Otago Medical School Simulation Strategy

A plan for simulation-based education and research at the Otago Medical School

2018-2023

Division of Health Sciences

Approved by OMS Executive September 2018

Author: Dr MaryLeigh Moore,
OMS Simulation Lead

UNIVERSITY OF OTAGO

CONTENTS

VISION

Best-practice simulation-based education (SBE) integrated within health professional programmes at the Otago Medical School (OMS) producing outstanding graduates who will contribute to optimal patient experiences and outcomes

Simulation-based education (SBE) is an extraordinarily powerful tool for producing health professional graduates who are knowledgeable, skilled and actively engaged not only with patient care and outcomes, but also with their own life-long learning. The Otago Medical School (OMS) has both the opportunity and expertise to implement SBE that is deeply embedded and integrated into its health professional training programmes. Through a combination of careful planning and collaboration alongside the embracing of diversity, innovation and opportunity, OMS will be able to maximize benefit from high quality best-practice SBE while also exercising responsible stewardship of the required resources.

INTRODUCTORY COMMENTS

SCOPE AND PURPOSE

This strategy is intended to apply to all health professional training programmes and courses within the Otago Medical School (OMS). These include undergraduate and postgraduate courses across several professions. The impetus for the development of the strategy arose specifically in relation to the MBChB undergraduate medical programme and the MBChB programme is a major stakeholder, however the strategy intentionally applies to all health professional programmes and identifies and acknowledges the benefits, synergies and strengths, as well as challenges, from an inclusive approach encompassing all courses offered by the OMS. The primary purpose of an overarching OMS strategy is improved access to, and efficiency and effectiveness of, SBE through a shared vision and aspiration for high quality best-practice SBE and greater coordination and collaboration across all schools, campuses and sites where OMS students learn. Specifically this includes the School of Biomedical Sciences (BMS), Dunedin School of Medicine (DSM), University of Otago Christchurch (UOC) and University of Otago Wellington (UOW), and regional and rural sites. At this point specific courses known to include SBE components include the MBChB programme, the Postgraduate Rural Programme in the Section of Rural Health (DSM), the Centre for Postgraduate Nursing Studies (UOC) and the Department of Radiation Therapy (UOW). The MBChB programme features within the strategy as both a key stakeholder and as one example of an OMS professional programme endeavouring to optimise use and outcomes from SBE within its own course and through collaboration with others.

The importance of interprofessional education (IPE) for health professional programmes in general, alongside the strengths and opportunities from interprofessional simulation (IP Simulation), suggests that consideration of the optimal relationships between all University of Otago Division of Health Sciences (DHS) programmes in relation to SBE is warranted. Other DHS programmes known to be using SBE include School of Physiotherapy, Faculty of Dentistry, School of Pharmacy, and in the Division of Sciences (at least through IPE), the Dietetics programmes in the Department of Human Nutrition.

DEFINITIONS

Simulation and clinical skills are often incorrectly conflated.

Simulation is an education method, an educational approach which is far-reaching and varied in its utility and formats.

Clinical skills (CS) is one content area and set of outcomes well suited to SBE. CS is also more than the procedural skills many people think of, especially when they are thinking about SBE.

SBE is also much more than the 'high-tech' and 'tools' activities many people think of. Advanced communication skills are an important example of clinical skills optimally learned through SBE where the simulated component, the patient, is provided by a professional actor.

And finally simulation is NOT role-play.

OMS adopts the following definition of simulation-based education (SBE) in health professional programmes:

"Healthcare simulation is an instructional medium used for education, assessment, and research, which includes several modalities that have in common the reproduction of certain characteristics of clinical reality. Simulation-based educational activities rely on experiential learning, including feedback and reflection. As a fundamental requirement, they must allow participants to affect, to different degrees, the course of the educational experience through verbal or physical interaction with the simulated components, including simulated patients." (Adapted from Chiniara, Cole et al. 2013)[1]

A full list of definitions is included in Appendix One. (p19)

Elements or aspects of reality which can be represented or reproduced in simulation include:

1. Environments/contexts in which patients receive care (and locations of transitions of care): e.g. home, community and primary care facilities, ambulatory secondary/tertiary care facilities (OP clinics), inpatient ward environments, other secondary/tertiary care environments - emergency resuscitation bay, operating theatre, intensive/critical care environments transport environments
2. Patients and part of patients: full-body human simulators [2], manikins, part-task trainers, simulated patients (SPs) using professional actors and trained volunteers
3. Patient conditions: both presentations and specific conditions or components of them such as specific signs or symptoms

[1] Chiniara G, Cole G, Brisbin K, Huffman D, Cragg B, Lamacchia M, Norman D. 2013. Simulation in healthcare: A taxonomy and a conceptual framework for instructional design and media selection. Medical Teacher.35:e1380-e1395.

[2] 'Full-body human simulators' describes computerised life sized manikins (such as the Laerdal SimMan3G simulator) which have features additional to standard resuscitation manikins (such as Laerdal Resusci Anne) including usually the capacity for spontaneous breathing.

4. Single episodes of patient care and/or patient journeys through healthcare including transitions across and through the various health care environments. This 'patient journey' type of simulation is most relevant to health systems planning and evaluation.

