adapted by social scientists to discuss the ways in which the act of observation and being observed, shapes the event. Observers bring a specific lens and perspective, and explanations of behaviour are equally subjective and biased by these perspectives, as indicated by literature on attribution patterns, emanating from the work of Harold Kelley (Kelley & Michela, 1980) and Fritz Heider (2005). However, this does not deny the value of observation so much as show its limits and uses. The Heisenberg principle was demonstrated during the video replays of simulations in other settings with different audiences. The observational perspectives multiply and enrich teaching and learning potential of simulation.

Methods

Given the complex and elusive nature of valid assessment of professional competencies in general practice using tools such as objective measures, observation and simulation (Allen et al., 2011; Kane, 1992; Laughlin et al., 2012) a complex set of methods was chosen for this project. In addition to the simulation scenarios these methods comprised of focus groups, questionnaires, video observation and participant feedback. These multiple methods captured richly descriptive data that was used for analogical analysis, a process of triangulation of data by viewing a phenomena from various perspectives (Creswell & Miller, 2000; Tobin & Begley, 2004; Vaughan, 1999, 2005).

All clinicians participated in three levels of evaluation: practice, observation and reflection. Practice in the simulations was limited to only one or two GPs and a few other clinicians at a time, so those that were not participating were able to view the scenario via video streaming in real time and were given the opportunity to discuss their observations in a structured focus group. The focus group was audio recorded, and later transcribed and analysed thematically. The reflection phase involved the participants

in each specific scenario in a formal and supervised debriefing session immediately the scenario ended. The debriefings were not observed in real time, but they were filmed and these were later viewed by a focus group of academics.

Findings

To meet the need for variable evaluation that was inductive and experimental, the layers of evaluation that were developed in this project focused on specific dimensions of the simulations, which are shown briefly in the chart below. An elucidation of each method follows.

Method	Purpose	Outcome
Video capture of the entire simulation and debriefing. Perspective: subjective experiences	Each debriefing captured participants' subjective comments on the scenario they personally participated in. They reflected on their clinical competency, teamwork and the sense of immersion. It was immediate and facilitated by the trainer.	Participants explained the strengths and limitations of the experience as a learning tool. Participants also discussed the quality of the immersion, the constraints of the scripts, and limitations of the actual settings, equipment and manikins
Interactive keypads (clickers) were used to respond to a three minute questionnaire shown on an overhead at the end of the debriefing. Perspective: immersion	Responses logged instant anonymous reactions that measured immersion by focusing on questions of anxiety, vulnerability, teamwork, consultation, respect, conflict avoidance and leadership experienced by the group in simulation.	The clicker results showed that three of the four scenarios had produced an experience adequately immersive to validate further exploration of the inter-professional elements such as exchange of skills and knowledge between the doctors, nurses and paramedics in the simulated emergency.
Video streaming (real time) focus groups	Participants who were cycled out of a current scenario participated	Participants noticed that they now had a wider focus of the

Perspective: team work Contemporaneous and rotating focus groups were sound recorded, transcribed and analysed thematically.	in an observational focus group in a break-out room with an independent facilitator.	entire scenario unfolding, and more time to consider responses than when they were in a scenario.
Video viewing (retrospective) Perspective: holistic assessment of the simulation event	Ten academics viewed the videos one month after the event.	Clinical skills which had not been closely observed at the time of the scenario became a focus for the academics. The learning potential of the videos for the students and their supervisors to use retrospectively was clear. Leadership, communication and individual participation were closely scrutinised, and opportunities for using the videos as a teaching and learning tool in the university setting were positively evaluated. One scenario which had seemed funny and ineffective at the time was seen as realistic and effective when replayed to a group which had not known of the prevailing after-lunch atmosphere. The death of the child scenario which had been harrowing for real-time participants and observers, was viewed more objectively for its clinical decision-making and communication content.

1. Video Capture

The IPE Simulation Centre at Charles Sturt University has a closed system of video recording which also allows the streaming of events to break out rooms. At the end of each scenario the participants went into a structured debriefing session which was video recorded, but not streamed. The debriefing session

with participants ran parallel to a focus group in another room attended by those who had not participated in the scenario. Two weeks later the videos were made available to a focus group of academics using an observational guide which correlated with the prompts used in the video streamed focus group session. Video capture produced data from the comparison of different observer groups.

Analogical analysis (Vaughan, 1999) was used to explore data from the parallel observation sessions. This is a method of comparing the evaluation of the real-time participants with the evaluation of the real-time observers. It became evident that subjective reflection during observation was a potent learning tool. Individual participants were aware of their own strengths and weaknesses and used observation to learn from others, to evaluate their own performances, to rehearse and anticipate situations. Moreover scenario participants were empathetic and tolerant of the errors of others by comparison to the academic control group which viewed the simulations and de briefs at a later date.

The abstracts below show three different observer groups and the difference in engagement, empathy and insight. Prior to the 'Death of a Child' scenario the doctors were not told that it was possible that a simulated patient might die. Participants in the observation room had the algorithm and were therefore informed that the event would take place. In the scenario, the mother was wearing a head covering and could not communicate a case history, although the child was known to a palliative care team. The mother was begging the doctors to save her child whom she had found in bed cold, inert and asystole. Although this situation seemed extreme to some observers, in that the mother had taken her dead child to a local clinic, it was in fact a reflection of a phenomena in some cultural groups where the family doctor is more trusted than uniformed paramedics who might take a family member away, or be unaware of cultural taboos.

