Using simulation in Paediatric Emergency Medicine – An interdisciplinary, multi modal program.

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Simulation-based learning (SBL) is being used as a teaching tool, in a range of health professional training programs, both at the undergraduate and postgraduate levels, as it enables educators to produce relatively realistic patient encounters at times convenient to both students and tutors. Using a variety of modalities, including actors and manikins, the SBL 'patient' is created with physiological parameters, wounds and sounds to create an infinite number of 'real' clinical encounters suitable for a range of learning objectives from simple clinical skills, through algorithm based rehearsal to challenging patient management issues, team-work and crisis resource management(CRM) . Embedding learning in realistic cases or scenarios and coupling this with debriefing is what differentiates simulation based learning from traditional skills-based learning. There are numerous reports of its use in adult emergency medicine (EM) and a smaller but growing number in paediatric EM, including 'in-situ' and laboratory-based programs as well as descriptions of applications such as orientation to practice, teamwork, exam preparation and practice review. Collectively these publications reveal that SBL can be applied in a number of settings to a range of purposes although practical descriptions that assist newcomers wishing to introduce SBL into their programs is relatively lacking. In New South Wales the Child Health Networks, The Children's Hospital at Westmead, The Sydney Children's Hospital, the Sydney Clinical Skills and Simulation Centre and the Kim Oates Australian Paediatric Simulation Centre have worked in partnership to produce a variety of programs addressing the needs of the undergraduate and

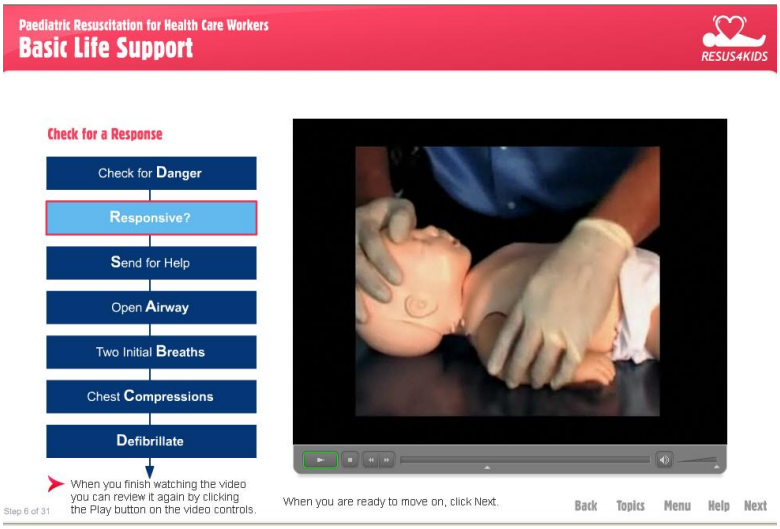
postgraduate workforce at the level of the tertiary paediatric hospital, non-specialist hospitals across NSW and the University of Sydney. This report highlights a number of the educational applications of SBL in paediatric EM with the purpose of describing activity and guiding new program developers.

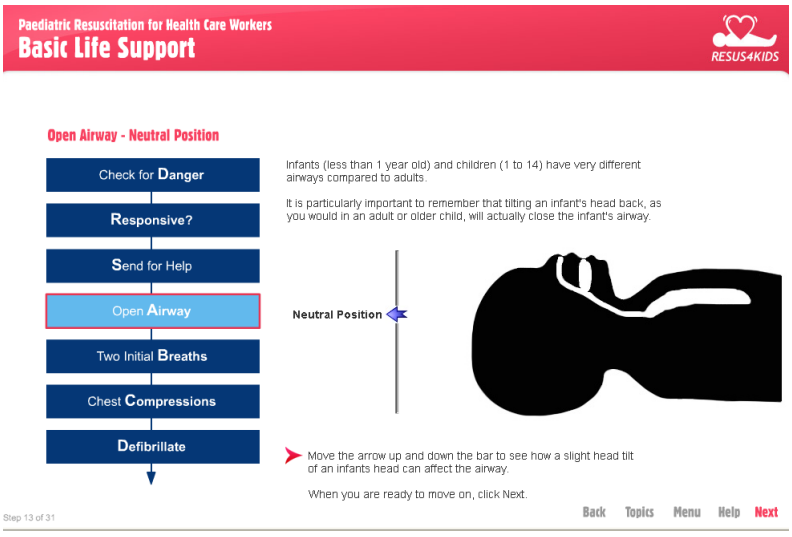
When creating simulated learning environments one must consider both the reliability and validity of the scenarios. Validity is how 'real' the situation appears to the participants. Increasing the realism of a simulated encounter increases its value to learners although how this translates in terms of complexity of the manikins and learning environment is not clearly defined, depending rather on the experience of participants and what learning outcomes you want to achieve. Some applications require more sophisticated manikins or professional actors and comprehensive environmental props although for many applications good learning outcomes can be achieved with relatively 'low fidelity' manikins and simpler set-ups. It's not the expensive manikin that makes a good scenario it's the scenario itself, with an expert faculty to run it. Reliability refers to the degree to which the scenario is reproduced each time it is run. This is important when using scenarios as part of a formal accredited course or assessment process. It is also essential to consider this when you have specific learning outcomes to achieve.