SBE has been described as encompassing 4 main types of activities (Okuda Y, Bryson EO et al. 2009):

1) use of real people as simulated (or standardised) patients (SP)
2) part-task trainers or simulators usually used for procedural/technical skills and examination skills training
3) fully immersive simulation (or full environment simulation FES) using simulated clinical environments in conjunction with full-body manikins or full-body human simulators and/or SPs usually for 'case-based scenarios'
4) computer-based (or screen-based) interactive cases or scenarios

Other more traditional methods have included use of animals and human cadavers. In addition virtual reality (VR) simulation, ultra-sound simulators and laparoscopic/endoscopic simulators are more recent developments within the technology-enhanced group of simulation tools which includes part-task trainers, manikins and full-body human simulators.

Regardless of the specific method or type of simulation, all "share the feature of separating training and education provision from actual patient care." (Ziv, Small et al. 2000). And, they all share the same underlying education theory and principles. Importantly, "effective simulation-based medical education is founded on an understanding of the attributes of the various tools and methods available."(Ziv, Small et al. 2000)

DEFINING FEATURES AND APPLICATION OF SBE

Three key defining features of SBE are:

- actual physical, active experience and participation
- interaction that influences the experience and the education/learning outcome
- feedback and reflection

SIMULATION CURRICULUM

SBE is effective for a broad range of curriculum content and learning outcomes. There are also a variety of SBE activities or sessions which can be constructed to produce effective learning opportunities depending on the context, content, desired outcomes, learner group and resources available. SBE is commonly understood to be useful for the acquisition and maintenance of competence in generic clinical skills (CS) however this limited perspective falls far short of the true value and power of SBE as an educational method. Learning outcomes well suited to SBE include also case specific (presentation and condition) knowledge and skills including clinical reasoning, complex and integrated learning such as that required for interprofessional collaborative practice (IPCP), and many more including those focused on patient-centredness and safety, cultural competence, health systems, quality improvement, and ethical and professional practice.

Within the OMS MBChB a clinical skill has been defined as any discrete act within the overall process of patient care [3] and four main categories identified: [4]

(1) Clinical skills within the doctor-patient consultation: including communication, medical history taking, examination, clinical reasoning/problem solving, explanation and planning/shared decision-making, and documentation of the consultation
(2) Advanced communication skills e.g. seeking consent, breaking bad news
(3) Clinical skills, including communication skills, required for effective intraprofessional and interprofessional interactions
(4) Procedural skills.

SBE activities sit within a continuum of educational experiences and tools and should be deliberately planned to complement and supplement other teaching methods, including traditional bedside teaching. SBE improves preparedness for, and reinforces, learning in clinical contexts, but does not replace it. Immersive simulation recreates the closest thing possible to real clinical practice where integrated knowledge and skills are required, and in many ways provides better learning opportunities than the often opportunistic and time constrained sessions possible at the 'bedside'. In addition simulation is valuable for remediation and may be used for assessment.

SIMULATED PATIENTS IN SBE

Simulated patients (SPs) usually facilitate the achievement of a different range of learning outcomes to those achievable from technology enabled SBE. A dedicated SP programme utilising professional actors and trained community volunteers, for example individuals with chronic health conditions and Māori health workers, would include a pool of well-trained SPs encompassing a broad range of diverse patient groups with respect to age, gender, ethnicity and clinical conditions.

Sessions deliberately constructed to involve SPs not only provide valuable learning for standard and advanced consultation skills but can ensure these skills are learned within an overarching culture which is patient-focused, specifically inclusive of minority and otherwise disadvantaged or vulnerable members of the community, and actively inclusive of members of the community as partners in health professional training. Simulation, or more correctly those utilising it, can be considered to be potential 'change agents' in relation to the cultures of health care and of health care education.

JUSTIFICATIONS AND EVIDENCE FOR SBE IN HEALTH PROFESSIONAL PROGRAMMES

The arguments for SBE in health professional training are widely documented and convincing. There is also a substantial body of evidence demonstrating the effectiveness of quality SBE. An in depth discussion is contained in Appendix Two. (p25) In summary SBE provides learning opportunities that are:

- motivating and effective for the current and future generations and range of individual learners/learner styles and preferences

[3] Adapted from Association of American Medical Colleges (AAMC). 2005. Recommendations for Clinical Skills Curricula for Undergraduate Medical Education.

[4] Moore ML (on behalf of the Faculty Clinical Skills Subcommittee). 2016. Clinical Skills in the Undergraduate MB ChB Medical Curriculum: An overview map 2016 version. University of Otago Medical School

- effective for the range of required outcomes including integrated knowledge, skills and complex psychomotor, cognitive and interpersonal tasks
- suited, through repetitive and deliberate practice, to creating desired 'habits of practice' that can be safely transferred to the clinical environment
- designed as an 'integrating tool' providing learning opportunities where students can integrate knowledge and skills, and knowledge and practice across domains, disciplines and professions
- both learner-centred and patient-focused
- 'safer' for patients and learners
- more 'acceptable' to individual patients and the community
- 'necessary' in response to acknowledged deficits in traditional learning opportunities, in particular knowledge and skills required for rare, infrequent and critical presentations and conditions and where learning is currently 'opportunistic' and skills 'at risk' and/or 'vulnerable' to insufficient learning opportunities [5]
- 'necessary' in response to acknowledged changing health care needs and contexts
- able to be structured and sequenced to allow optimum observation-based feedback and reflection which can be difficult to achieve in clinical practice settings
- designed to provide scaffolding and transitioning of learning
- valuable in bridging the gap between 'knowing' and 'doing', between 'theory' and 'practice' and both 'making visible' that gap, and at the same time providing the opportunity for the learner to receive feedback, reflect and work toward closing the gap
- sufficiently authentic and 'close to' the real thing as to require students to 'behave as if'
- designed to allow students to see the consequences of, and feel accountable for, their decisions and actions

Together these provide justification for SBE integrated into health professional programmes to produce graduates who are 'work-ready' and 'fit for purpose' as well as passionate about life-long learning; and engaged and passionate about patient and community care.