Participants in their own debriefing	*Non-involved observers at a later date*	*Participants who observed the scenario in a focus group*
(I feel) A bit deflated. Even though I know it was a scenario	The doctors bought it – there was hesitancy and uncertainty	But he did it so well and the mother just lost it, like started thumping on the chest and that. But he just stood there and then – yeah. But it was really good to – not really good, but it was good

		to see that.
Perhaps I should not have put my hand on her shoulder – possibly in her culture - but it was instinctive.		So they'd (other cultural groups) rather go see their doctor, which they know, than opposed to calling strangers in the ambulance or opposed to running up to strangers at the hospital. So we had a few – not that exact thing but people that really needed quick transport to emergency that were with a GP.
I hope I never have to do that in my life It was a tough... It's not just the acute medicine – what do you say, what do you do, how do you phrase it – your child is dead.	He did not clearly say she was dead	For me, that was one of the hardest things to actually say that to a relative, like to actually get those words out – not easy.
It nearly brought tears to my eyes	It was surprisingly realistic.	I thought this was an excellent case. And the reason I say that is because in a lot of these simulation runs, the goal is to try and get the patient well and that's what usually happens. But this is what can happen in real life where sometimes you don't win. And knowing how to deal with that before you're put in that situation is very useful, I think, because then you can finetune how you'd actually act in real life.

I was not watching it – it was too real, being a mum	Everyone feels different when it's a kid. Everyone was on edge.	
I was hesitating not sure whether we should be doing anything, because there was so little information. Not sure whether we should (resuscitate)	They all agreed (to stop the resuscitation) – he should have said, no, that's it, but he sort of changed his mind.	I mean they realised pretty quickly on that as long as they've got the approval from the hospital to stop the resus, there wasn't going to be any point in continuing. But hey, tell that to the parent who wants everything to be done.
If you don't know, you treat. You do it for the mum. You do everything for the family	He was depending on his knowledge of adult cardiac situations. He was unsure of his knowledge and skills	

2. Interactive Keypads to measure immersion and authenticity

Immersion is the sense of engagement produced when participants experience a scenario as authentic, and this can be evaluated by observation, subjective reflection in debriefing, and in more objective ways such as the use of Likert scale questions. For this project a short set of questions was screened on an overhead projector, immediately after the debriefing, and participants had interactive keypads to give instant responses relating to the authenticity of the simulation (immersion) and the experience of teamwork. Immersion can be evidenced by tension, but it is a positive condition that stretches a clinician. A positive measure for team work and supportiveness in the presence of stress indicates that IPE is not impeded by the content or delivery of a scenario.

In the table below the scenarios are broken down into sets of skills that would be enacted and the inter-professional challenge that was staged to intensify the crises. All of the components of the scenario answer Ziv's authenticity domains (Ziv, et al., 2005).

Skills:	Assessment & History Taking Skills	Clinical Skills	Resource Management	Inter-professional Challenge
Dyspnoea **(Doctor's Surgery)**	• paediatric medical assessment and history • consider the differential diagnoses for respiratory distress • differentiate between asthma and anaphylaxis • recognise patient clinical deterioration and improvement	• administer oxygen, bronchodilators & adrenaline • consider antihistamine & steroids • obtain peripheral IV access • calculate paediatric drug doses • demonstrate critical thinking	• team lead a second 'peer' physician and surgery nurse • delegate tasks • prioritise treatments • communicate with team, patient, and family	• perform effective clinical management of the patient while the mother, a paramedic interrupts with inappropriate treatment suggestions, disrupting the team's workflow • provide succinct patient handover to paramedics • communicate with A&E physician • lead a team of staff who are not accustomed to working together, ensuring they feel valued
Car vs Pedestrian (A&E)	• perform a trauma assessment • obtain history of events from paramedics • communicate with a crying patient and upset mother • identify traumatic injuries • recognise patient clinical deterioration and improvement	• manage patient priorities despite pressure from radiologist • obtain IO access • administer 20ml/kg isotonic crystalloid for shock • administer analgesia • calculate paediatric drug doses • demonstrate critical thinking skills while under significant pressure • recognise the need for urgent transport to a trauma centre	• obtain a thorough history of events from paramedics • team lead a second 'peer' physician and emergency nurses • delegate tasks • prioritise treatments • communicate with patient and family	• manage the issue raised by the radiographer without responding negatively • maintain a positive working environment despite the interruptions of a disgruntled team member • diplomatically deal with the paramedic who wants his spineboard back • lead a team of staff who are not accustomed to working together, ensuring they feel valued
Child death (Doctor's Surgery)	• perform DRABCD for a cardiac arrest • obtain history from a distraught mother • address potential cultural or religious considerations • attempt to determine 'down time'	• manage a paediatric cardiac arrest • utilise a cardiac monitor • use critical thinking to determine whether to initiate resuscitation • treat asystolic cardiac arrest at the BLS and ALS levels • support the mother after resuscitation is ceased	• team lead a second 'peer' physician, surgery nurse and responding paramedics • delegate tasks • prioritise treatments • communicate the child's death to the mother	• be able to make a decision to cease resuscitation when appropriate • be able to diplomatically convince the impatient paramedics to allow the mother time with her child at the end of the scenario
Febrile seizure (A&E)	• perform a medical assessment on a seizing patient • obtain history from father • consider list of differential diagnoses for seizures	• perform airway management • administer a benzodiazepine • perform cooling measures • identify potential medication error	• team lead a second 'peer' physician and emergency nurses • delegate tasks • prioritise treatments • communicate with father	• support the nurse after a near miss drug error • advocate for the nurse when her peer is admonishing her • reassure the father regarding the nurse's abilities

The clicker results showed that three of the four scenarios had produced an adequately immersive experience. An IPE exchange of respect, co operation, skills and knowledge, could be surmised from the questions relating to teamwork, although one participant did indicate some communication difficulty and there was slight confusion over leadership in some scenarios. The uncertainty relating to leadership and communication was also independently observed. The keypad results were screened immediately for the participants. Demographic information was also collected. Samples of the results as they appeared for the participants are shown below.