Distributed Simulation Based Learning: RESUS4KIDS

RESUS4KIDS is a multimodal basic and advanced paediatric life support course for health care workers which has just received funding from NSW Health, via the Child Health Networks, for roll out State wide. The course is designed to be delivered at undergraduate or postgraduate level to medical, nursing, allied health or paramedic participants to equip them with the essential skills for the first 10 minutes of a paediatric collapse.

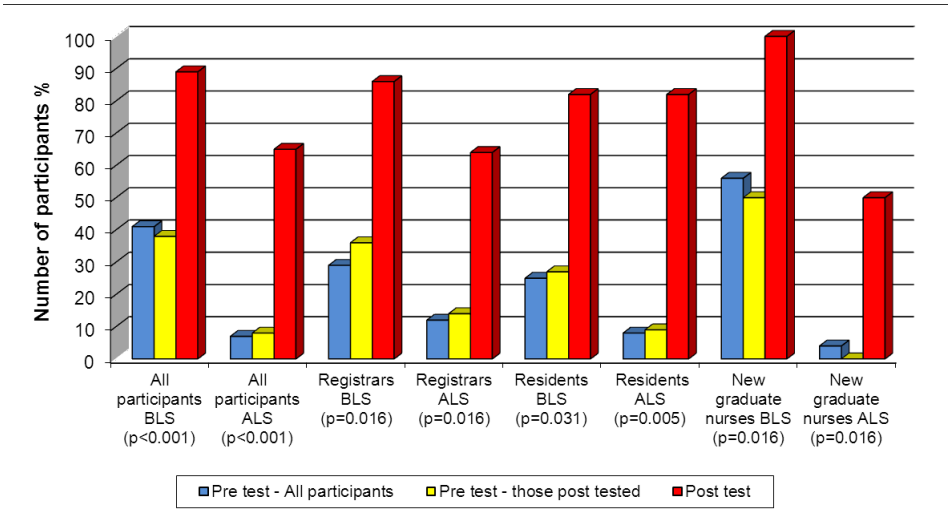
The course is divided into an e-learning module and a short practical course. The e-learning is designed as pre-learning and enables tutors to deliver the practical component in a relatively short time as theory will have been acquired before the face to face session. The e-learning uses a mixture of interactive steps and

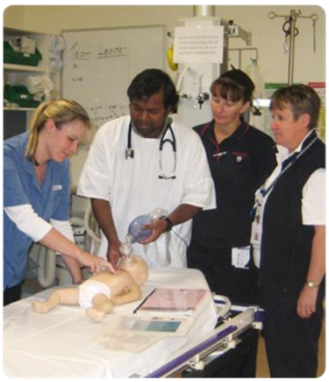




video to take the participants through the stages of a paediatric resuscitation, recent additions to the e-learning include lessons on use of the EZ-IO drill, 4Hs and 4Ts and abnormal rhythm management.
The e-learning has been well received and to date over 44,314 lessons have been accessed with over 2626 participants completing the whole course and passing the post course test.
The e-learning has been evaluated in medical students, nurses and doctors using a before and after methodology using a simulated arrest in a 12 month old. With medical students we demonstrated a 57.7% (95% CI 34.9-80.5) improvement in their ability to perform basic life support (BLS) and an 80.8% (95% CI 61.8-99.8) increase their in ability to perform advanced life support (ALS), p<0.001. The graph below illustrates a similar improvement in medical and nursing staff.