In addition, skills acquired by teachers and facilitators in SBE are readily transferrable to other educational modalities and contexts, including education in the clinical workplace, and to clinical practice including for example in 'learning conversations' with patients and teamwork in interprofessional collaborative practice (IPCP). The growing number of clinicians who have themselves experienced SBE and its value to their own learning ensures an ever increasing pool of individuals to recruit from who truly understand the substantial benefits of SBE.

While the focus areas for the strategy separate the faculty (staff/personnel resources and their training) from the facilities and equipment it is best to think about these combined to create a 'SBE service' and 'not just a centre'. The combination of confident and competent staff, sound educational practice, fit for purpose physical environments and equipment, including supporting AV and IT, together create a trustworthy and supportive culture and environment for education through simulation.

[5] Moore ML (on behalf of the Faculty Clinical Skills Subcommittee). 2014. The Faculty Clinical Skills Map Project: Initial Report.

The following section outlines core values which are not unique to simulation, nor new to the OMS or Division of Health Sciences, but should be recognised as especially important in SBE and the OMS Simulation Strategy.

VALUES

PASSION FOR LEARNING

High quality SBE is hard work for both students and staff. It requires the integration of theoretical knowledge, psychomotor skills, interpersonal and communication skills and often complex cognitive skills including clinical reasoning. In addition it is 'heavy' on the senses and can, if not properly executed, result in both sensory and cognitive overload. It is also emotional and can be fun and funny, and sad and contemplative. OMS has a wealth of passionate educators who, provided with opportunity and appropriate training and support, have already and would in the future, engage with this educational method. Simulation educators not only reap the reward of sharing in the learning journey of their students but also enjoy the continuous learning and growth opportunities that SBE provides for them as educators.

COMMITMENT TO QUALITY, STANDARDS AND BEST-PRACTICE

There is a wealth of literature and evidence about how to produce and deliver 'best-practice' SBE. [6] The development and delivery processes for SBE are both resource intensive but there are solid underlying educational principles and many opportunities for sharing and collaboration to improve efficiency. As is the case for learners, simulation educators become more efficient and effective with repetitive and deliberate practice and through sharing of resources and knowledge of education principles and practice.

SBE is most effective when it has clear and defined purpose (objectives) and is properly embedded and integrated within the overall curriculum.

Commitment to evaluation, quality assurance (QA) and continuous quality improvement (CQI) ensures maintenance of learning opportunities and experiences that are efficient, effective and often transformative for learners. Health professionals who aspire to excellence in patient care, health service and continuous improvement in their own professional practice are often attracted to SBE. Educators who truly love learning and facilitating the development of their students enjoy the constant challenge and reward from being involved in SBE. Participation in SBE for students also requires a commitment to continuous learning and improvement in order to achieve the best education outcomes and thus fosters these skills and attitudes in our future health professionals. Associated audio-visual (AV) and digital video-capture technology commonly used in SBE to manage student numbers facilitates self-reflection and review for both students and teachers, and through faculty review contributes to CQI.

An overarching strategy and OMS Simulation Governance group will help ensure that SBE at OMS is implemented in line with underlying education theory, the current evidence base and best-practice guidance, and that planning includes quality measures and strategies for continuous quality improvement. This is, of course, important in all education practice but arguably more so for SBE which is acknowledged to be high-cost as well as high value, and

[6] These are covered in some detail in two papers: McGaghie, Issenberg et al. 2010 and the AMEE Guide No 82 by Motola et al. 2013 See also Appendices Two to Four

where 'negative learning'[7] and potentially negative impacts on learners are real and well recognised.

COLLABORATION

Development and delivery of immersive and interprofessional SBE, by their very nature, require effective teamwork and collaboration within the teaching team. The learning experiences also provide invaluable opportunities to foster collaboration and teamwork in the participating students, skills critical to high quality health care delivery. The resource intensive nature and 'specialist' knowledge and skills required for SBE, along with the dispersed campuses and varieties of health professional programmes at OMS, also make collaboration essential. Given the common underlying educational principles and well defined agreed curriculum within each programme it is sensible, efficient and effective to share teaching resources such as case-based scenarios and other teaching resources, for example in the MBChB across ALM (Advanced Learning in Medicine) campuses, and potentially also across other health professional programmes. Simulation communities of practice tend to be collaborative and there is a wealth of local, national and international experience from which OMS can benefit, and to which OMS can contribute.

TRUSTWORTHINESS

The vulnerability of learners in SBE must never be underestimated or ignored. When learners participate in simulation they put their personal and professional selves on display, often in the context of a clinical skill or scenario which necessarily must challenge them in order for learning to occur. For students to truly fully participate in simulation, including feedback and debriefing conversations, they must be able to trust that the culture and behaviours of teachers and fellow learners will be respectful, and not subject them to ridicule or harsh judgement. At the same time they need to trust that less than satisfactory performance will be identified and addressed such that they have the opportunity to learn and improve. Otherwise there is little point in taking on the challenge, taking risks and sometimes falling short. In addition SBE must always be inclusive of a focus on the patient, patient safety, and trusted to regard the patient as a person to be respected and protected, and for whom only the best possible outcomes are acceptable.