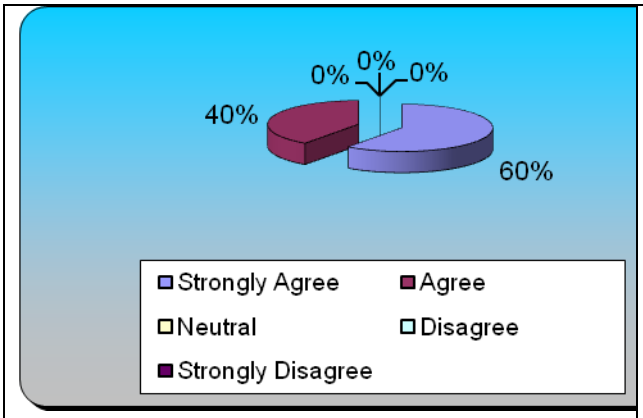

Figure 1 There was an intuitive cooperation at work in the group

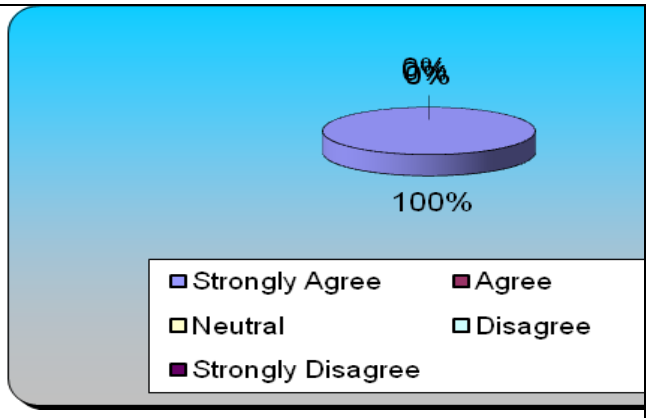

Figure 2 Patient care was a priority in the group

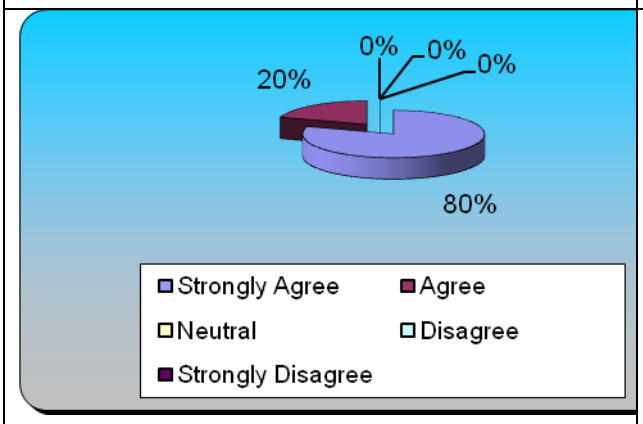

Figure 3 I felt we formed a team

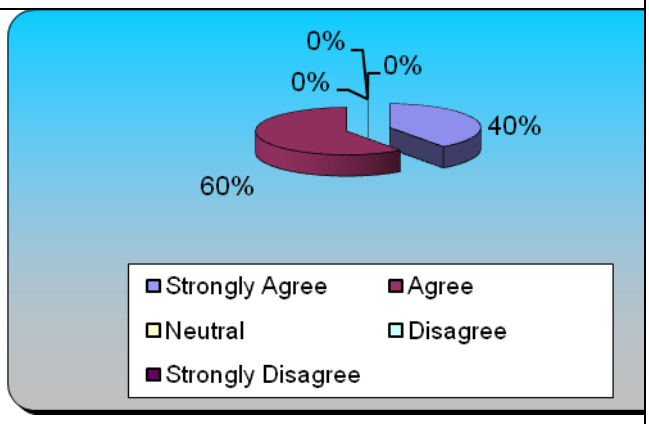

Figure 4 Consultation was occurring within the group

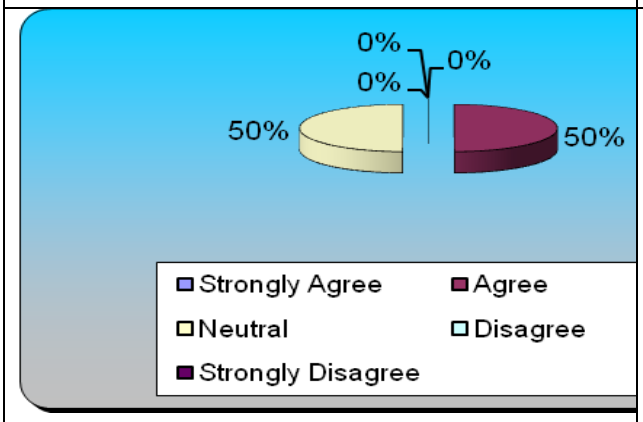

Figure 5 I felt competent and in charge

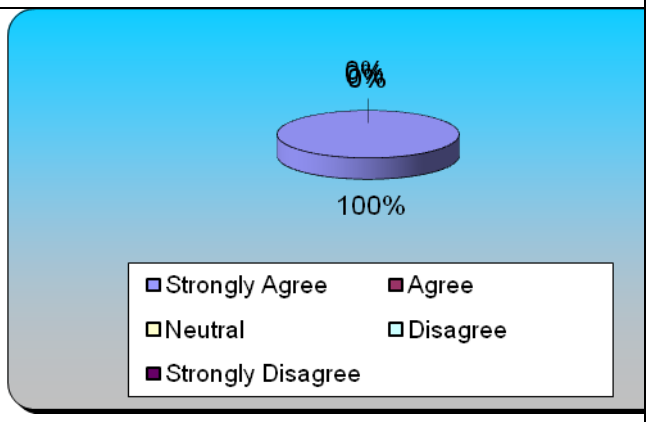

Figure 6 There was a positive and respectful attitude in the team

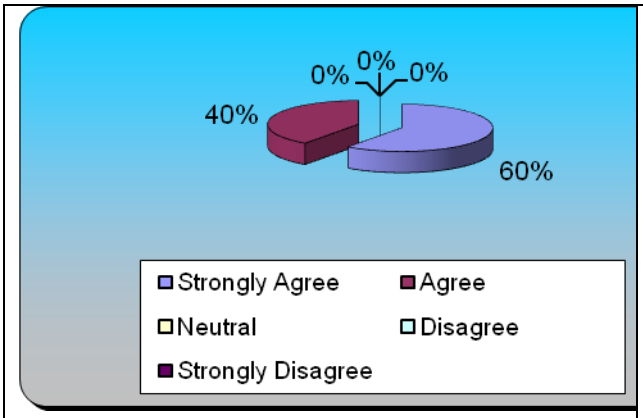

Figure 7 We resolved issues quickly to avoid conflict

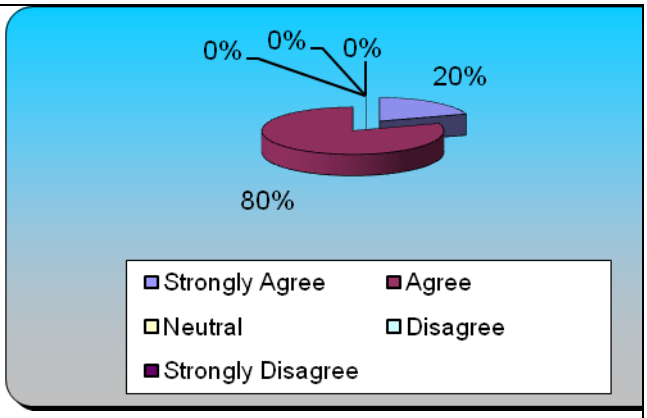

Figure 8 I experienced some anxiety

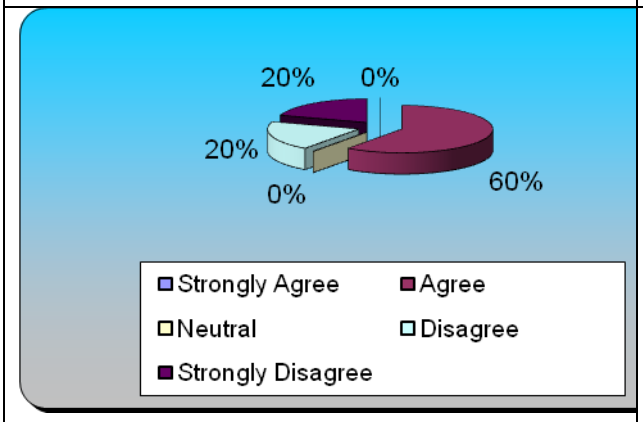

Figure 9 I felt vulnerable

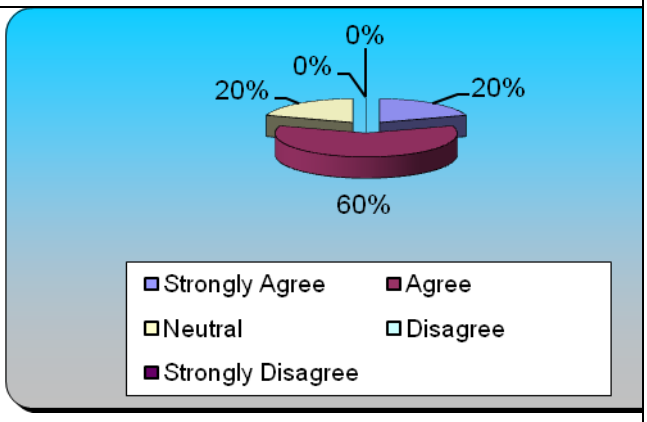

Figure 10 The physician was leading the group

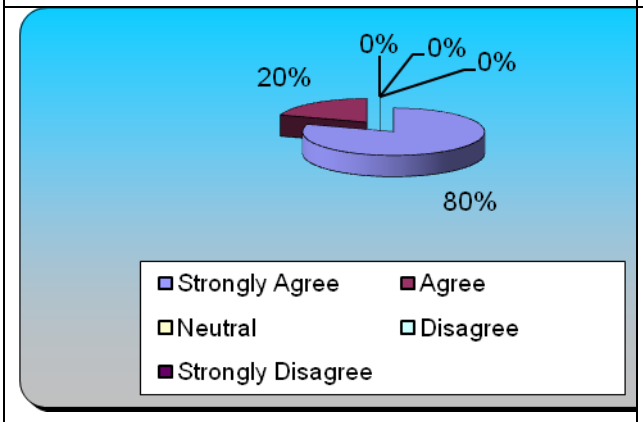

Figure 11 I felt supported by the group

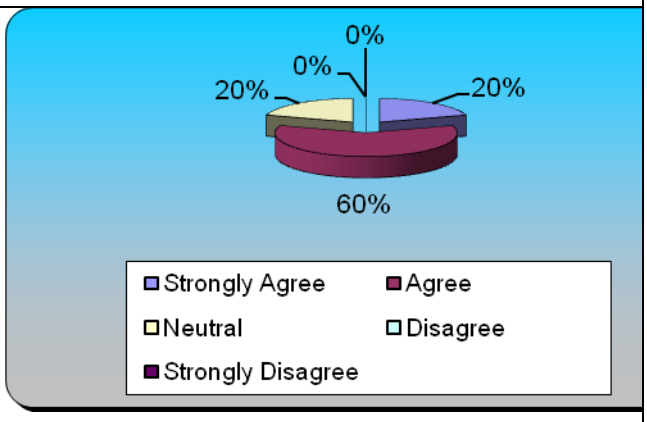

Figure 12 I felt some stress

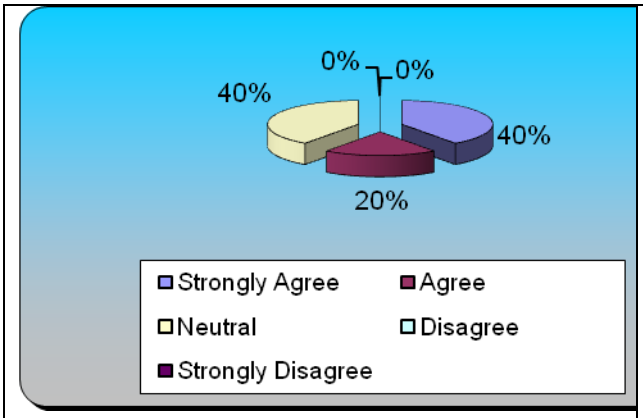

Figure 13 We overcame communication barriers

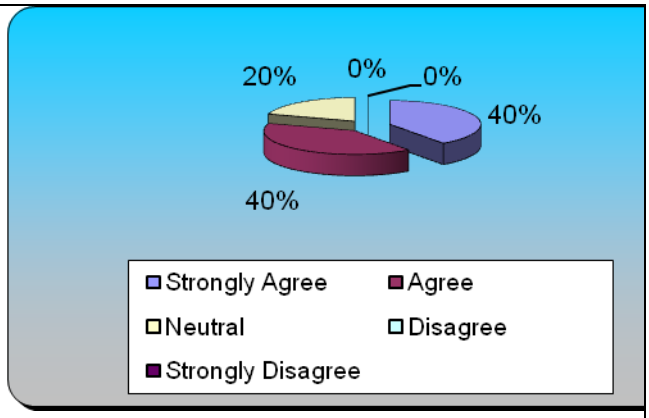

Figure 14 I felt my own skills were adequate

3. The Debriefing sessions

The effectiveness of simulation for IPE is reinforced through the debriefing process, which occurs immediately after the scenario and usually takes as long as the scenario itself (Fanning & Gaba, 2007). Practitioners who become fully immersed in a scenario demonstrate diminished awareness of dimensions that are not within their own immediate focus. These issues are drawn out by the debriefing facilitator, which helps participants become more aware of themselves and others. The debriefing became another level of evaluation of the simulation by the participants