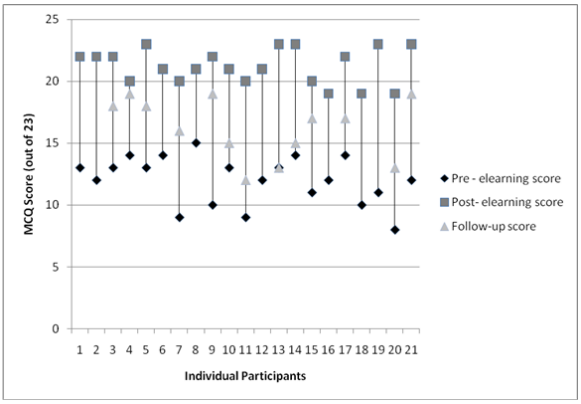
The ability to perform BLS and ALS pre and post e-learning





The short practical course is divided into two sections: team work and communication (30minutes) and scenario based, pause and discuss format, hands on practice (60 minutes). The first section uses a game and video to illustrate the need for effective team work and communication in a critical situation and introduces some of the principles of crisis resource management. The second section takes the participants in a pause and discuss format through the structured assessment and management of an infant in cardiac arrest, covering both defibrillatable and non defibrillatable arms of the algorithm. Each participant demonstrates their ability to perform each of the basic life support skills such as bag and mask ventilation and chest compressions. The course is needs minimal equipment and uses an infant manikin such as the ALS baby (Laerdal). The course uses a train the trainer and Super trainer model to allow it to be delivered at unit or facility level throughout NSW. Over 800 participants have completed the whole course so far. There has been particular interest at undergraduate level at CHW, Tweed Heads and Bathurst. At postgraduate level courses are now being held throughout NSW in all three Child Health Networks and the recent funding will allow for the employment of project officers and Staff Specialist support to integrate the program into the annual learning needs of every healthcare worker who may potentially treat a sick infant or child. Medical students completing the pilot program were evaluated pre and post e-learning and again at eight months with a multiple choice knowledge test. The results

are consistent with other literature showing a degrading of knowledge with time, but better than before the course. RESUS4KIDS is being integrated into the ED orientation program at CHW and this year all 16 of the Pre-intern students attached to the CHW Clinical School completed the program. For further information on RESUS4KIDS see www.resus4kids.com.au or contact Fenton at fentono@chw.edu.au



Assessment and Feedback: Mini-CEX Simulation in the ED

Mini clinical evaluation exercises (CEXs) are short, individual, patient centered exercises with clear learning objectives increasingly being used as both an assessment and education tool by the specialty colleges. Exercises can include history taking, examination skills, clinical skills and clinical reasoning cases and have the benefit of providing immediate direct feedback to the participant by a perceived expert. Within the emergency department it can be difficult to find 'ideal' patients who have the right mixture of symptoms and signs at any one time. The benefit of a simulated patient is that an ideal scenario can be repeated time and time again for each participant, at a time convenient to participant and facilitator. At CHW we are using 'low-fidelity' manikins such as Megacode kid (Laerdal) combined with computer generated physiology to reproduce patient encounters for individual learners.

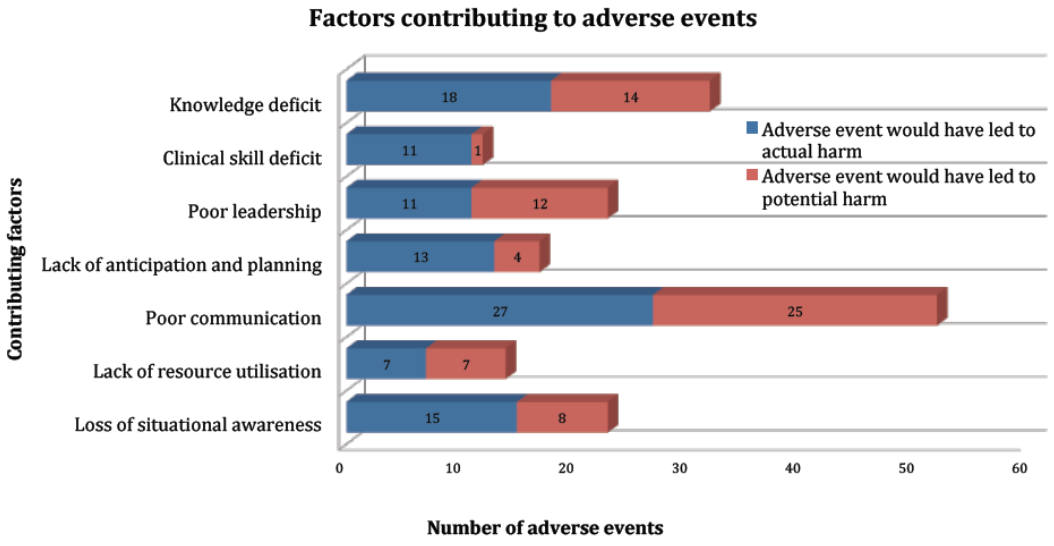
We recently evaluated this approach with a mini-CEX on anaphylaxis and 100% (n=56) of participants reported that they either agreed or strongly agreed that the session had improved their knowledge of anaphylaxis, liked the method of education and would recommend the session to their colleagues.