RESPONSIBLE STEWARDSHIP

High quality effective SBE is often, although not always, resource intensive. Sustainability must be to the fore of strategies to enhance SBE within the OMS. Resources, including staff time, are commonly stretched and spread too thin. Time in the medical curriculum and other health professional programmes is also limited and often difficult to access. Student time and energy is similarly a precious commodity without endless supply. For all of these reasons those leading SBE need to exercise wise stewardship along with transparency and accountability for ensuring resources achieve the desired outcomes from integration of best-practice SBE within the overall educational endeavour.

[7] 'Negative learning' occurs when SBE inadvertently results in students/learners acquiring attitudes or practice which would be harmful if transferred to real clinical environments. See also Appendix Four

FOCUS AREAS AND STRATEGIC OBJECTIVES

The following section identifies important focus areas for attention and the key objectives and goals within each focus area.

This section includes indicative timeframes and priorities for implementation. Timeframes for completion of the implementation will of course depend in part on implementation of specific recommendations in relation to staffing.

Successful implementation of a cohesive OMS simulation strategy will require a shared vision and 'mental model', agreed goals and attention to the following specific elements:

- Effective leadership and governance
- Specified simulation curricula for each programme/course i.e. content or syllabus (topics or elements covered) plus learning opportunities (sessions or activities) plus learning outcomes for the SBE components integrated within the overarching curriculum
- Facilities, equipment, resources, staffing and 'time' in the curriculum required to deliver and support the SBE components

It is important to note the distinction between the simulation curriculum and the facilities required in order to deliver and support the SBE curriculum. For each health professional programme, a simulation curriculum would be identified and sessions would be planned and delivered in a coordinated, progressive and cohesive fashion. A proposed OMS MBChB 'simulation curriculum' and approach is included in Appendix Five (p42).

Ideally professional programmes will collaborate to include interprofessional simulation sessions for shared curriculum content and outcomes, and to address specific IPE outcomes. Across OMS there would then be sharing at several levels including curriculum, staff time and expertise and physical facilities and equipment.

Eleven focus areas have been identified:

1. Leadership and Governance
2. Quality, standards and best-practice in SBE
3. Faculty training / staff development and support
4. Equitable, accessible and fit for purpose facilities, equipment, staffing and curriculum 'time' enabling SBE for all
5. Interprofessional simulation-based education (IP Simulation)
6. Research and scholarship in SBE
7. Collaboration
8. Simulated patients and volunteers in SBE
9. Community involvement and engagement
10. Simulation for assessment purposes
11. E-learning contributions to SBE including blended learning approaches and computer/screen based simulation and virtual reality (VR)

LEADERSHIP AND GOVERNANCE

1) Continue the OMS Simulation Lead role
2) Establish an OMS SBE governance group with membership to include representatives from each of the health professional programmes utilising (or wishing to utilise) SBE, and at least one member from the DHS IPE Centre *(by end of 2018)*
3) Establish an OMS SBE entity or 'virtual' centre in addition to the OMS Simulation Lead role

4) Establish OMS SBE Manager role *(for 2019)*
5) Define TOR for the governance group *(by end of 2018)*. Current recommendation is that the OMS SBE Governance group:
   - Reports to, and advises, the OMS Dean and OMS Executive in relation to SBE
   - Oversees and supports all SBE in OMS in order to embed high quality best-practice SBE as the norm of education practice for health professional training at OMS
   - Liaises with education leaders in all health professional programmes utilising SBE
   - Facilitates collaboration and coordination of existing and new SBE resources and activities within OMS with a focus on quality, efficiency and effectiveness
   - Administers and oversees resources/funding specifically allocated from OMS for SBE
   - Leads the development of defined standards and best-practice guidance for SBE activities including SBE teaching sessions/activities, simulated patient use and simulation for assessment purposes
   - Develops a specific strategy and provides oversight for the use of technology in SBE, including audio-visual, digital video-capture and supporting IT services, and full-body human simulators, resuscitation manikins and part-task training models
   - Leads the development of agreed standards and best-practice guidance for training for all simulation staff (academic, clinical and technical) including development and sharing of standardised OMS faculty training resources
   - Leads the development and implementation of QA / CQI processes for SBE in OMS
6) Specifically address the challenges of delivering SBE to OMS students in regional, rural and remote locations and develops models for ensuring equitable access and learning opportunities and staff support (*begin end of 2018 – aim to complete by end of 2019)*
7) Promote SBE to the wider University and community, and investigate external sources of funding for example from donations/sponsorship from community, industry, Medical Council, Professional Colleges, Health Workforce NZ, Health Quality and Safety Commission

QUALITY, STANDARDS AND BEST-PRACTICE IN SBE

1) Establish an OMS working group to:
   - agree defined standards and best-practice guidance for development and delivery of SBE teaching sessions/activities *(by end of 2020)*
   - define standards and best-practice guidance for recruitment, training and practice of simulated patients *(by end of 2021)*
   - design and implement outcome measures for simulated patient practice *(by end of 2021)*
2) Establish professional programme specific working groups e.g. the MBChB programme, the MNSc, to:
   - define the core/minimum curriculum for SBE for each stage of training for their students referenced to agreed curriculum documents and including expected standards/levels of learning *(For MBChB by end of 2019)*
   - develop shared teaching templates, materials and session resources for their programme and potentially for sharing across programmes *(For MBChB by end of 2020)*