The debriefing sessions were conducted in an atmosphere of psychological safety to allow open discussion. All debriefings were structured to sustain reflective approaches to the experience (Fanning & Gaba, 2007). Debriefing should provide feedback on both inter personal and clinical medical skills to enable participants to reflect on their performance (Berkenstadt, Erez, Munz, Simon, & Ziv, 2007b). Due to constraints of both time and technology it was not possible to include a video screening of the scenario for observation in the debriefing, although these were provided to participants for their personal use later.

Each debriefing was held without observers in a small break-out room with sofas. All clinicians involved in the scenarios participated in debriefing. The sessions were led by the simulation facilitator who was both a nurse and a paramedic with qualifications in advanced life support and simulation education.

The 'Death of a Child' scenario debriefing was supported by the medical educator who had contributed the concept of staging a death in a doctor's surgery. Participants tended to remain positive and supportive of one another, and there was not a critical evaluation of the team although some individuals reflected on their own errors or concerns. Findings indicate that the debriefing situation did create

significant learning opportunities through reflection on the scenarios, the algorithm, personal participation, differential diagnoses and thoughtful approaches to patient management.

The 'Death of a Child' scenario provided a particularly rich opportunity to confront fears and through the debriefing process, rehearse future roles. In this scenario a GP is confronted by an hysterical mother of uncertain ethnic origin whose child is cool and has no pulse and is not breathing. The child's medical records are not available, but it becomes clear the child had leukaemia and was known to the palliative care team. A second GP working in the practice comes in to help. There is a practice nurse, and a team of paramedics arrives later. A technical problem resulted in a defibrillator not working, although its use was questionable. The doctors commence compressions at the insistence of the mother. During the de briefing the team reflected on the genuine stress and fear they experienced during the scenario. In the chart, using abstracts from the de briefing the interprofessional support and learning becomes evident.

Context	*Response*	*Analysis*
Doctor's response to the arrival of a mother with a lifeless child.	Horror I was lost	The doctors had not been warned that there could be a scenario in which the patient died or could not be resuscitated.
Team members who were asked to share the decision to end the resuscitation attempt	I felt valued – included It was more collaborative than anything I have experienced in the field You looked everyone in the eye and said – should we stop?	The doctor asked each team member individually if they were comfortable to bring the resuscitation attempt to an end despite the pleas of the mother.