In-situ Simulation Based Learning: CHW interdisciplinary scenario based teaching program

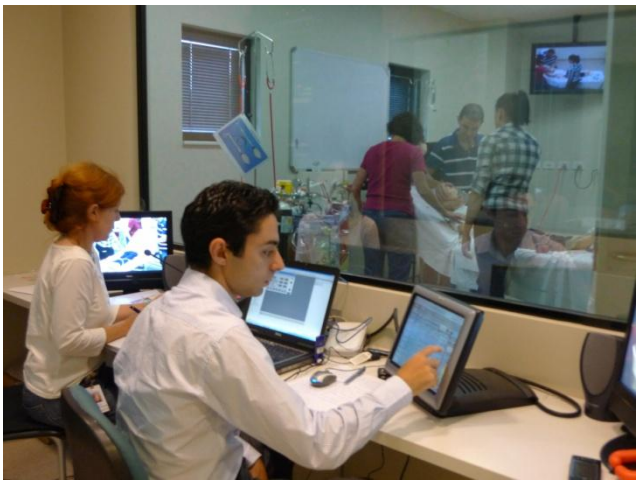
Over the last year we have developed an in-situ scenario based teaching program that is run for doctors, nurses and students within the ED. One morning each week we run a scenario using the same technology as for the mini-CEX, incorporating low-fidelity manikins and computer generated physiology. We have a bank of ten scenarios

that run from week 2 of each 13 week term, and the whole program runs four times a year. Scenarios have specific learning outcomes that are suitable for a mixed group of participants; examples include status epilepticus, life threatening asthma, blunt trauma and septic shock. We are also running sessions in

conjunction with the department of anaesthesia. The program is currently being evaluated on several fronts. With 3 months follow up the nurses who have participated in the program report that 10% had encountered the same life threatening event, 24% had used the new knowledge or skills learned and 94% perceived an increase in confidence in future management of the clinical situation. In-situ simulation also enables system issues to be identified and rectified. So far ten significant system issues have been addressed. We are also applying a quality assurance approach to the program trying to capture reasons that may lead to potential or actual patient harm. Each scenario run in ED or in the operating theatre is evaluated on a standardised proforma and when adverse events occur the educator will determine the cause of event. This occurs after the debriefing to ensure the educator is aware of all the facts. The graph below illustrates preliminary findings.



Laboratory-based Simulation Based Learning: Paediatric Emergency Crisis Training (PECT), PETALS and Paediatric Team Training (PETT), Paediatric Trauma Team Training (PTTT) and Paediatric Emergency Medicine Crisis Management (PEMCM)



PECT is a one day interdisciplinary course for advanced trainees (ACEM and RACP) and ED nurses held at the Kim Oates Australian Paediatric Simulation Centre (KOAPSC). The course focuses on introducing the concepts of team work, communication and crisis resource management along with the management of difficult clinical cases. Most of the cases are drawn from real presentations to CHW ED and are chosen to cover a range of critical presentations eg trauma, shock, seizure, airway obstruction etc. The course has expert medical and nursing faculty who run the scenarios and facilitate the debriefs. Each course has 6 doctors and 4-8 nurse participants.