FACULTY TRAINING / STAFF DEVELOPMENT AND SUPPORT

1) Make simulation educator training and resources accessible to all OMS academic and clinical staff involved in SBE by:

- Supporting OMS developed and delivered SBE educator training courses/ workshops (such as the UOCSC Simulation Instructor and Debrief workshops) and attendance at these courses by OMS staff *(immediate and ongoing)*
- Ensuring targeted (responsive to need) training opportunities at all campuses, regional and rural sites *(during 2019 onwards)*
- Developing and sharing standardised OMS faculty training resources *(by end of 2021)*
- Keeping an inventory of currently known simulation educator training programmes outside of OMS and general education staff development opportunities *(by end of 2020)*

2) Keep an accessible inventory of OMS staff involved in SBE including their training and specialists areas of expertise and interest *(end of 2020)*
3) Establish SBE 'fellow' training positions at each of the main campuses in order to build capacity and sustainability [8] *(from 2019 if these positions are to contribute to the work of strategy implementation – or from 2020)*. These positions should include research opportunities (see also Research and Scholarship section below)

EQUITABLE, ACCESSIBLE AND FIT FOR PURPOSE FACILITIES, EQUIPMENT, STAFFING AND CURRICULUM 'TIME' ENABLING SBE FOR ALL

1) Seek external expertise to work with the OMS SBE governance group and SBE leaders at OMS to develop business models for developing facilities (new and re-structured) and operating 'fit for purpose' SBE services with an explicit focus on 'return-on-investment' and 'value-adding' propositions *(from end of 2018)*[9]
2) The MBChB programme specifically resolves the current variation in CS module structures and access to SBE across the three main ALM campuses and for students located in regional and rural sites. See also Appendix Five (p42 and proposed model at p51). (A*t least interim solution by end of 2019 and from 2020/2021 for ALM main campuses in keeping with MCC ALM alignment plans)*
3) All health professional programmes identify and resolve/eliminate any barriers to ensuring comparable and optimal SBE opportunities for all OMS students at all sites
4) Complete an up-to-date stock take of current SBE facilities, equipment and staff resources at all OMS main campuses, regional and rural sites, and a subsequent needs assessment based on core simulation curricula and minimum/essential equipment required *(by end of 2018)*
5) Determine costing for provision of minimum/essential SBE equipment and staffing at each main, regional and rural site *(indicative by end of August, more accurate and detailed by end of 2018)*
6) Ensure provision of minimum/essential equipment *(by mid-2019)* at each campus and regional site and essential accompanying staffing and staff training where required *(ideally by end of 2019)*

[8] These would ideally be recognised by medical specialty training colleges (and other health professional training bodies) and could potentially be joint-funded positons with DHBs.

[9] Work would include collaboration on facilities design and should also include a specific focus on technology and potential cost-efficiencies as well as educational advantages from a coordinated approach. The CS and Simulation Working Party recently established at UOW and inclusion of the OMS Simulation Lead on that group is an example of how this concept can be operationalised and make best use of existing experience and expertise within OMS. The University of Otago Project Management Office is willing to assist but initial indications are that external expertise would also need to be sought/contracted.

7) Operational budgets are included in OMS funding models and allocated to sustain SBE services at all main sites and regional campuses and to ensure access for students placed in rural and remote locations according to the delivery models developed. [10]
8) Operational budgets should cover:
    - dedicated SBE staffing including educators, facilities manager/coordinator, administrator, technicians and technical assistants [11]
    - equipment maintenance
    - equipment replacement
    - AV and IT maintenance and development
    - consumables

INTERPROFESSIONAL SIMULATION-BASED EDUCATION (IP SBE)

1) Identify all OMS and other Division of Health Sciences health professional programmes already utilising SBE and/or interprofessional education (IPE) *(by mid-2019)*
2) Establish working party for IP SBE and close liaison with the Division of Health Sciences Centre for IPE, and its Director and Manager *(mid 2019)*
3) Embed planned and coordinated IP SBE within the MBChB programme and other OMS health professional programmes *(from 2020 onwards)*

RESEARCH AND SCHOLARSHIP IN SBE

1) OMS Simulation Lead and governance group (or specific working group) develop an OMS SBE research strategy and identify, support and facilitate individual and collaborative SBE research activities *(capacity and timeframe to do this likely to depend on new staffing including establishing simulation fellow positions and/or dedicated funding – during 2019 or 2020)*
2) OMS staff experienced in SBE contribute to dissemination of best-practice SBE via OMS led faculty training and staff development opportunities, and by contributing to regional, national and international SBE research and scholarship activities *(ongoing)*
3) Explore collaborative research opportunities specifically with the DHS Centre for IPE *(from 2019)*
4) Liaise with the OMS Medical Education Research Academic Lead to facilitate applications for OMS medical education research funding for SBE specific research projects *(2019)*
5) Explore establishment of a SBE research fund similar to the IPE Grants funding *(during 2019)*
6) Establish SBE research assistant/fellow positions at each main campus to ensure OMS capacity to achieve SBE teaching and research outputs *(see earlier comment – 2019 or 2020)*

[10] It is widely recognised that capital investment without guaranteed ongoing operating budget is a common cause of failures in SBE internationally.