Doctor invited paramedic to intubate and administer adrenaline	It was a polite inter-professional thing – you have more experience so go for it	Paramedics have more contact with doctors in hospital emergency situations rather than in surgeries. Experienced emergency department doctors invariably take charge and lead their own team while paramedics stand by.
Paramedic who was invited to treat the patient	You let me work to my level as a professional	The inter personal skills of the GPs were a constant source of surprise to the paramedics.
Paramedic reflecting on the element of surprise in the scenario for the GPs	You were blindsided – if we are called to a situation like that we might have a couple of minutes in the truck to prepare ourselves	The GPs responded by saying they did not expect a lot of warning with emergencies
The second GP on the scene had co operated with the resuscitation attempt but felt it was futile and not helpful to the mother. In the debriefing others expressed this concern.	I frankly felt uncomfortable with the process of starting anything (on the patient). The priority is the mum. There is trauma in doing anything at all that is unhelpful.	The second GP had not raised any concerns during the resuscitation attempt, but neither had any of the other professionals in the room until the leading doctor decided to call the death with their agreement.
The doctor who led the scenario felt it was valuable despite the intense emotions of the experience.	Do it again – it is an important lesson. We know the theory but…	The death of a child scenario was experienced as authentic by participants and observers. All involved felt it was an opportunity to ask themselves how they would respond to a parent in such a stressful situation.

4. Video Streaming: The value of real time observation of the simulation

One of the serious limitations of IPE simulation is that only a few clinicians can participate in each session. However, facilitated observation of the unfolding scenario by video streaming keeps participants engaged in the process during their downtimes. In this research project there was an observation room for all participants who were not participating in the current scenario and the observers became a focus group evaluating the uses of facilitated observation. Observers comprised GPs, paramedic students, and double degree nursing-paramedic students. They were asked to discuss the differences in learning and teaching between observation and participation. They could comment at any time during the session. All sessions were recorded, transcribed and analysed into eight themes.

To create another level of control, the same videos were played back to a group of ten academics in the Bachelor of Clinical Practice program, two weeks later, with similar questions for reflection. The intensity and empathy which characterised real time observation was replaced by a more critical approach to clinical skills, leadership and technical issues of the simulation itself. These differences could be attributed to the nature of the group and its interests, the "afterglow" of experiential immersion that real-time observers brought to the observation room, and the fact that post-hoc facilitated observation prompts a different set of responses.

Theme	*Remarks*	*Analysis*
1. Immersed and rehearsed actors and commitment to the learning process	"It comes back to what X said before about acting….I think if everyone really commits to the task at hand it's awesome. If it's one of those really dodgy scenarios where it's Oh no Grandma is so sick, and you just go, Oh, whatever. Everyone (here) is really committed. No one's blowing it off"	The willingness of all participants to act in their roles made the scenarios convincing and realistic for the real-time observers. Immersion was related to the competence of actors as well as committed participants.
2. Empathetic observation	"I think you could be possibly unfairly critical sitting here watching them if you didn't know what it was like doing that yourself." "Without the threat (of participating in the next	Research participants who had been cycled out of a scenario to participate in the real time viewing of another simulation, were less critical of the skills and leadership of their colleagues than academics who viewed the scenes two weeks later.

	scenario) it's easy to go, oh yeah okay, I understand without actually being able to (get that line in) "Everyone's going to stuff it – don't worry about it. If you don't there's no point – we're all here to learn – what you're supposed to be getting is constructive criticism"	This worked in two ways. Colleagues were reluctant to criticise the skills and decision making of others during the simulation event debriefing, and it could have been regarded as a lost learning opportunity or a positive example of inter-professional empathy. The learning potential of the videos as a retrospective and subjective tool for clinicians and their supervisors was made clear.
3. Increased inter-professional understanding and respect by exposing vulnerabilities	"For me, when I heard the way you analyse things here, I have a great respect for you guys." "The first thing you said was, well that was pretty stressful. And me and X said It was pretty average. We always sort of thought of doctors as god like. We didn't realise this isn't your bread and butter." "When I was a brand new doctor I was scared of everyone..not just my medical seniors but the police and the ambos who might come in. Everyone had a lot more experience and I was the doctor." **"**There are some people I've worked with out there who don't know how much you guys know or what you can do."	When GP registrars expressed their vulnerability and lack of confidence in certain emergency situations, the paramedics gained a new insight into their own role in emergencies, even if a doctor was present. The two professional groups gained respect and became more comfortable working together .
4. The role of stress in simulation	"It's a lot less stressful sitting here and watching it than being in it. But stress helps…it is a helpful thing at times," "The intensity of when I walked in there was huge. Physically when I went in there it was all quite overwhelming, I felt it going from this room to observing in the actual (clinical)	It was evident that observers who had just come out of their own simulation, carried some of the tension into the observation room. They were aware of the tension of the participants, and they also came to appreciate the role of stress in learning. Observation gave them a chance to look at the big picture and select which participant to focus

	space." "It becomes a little bit passive in the learning sense when you haven't got that tension or the stress there, are you would have when you're actually treating a patient and learning that way." "You know this is quite full on because you've done it before." "So I think you can get much more out of it than just a normal video that you would watch and sort of ..tune out a bit." "So yeah it's absolute chaos…but you can sort of educate them on controlled chaos….you're capturing some of this unpredictability – this unpredictability is something that you learn from."	on as the scenario unfolded. They also made choices about what they would observe
5. Focus	"When you're observing you're not going through the motions and learning the ABCD stuff but you're probably taking a more critical look at it." "It (information) would draw your attention away from what's going on …you'd be going through that." "If someone is going to tape it and someone is watching that adds a whole dimension to it, whereas if it was just a small group….it would be more like real life because you know that there isn't going to be a record of what you've done." "I was following X (in the video) just because I was quite positively surprised by the way he communicated. He did give some feedback at times to the	In the observation room participants could access copies of the script for the unfolding scenario. Observers did not feel their learning was enhanced by the additional information They often made their own choices about an aspect of a scenario they would follow, such as an individual, but some watched the clinical process. This focused observation was a contrast to later viewings with academics who took a global and critical interest in skills performances, both clinical and inter-personal.

	patient and he was speaking more clearly than everyone else, so I could hear him, and I guess that's why I followed him, naturally." "I concentrated more on numbers – the list of differential diagnoses in my head, and that side." "I was focusing more on the diagnosis." "I've found leadership is a challenge for me. And so I was actively watching how he was delegating."	
6. Learning from one another	"He was talking to X and being positive about what he was doing, based on his views and what he needed, and he explained it again, You've done really well, and this is the next thing I need you to do. And keeping up all that positiveness in a really stressful situation." "The doctor was giving a lot of reassurance to the child (manikin)….trying to remember the person in the scenario and give him comfort"	The inter personal communication skills of the General Practitioner interns were a surprised and source of interest to the paramedics.