Learning outcomes for the scenarios focus both on crisis resource management principles as well as specific knowledge and clinical skill acquisition. We find that interdisciplinary learning works well in this environment but we ensure that there are both medical and nursing faculty participating and that learning outcomes address both groups of learners. The temptation to make the course more diagnosis and treatment based has been avoided and scenarios are designed to appeal to the whole audience.

The course builds as the day progresses, so topics taught in the morning are reinforced in debriefing the scenarios. Faculty development has been a critical step in establishing this course, both medical and nursing and will be essential in ensuring the course continues.

PETALS is a similar program run since 2002, and pitched at a multi-professional group of staff working in a dedicated manner in paediatric ED and paediatrics wards within the Northern Sydney Local Health District. PETT developed in 2005 through the GESCHN program and PTTT (developed 2008) sponsored via NSW ITIM (see below) are based on similar principles and available for multi-professional teams across the GESCHN network and state respectively. Methodologically the courses are similar to PECT all integrating rehearsal of guidelines, teamwork and decision-making in case management and CRM. Hundreds of staff have completed these programs since their introduction.

PEMCM is the daughter of the adult course, EMCM and is a two day course held at The Sydney Clinical Skills and Simulation Centre (SCSSC). This course is designed for less experienced medical staff. Day one covers the principles of team work, communication and crisis resource management, as well as paediatric resuscitation, the approach to an unwell child, neonatal emergencies, respiratory emergencies and acute airway skills. On day 2 participants are immersed in scenarios and are able to practice some of the clinical skills they may have learnt on day 1. This course has been designed in partnership with the SCSSC and the Hospital Skills Program (HSP). Attendees are either registrars in the ED at CHW or CMOs enrolled in the HSP. This participant mix brings a unique blend of skills and experience to the scenarios with huge educational benefits to both groups

Greater-Eastern Southern Child Health Network (GESCHN) and NSW Institute for Injury and Trauma Management (ITIM) programs

Between 2005-2011 these NSW Health funded programs led by the Sydney Clinical Skills and Simulation Centre in partnership with SCH, included a suite of paediatric SBL courses for a range of settings including paediatric EM, ICU, Perioperative care and general paediatrics. EM clinicians from both children's hospitals as well as rural paediatricians were highly instrumental in instructing in the program's courses which included laboratory-based multi-professional courses on CRM including "Paediatric Emergency Team Training; and Paediatric Trauma Team Training. The content and format of these courses in conjunction with PECT and PEMCM (described elsewhere) demonstrate how a central technique can be expanded and varied to create courses pitched specifically at the learning needs of different groups without needing to write course curriculums from scratch, an economical way to develop curricula. Other courses in the program included the advanced team and patient communication course also suitable for EM clinicians and the mobile modular and broadband programs described below.

Mobile and outreach SBL: GESCHN / ITIM Mobile Modular Program

A variation of in-situ simulation, this form of SBL transports simple mobile systems to off-site locations including in-situ ward set ups in wards and also non-clinical educational facilities. This approach is useful in addition to in-situ when learners work in different locations and disciplines and the availability of a real ward, such as a resuscitation bay, cannot be guaranteed. In this program a series of half-day study modules were developed around specific themes including paediatric head trauma, breathing difficulties and deteriorating patient and pitched at medical and nursing staff of intermediate level experience including career medical officers, resident medical officers and nurses working in non-paediatric hospitals. In particular it was designed for community and rural emergency department staff. As with the other programs described in this paper, this form of simulation is scalable to match pitch

with learners context and experience levels. For example the MM program was adapted and delivered easily to staff requiring tertiary hospital level training (SCH) as well as ED staff in metropolitan general hospitals and rural facilities. In the latter it coupled well with the one day PLS course. In the later stages of the program the mobile modular course was delivered over broadband.

Instructor development

Instructor development courses are run by the KOAPSC and the SCSSC and a large component of instructor development has occurred by way of buddying and mentoring in the larger laboratory based courses.

10 tips to develop your own program

1. Find an expert who has done it before, and learn from them
2. Start small – bigger isn't better
3. Engage the rest of the ED, hospital, University, etc
4. Simple scenarios often work better – consider learning outcomes.
5. Using real patient presentations adds validity
6. Don't buy expensive manikins
7. Scenario design, directing and debriefing are all equally important
8. Invest in faculty
9. For interdisciplinary learning you must have interdisciplinary faculty. Ensure learners are familiar with content before tackling inter-professional objectives.
10. Don't throw any unused equipment away