[11] The distinction between simulation technicians and technical assistants is important, as is the general principle of support staff to ensure all staff are working to their skill set and in particular that academic staff are not required to undertake daily management tasks which detract from education, research and scholarship.

COLLABORATION

1) Identify all heath professional programmes in the OMS (and /or Division of Health Sciences) currently employing SBE, and enable facilitation and collaboration through an OMS governance structure including the OMS Simulation Lead and Simulation Manager *(by end of 2019)*
2) Identify opportunities for new SBE sessions to be developed within existing programmes and facilitate and support these *(during 2019 and ongoing)*
3) Ensure MBChB specific experience and that of other health professional programmes is shared across OMS in order to improve and sustain efficient SBE *(ongoing)*
4) Translate collaboration and sharing of expertise and resources into targeted embedded interprofessional simulation sessions in all OMS health professional programmes (IP Simulation) *(by 2023)*
5) Seek OMS MBChB funding for projects which specifically include collaboration across ALM sites and between ELM and ALM *(from 2019)*
6) Establish OMS wide simulation interest group to interlink with existing regional (Canterbury, Otago and Southland) interest groups and NZASH (NZ Association for Simulation in Heath Care) *(from 2019)*
7) Build relationships with other SBE providers nationally and internationally *(ongoing)*

SIMULATED PATIENTS AND VOLUNTEERS IN SBE

1) Work more pro-actively with existing provider of simulated patients (Outstanding Performances) to ensure SP practice in OMS is consistent with defined standards and best-practice including use of SPs in assessments *(dependent on new/additional SBE tenths or staffing)*
2) Investigate establishment of an additional (to professional provider above) OMS specific programme to recruit and train SPs *(dependent on new/additional SBE tenths or staffing)*
3) Develop Volunteer patient programmes at all main campuses and regional sites which recruit and train community volunteers to participate in SBE both as their 'authentic selves' and as SPs. [12] See also section above with respect to quality stands and best-practice (*depending on resources and staffing – from 2019 or 2020 onwards)*
4) Through opportunity for greater community involvement in education ensure a patient-centred focus and patient voice in SBE *(as above - dependent on new/additional SBE tenths or staffing)*

COMMUNITY INVOLVEMENT AND ENGAGEMENT

1) Establish "Friends of the Otago Medical School" equivalent groups at all main campuses and regional sites to serve as a pool from which to:
    1. recruit volunteers specifically for participation in education including SBE
    2. train a subset of volunteers to function as simulated patients – as above

[12] It is acknowledged that volunteers participating in education activities as their 'authentic selves' is not actually SBE. A subset of community members involved in this way can however also be supported and trained to contribute to development and/or delivery of SBE activities

2) Promote OMS SBE activities by hosting community open days and targeted activities such as school visits *(from 2019)*
3) Through community engagement investigate opportunities for donations / sponsorship / funding *(from 2019)*

SIMULATION FOR ASSESSMENT PURPOSES

1) Establish working group to investigate international evidence and guidance on use of simulation for assessment purposes including specific advantages, risks and feasibility of simulation for assessment in health professional programmes *(from 2021 or 2022)*
2) For the MBChB determine if, how (including standards) and when simulation should be included in MBChB programmatic assessment *(from 2021 or 2022)*

E-LEARNING CONTRIBUTIONS TO SBE INCLUDING BLENDED LEARNING APPROACHES AND COMPUTER/SCREEN BASED SIMULATION AND VIRTUAL REALITY (VR)

1) Establish 'Technology in SBE' working group *(from 2019)*
2) Develop clear guidance in relation to use of technology for SBE including policy and procedures in relation to consent, confidentiality and use of video-recordings using B-Line Medical and any other software programmes used by OMS *(by end of 2019)*
3) Explore functionality and facilitate greater use of the B-Line Medical digital video-capture system including for research purposes *(from 2019)*
4) Investigate:
   - blended learning in SBE whereby e-learning is combined with SBE
   - use of technology to support 'access' to SBE activities for remote and distance students
   - the place of computer/screen-based simulation and VR in health professional programmes and ensure any developments are consistent with current evidence and best-practice and integrated within programmes.

CONCLUDING COMMENTS

Much can and will be achieved through existing experience, expertise and already strengthening collaboration amongst those utilising SBE within the OMS including within the MBChB programme. As stated previously while the MBChB programme remains a major stakeholder and the origin of the specific vision and motivation for developing a simulation strategy, the strategy itself is intended to enable and strengthen SBE within all OMS health professional programmes. Whether or not the scope of this Simulation Strategy should be extended to encompass the entire Division of Health Sciences could be considered.

To embed SBE as a norm of high-quality education practice integrated within programmes additional work and resourcing will be required. This is necessary to ensure both the capacity (facilities and equipment) and capability (staff expertise and time and curriculum time) to provide equitable access and best-practice SBE learning opportunities for all students. Investment is also necessary to ensure a sustainable programme of activities and future-proofing against anticipated changes in health service delivery and education.

As a leader in medical and health professional education OMS should rightly focus on education quality, standards and best-practice, and on research and scholarship in SBE, including SBE-specific faculty training. Existing OMS experience and expertise in faculty training, and in undergraduate IPE and IP SBE provide at least two potential areas for focused scholarship and research. IPE and SBE share many underlying principles and challenges and in addition their vision and strategic plans align well such that cooperation and collaboration is likely to achieve greater efficiencies and outputs than either working alone.