Reflection on findings & concluding thoughts

Two key elements of IPE are addressed by simulation: the opportunity to gain inter-personal and interprofessional confidence in a complex and collaborative health care situation; and the transfer of knowledge between health professionals. There is no doubt that simulation is an effective tool for adult learners because it enhances engagement and the transactional and participatory elements are expressions of the best andragogical or adult learning practice (Fanning & Gaba, 2007; Knowles, 1978). Interprofessional simulation stimulates adult professionals to use their clinical psycho-motor skills while simultaneously strategising to resolve the team's internal and external interpersonal issues. The post graduate doctor goes beyond repetitive clinical skills acquisition in the more complex IPE situations because the script makes it impossible to approach the patient as only a cluster of biomedical problems.

The potential for collaborative research into IPE to provoke spontaneous interprofessional learning exchange was evident from the start of the project. For example, as paramedics planned the simulations they became aware of the limitations in their own knowledge of general practitioners' working environment, skills, and knowledge. The medical educator involved in evaluating the pilot sessions was in fact providing paramedic and nursing academics with useful insights into the GPs working world. At another level, the research process demonstrated a web of post-simulation learning opportunities for all professions through personal and group observation of the video recordings, reflection and further instruction for the refinement of clinical skills.

The focus of interest for individual observers was significant. Observers often made their own selection of the clinician whose actions they followed, or the clinical event that they wanted to watch. This was sometimes based on their personal learning needs, such as an interest in leadership or communication skills, or a decision about drugs dosage. As clinicians shared down time from scenarios in the focus-group their observations revealed the depth of learning which occurred spontaneously. In the focus groups the GPs were transparent about their own challenges to confidence and skills in emergency situations, and they expressed respect for the knowledge and skills of student paramedics. In addition, final year paramedic students discussed that their previous perception that doctors were 'god-like' and 'natural leaders' in emergency situations, when in fact the GPs said they were: *"Waiting for you guys."* The paramedics learned about the limitations of equipment in a general practice, the few opportunities doctors had to practice many of their skills, and the fact that general practitioners generally excelled in communications whereas those "*hardwired for emergencies*" would focus on hospital emergency department work.

In one scenario participants reported less engagement, and to the observers there was a sense of unreality or unauthenticity. On reflection detachment in the fourth scenario could be attributed to some levity and distraction because it was staged after lunch, and after the death of a child scenario. Participants had got to know one another and the actors began to increase the intensity of their roles. Although the fourth scenario may have seemed to lack authenticity resulting in lowered engagement for the participants, when it was viewed by academics a fortnight later it was judged to be realistic and they did not notice any evidence of disengagement. This tended to confirm that real-time observers carried the mood of the venue into their break-out room, whether it was tension or levity.

The significance of observer and actor effect is particularly evident in simulation. Higher order simulation as a teaching and learning tool is greater than the sum of its parts, so that the learning potential is not quantifiable and predictable but dependent upon the responses of a discrete group of participants and their responses and choices in that unique event. It is subjective and objective, and it is dynamic and volatile, and for this reason the viewing and replaying of simulations creates multiple learning and teaching opportunities.

However, simulation for IPE is such a time and labour intensive practice that it can only be justified by its capacity to continue delivering potent clinical education at multiple levels, both to the immediate participants and future observers. To achieve its full potential future IPE simulation would need to be paired with instructional clinical workshops for the practice and evaluation of skills, and close collaboration with the participants' own medical educators or supervisors for a critique of their leadership, team and communication skills.

Limitations and lessons learnt

This project was limited in that it was not designed to re visit the clinical skills deficits that participants identified during their de briefings. Future IPE simulations would need to factor in focused training of the specific clinical skills indicated in the scenario design, to make it a more comprehensive educational tool. In an educational setting, rather than a research situation, a medical educator could focus immediately on the clinical issues and demonstrate, for example, a more appropriate rate of compressions for resuscitation. A medical educator could also have focused on the drug calculations and the most appropriate use of defibrillation, resuscitation rates and duration, and the use of specific drugs for the differential diagnoses.

At the same time, because it was a research project, some dimensions of the project were not fully developed. This seemed to be particularly true in the debriefing sessions where there was an uncritical

approach, a lack of interpersonal intensity or judgement. A number of reasons for this could be suggested, and rather than deference to doctors it was the recognition of a research situation. The medical practitioners were invited participants and the host professionals did not set out to judge their skills, but rather focus on the inter-professional elements in an emergency setting. The facilitator was more used to physician-led situations and in a research project did not want to draw attention to their clinical skills in the same way that she might deal with paramedics and nurses. Many of the debriefing participants were informed actors who would not take unfair advantage of the GPs who had gone into the scenarios without any knowledge of what they would encounter. However, GPs were aware of their own training needs, and the scenarios did provide an opportunity for participants to make a personal audit of their skills.

The observers were also uncritical of those participating in the scenarios, for another set of reasons. Those who had participated in simulation, unlike academics viewing the videos two weeks later, carried urgency and tension into observation, and they were empathetic towards those engaged in the scenario. In addition, during observation they reported that they had a more complete view of the scene than they had during participation, and they were able to think more deliberately and reflectively about diagnosis and treatment. The scenarios had simulated the haste and confusion of a genuine emergency. The role of stress as a positive stimulation for learning was discussed by the observers. Observers also recognised that the depth of their personal commitment to the simulation, such as suspending unbelief and relating to the manikin and actors in a realistic way, had been part of its effectiveness. None of these factors were evident to those observing the videos two weeks later when the focus was entirely on clinical and leadership skills. Simulation depends on technology and technological limitations were made clear in the responses of the academic observers of both the pilot session and the final simulation workshop. Many technical problems that were not immediately noticed by participants were clearly observed by others both in real time streaming and in later video screenings. These problems included equipment that could not be made to work by participants, such as a defibrillator that required a specific connection; the limited authenticity of the manikin in terms of pallor and breath sounds; the comparative weight and size of the manikin in relation to the child actor in a prequel video; the sudden substitution of manikins so that one was available for paramedics to transport. Observers also experienced some frustration with sight and sound. The fixed cameras provided only a limited perspective and observers could not always see the computer displaying vital signs as actors moved around the patient. Between the pilot and the workshop technicians had worked hard to overcome the technical limitations, but surprisingly participants factored technical problems into the scenario. Real-time observers were quick to comment

that in a doctor's surgery equipment would be limited, or missing, locked up in a cupboard while a practice nurse was at lunch.

Despite the limitations of the study, and the expense and labour intensity of simulation for IPE, it has the capacity to provide intensive educational experiences in rare events such as paediatric emergency or disaster, for selective groups of post-graduates. Its educational value can be extended to various levels: to participants, observers in real time, and cohorts of students observing after the event.

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Appendix. 1. Literature search results

Total articles returned for the search *n = 46*

Table 1: Key terms (categorised into three search term sets)

Set 1: Interprofessional Education (IE)				
Search engine	**Search terms**	**Articles returned**	**Articles accepted**	**Articles rejected**
EBSCOhost (medical)	Interprofessional Medical education Best practice	9	4	5
	Interprofessional Medical education Teamwork /Collaboration	5	3	2
	Interprofessional Medical education Simulation	40	12	28
Search engine	**Search terms**	**Articles returned**	**Articles accepted**	**Articles rejected**
MEDLINE	Interprofessional Medical education Best practice	3	0	3
	Interprofessional Medical education Teamwork /Collaboration	0	0	0
	Interprofessional Medical education Simulation	5	2	3
Search engine	**Search terms**	**Articles returned**	**Articles accepted**	**Articles rejected**

SCIENCE – DIRECT (health sciences)	Interprofessional Medical education Best practice	50	6	44
	Interprofessional Medical education Teamwork /Collaboration	42	3	39
	Interprofessional Medical education Simulation	20	3	17
Total accepted articles for IE			**33**	

Table 2: Key terms (categorised into two search term sets)

Set 2: Simulation-Based Medical Education (SBME)				
Search engine	**Search terms**	**Articles returned**	**Articles accepted**	**Articles rejected**
EBSCOhost (medical)	Simulation-based medical education	30	8	22
	Simulation-based medical education Best practice	1	0	1
Search engine	**Search terms**	**Articles returned**	**Articles accepted**	**Articles rejected**
MEDLINE	Simulation-based medical education	27	5	22
	Simulation-based medical education Best practice	0	0	0
Total accepted articles for SBME			**13**	

Limitations placed on the search

- Books were omitted
- Articles prior to 2002 were omitted

Articles in the initial search were rejected due to the following reasons:

- Search engine returned articles relevant to only one or two search terms i.e. medical; best practice
- Search engine returned articles not in English
- Articles had been returned in a previous search and were therefore a duplicate of those already accepted
- The article is specific to a certain aspect of a particular profession and had no generic application

Articles were rejected upon in-depth reading for the following reasons:

- Limited usefulness to the purposes of the research
- Limited transferability of information

Appendix .2. Interprofessional Competencies

(Developed from Bandali et al, 2008, p. 182; Bridges et al, 2011, p. 6; Buring et al, 2009, p. 5; MacDonald et al, 2010).

Teamwork	The ability to synthesise observations and expertise, develop common goals, make joint decisions and work together to optimise patient care, determine team rules, make optimal use of professional knowledge and skills, seeks out the contributions of other team members.
Communication	Communicates clearly, is able to enhance team functioning, advocates, consults with others, can explain roles to others, choose effective communication tools, identify and overcome communication barriers.
Collaboration	Can work collaboratively with other health professionals to assess, plan, provide, and review care in a variety of practice settings.
Professionalism	Exhibits professional behaviour, respects the roles and approaches of one's own and other disciplines/professions, demonstrates positive attitudes and behaviours, addresses misconceptions and stereotypes among team members.
Knowledge of roles	Understands and can demonstrate the scope of one's own professional role and the roles of other healthcare team members.
Responsibility (and assertiveness)	Raises issues or concerns that may jeopardize patient outcomes with other team members, is accountable for individual and team outcomes, assesses and enhance team performance through self and peer assessment.
Conflict management	Can demonstrate consensus building, negotiate, conflict management, identifying and resolving issues on organisational, team and individual levels.
Critical thinking	Can evaluate steps and processes in problem solving and decision-making.
Leadership	Can facilitate team meetings, clarify objectives, determine roles, review and complete tasks, delegate, mediate, sustain team culture, support team members.