The current SBE research literature reflects the fact that SBE for health professionals began largely in the postgraduate 'in-service' and acute resuscitation training contexts. Evidence and published experience focused on undergraduate (pre-registration) health professional programmes is relatively sparse. OMS is well placed to make particular contributions in these areas.

The resource-intensive nature of SBE needs to be acknowledged. However SBE also has income-generating potential which should be embraced alongside its educational effectiveness. Included in this strategic plan therefore is an explicit focus on developing sound business models and on 'return-on-investment' and 'value-adding' strategies.

RECOMMENDED PRIORITIES FOR STRATEGY IMPLEMENTATION AND ADDITIONAL RESOURCE:

1. Continuation of the OMS Simulation Lead role beyond the current fixed term and consideration of increased tenths
2. Establishment of an OMS Simulation governance group
3. Consideration of establishing a Simulation-based Education and Research 'virtual' Centre with a website and a Simulation Manager role
4. Capital for minimum/essential facilities, equipment at all main campuses and regional sites with current priority focus on UOW campus
5. Establishing minimum SBE 'staffing' at each of the main campuses to ensure equitable SBE for all at those campuses, and to support the regional and rural sites. Staffing should include SBE educators and support staff including a centre/facilities manager/coordinator, administrator, simulation technicians and technical assistants.
6. Operating budgets to ensure ongoing staffing, and to cover other costs as above including equipment maintenance, equipment replacement, AV and IT maintenance and development, consumables
7. Funds to contract external expertise in business model development, in parallel with University 'facilities development' planning at all main sites
8. Establishment of simulation training and/or research 'fellow' positions at each of the main campuses. While a significant cost, if established early these positions would contribute to earlier implementation of the strategy and support many of the long terms goals such as collaboration with DHB partners and professional colleges, and OMS SBE research productivity.

BIBLIOGRAPHY AND OTHER SOURCES/INPUT INTO THIS REPORT

Association of American Medical Colleges (AAMC). 2005. Recommendations for Clinical Skills Curricula for Undergraduate Medical Education. Journal]. Available from: https://www.aamc.org/download/130608/data/clinicalskills_oct09.qxd.pdf.pdf

Clinical Skills Managed Educational Network. Delivering a Quality Skilled Workforce: Report and Recommendations for Health Boards on Clinical Skills Education by CS MEN. Scottish Funding Council.

Clinical Skills Managed Educational Network. 2010. Evaluation of the Pilot of the Mobile Clinical Skills Unit. NHS Education for Scotland.

Division of Health Sciences Rural Health Plan. 2015. University of Otago. Available from: https://www.otago.ac.nz/healthsciences/otago610433.pdf

Division of Health Sciences Strategic Plan 2014 – 2020: University of Otago. Available from: https://www.otago.ac.nz/healthsciences/otago077712.pdf

Ker J, Cachia P, Beasant B. 2015. A national approach for the use of simulation to educate and train the NHS workforce: the First National Clinical Skills Strategy. Scottish Medical Journal. November 1, 2015; 60:220-222.

Moore ML (on behalf of the Faculty Clinical Skills Subcommittee). 2014. The Faculty Clinical Skills Map Project: Initial Report.

Moore ML. 2016. What is the place of simulation in undergraduate medical education? Unpublished Research and Study Leave Report: University of Otago Medical School

Moore ML (on behalf of the Faculty Clinical Skills Subcommittee) 2016. Clinical Skills in the Undergraduate MB ChB Medical Curriculum: An overview map 2016 version. University of Otago Medical School. Available from: https://www.otago.ac.nz/medical-school/otago614760.pdf

NHS Education for Scotland. Partnerships for Care: Taking forward the Scottish Clinical Skills Strategy: Executive Summary. Scottish Funding Council.

NHS Health Education Yorkshire and the Humber. 2013. Quality Management of Clinical Skills and Simulation Training. Available from: http://qaclinicalskills.co.uk/CSQAMicrosite/media/Publications/QACSS-Final-Version-May-2013.pdf?ext=.pdf

NHS Yorkshire and the Humber. 2010. Clinical Skills and Simulation Strategy. Available from: http://qaclinicalskills.co.uk/CSQAMicrosite/media/Publications/Clinical-Skills-Strategy.pdf?ext=.pdf

O'Brien M, Pullon S, Skinner M. **2015**. Division of Health Sciences: Interprofessional Education: A Strategic Plan 2016-2019. In: University of Otago. Available from: https://www.otago.ac.nz/healthsciences/research/otago234601.pdf

Otago Medical School MBChB Curriculum Committee. 2015. The Otago Medical Course of the Future: A Masterplan for the Otago Medical Curriculum of the Future. University of Otago. Available from: https://www.otago.ac.nz/medical-school/otago614757.pdf

SOURCES OF INPUT:

This strategy was also informed by numerous conversations with Prof Jean Ker, William Evans Visiting Fellow 18/09/2017 – 06/10/2017 and also conversations and deliberately sought input from OMS staff and others during that time. Members of the MBChB Clinical Skills subcommittee have also provided input. Many other University staff, students and non-University colleagues have also, unwittingly at times, contributed to the development of this strategy.

A first draft for consultation was circulated within OMS in May 2018 and specific feedback and comment was received from 12 individuals and groups.

APPENDICES

APPENDIX ONE: TERMINOLOGY AND DEFINITIONS

SBE = simulation based education

SBL = simulation based learning

SBME = simulation based medical education

SBML = simulation based mastery learning

Technology-enhanced simulation as an ''educational tool or device with which the learner physically interacts to mimic an aspect of clinical care for the purpose of teaching or assessment'' (Cook et al. 2011).

"**Medical simulation** can be defined as the use of a device or series of devices to emulate a real patient situation for the purposes of education, evaluation or research." (Binstadt, Walls et al. 2007)

"**healthcare simulation** is defined to include all experiential learning techniques that incorporate modelling or emulation of actual patient care." (Weinger 2010)

"**SBME** in its widest sense can be defined as any educational activity that utilizes simulative aids to replicate clinical scenarios." (Ziv, Ben-David et al. 2005)

"Healthcare simulation" – a technique that uses a situation or environment created to allow persons to experience a representation of a real healthcare event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions; the application of a simulator to training, assessment, research or systems integration toward patient safety (SSH Accreditation, 2014) (Palaganas, Maxworthy et al. 2015)

Simulation is a method used in health care education to replace or amplify real patient experiences with scenarios designed to replicate real health encounters, using lifelike mannequins, physical models, standardized patients, or computers. (Association of American Medical Colleges 2011)

Simulation has been defined as "the artificial replication of sufficient components of a real world situation to achieve certain goals." (GABA, 1997) Cited in (Ziv, Small et al. 2000)

SLE = simulated learning environment

SLP = simulated learning program

Best-practice in SBE

The medical education literature reflects the current consensus about the features of SBE that are associated with effectiveness and which can be considered current 'best-practice'. (Issenberg, McGaghie et al. 2005, McGaghie, Issenberg et al. 2010, Motola, Devine et al. 2013).

The key features of 'best-practice' in SBE[13] are:

a. Feedback
b. Deliberate practice
c. Curriculum integration
d. Outcome definition and measurement
e. Matching simulation tools (with respect to fidelity and technology) to educational objectives
f. Planned progression in degree of difficulty and range of skills/learning
g. Inclusion (capture) of clinical variation within controlled environment
h. Application for both skill acquisition and maintenance
i. Individualised learning
j. Mastery learning
k. Instructor training
l. Application to team training
m. Focus on transfer to practice (from simulation to clinical practice)

Curriculum (for the MBChB) = the education plan for the MB ChB encompassing the expected outcomes, content to be learned, (which may also be known as syllabus), and the programme of teaching and learning opportunities and assessment activities.

Debriefing = a formal, reflective stage in the simulation learning process whereby educators/instructors and learners re-examine the simulation experience and foster the development of clinical judgment and critical thinking skills designed to guide learners through a reflective process about their learning (SSH Accreditation)

Debriefing = a conversation between 2 or more people to review a real or simulated event in which participants analyze their actions and reflect on the role of thought processes, psychomotor skills, and emotional states to improve or sustain performance (Center for Medical Simulation, Boston) (Rudolph, Simon et al. 2008)

Deliberate practice = involves repetitive performance of intended cognitive or psychomotor skills in a focused domain, coupled with rigorous skills assessment. Learners receive specific, informative feedback, resulting in increasingly better skills performance in a controlled setting.

Deliberate practice as a concept originates in instructional science research (Ericsson 2004, Ericsson 2008) and is grounded in information-processing and behavioural theories of skill acquisition and maintenance. It incorporates at least 9 features:

1. Highly motivated learners with good concentration,
2. engagement with a well-defined learning objective or task, at an
3. appropriate level of difficulty, with
4. focused, repetitive practice that leads to
5. rigorous, precise measurements, that yield
6. informative feedback from educational sources (e.g. simulators, teachers), and where
7. trainees also monitor their learning experiences and correct strategies, errors and levels of understanding, engage in more deliberate practice, and continue with

[13] These are covered in some detail in two papers: McGaghie, Issenberg et al. 2010 and the AMEE Guide No 82 by Motola et al.

8. evaluation to reach a mastery standard, and then
9. advanced to another task or unit (McGaghie, Issenberg et al. 2010)

It has been shown that "Initial 'overtraining' and subsequent repetition of the skill can help reduce skill decay." (Arthur, cited in (Perkins 2007))

Emotional Learning - the ability of SBE to induce emotional stresses and engage the learner in transfer-appropriate processing may also facilitate enhanced acquisition and retention of knowledge ascertained

Feedback = "specific information about the comparison between trainees observed performance and a standard, given with the intent to improve the trainee's performance." (Van de Ridder et al. 2008)

Outcome feedback – also called performance-oriented feedback provides participants with the knowledge of their results. While it is posited that such form of outcome would allow the individual to improve his or her performance by altering the strategies used to implement the task, some studies suggest that outcome feedback is ineffective for complex, uncertain tasks (Jacoby et al. 1984; Johnson et al. 1993).

Process feedback – also called learning-oriented, descriptive or cognitive feedback – aims at facilitating learning and has an explanatory value (Johnson et al. 1993). It provides descriptive information on how to perform a specific task or on how to improve performance. Contrary to outcome feedback, evidence suggests that process feedback improves the strategies used to achieve an outcome, and enhances performance, especially on complex tasks (Johnson et al. 1993).

It is also likely that the effects of both types of feedback are additive (Early et al. 1990)." (Chiniara, Cole et al. 2013)

Fidelity = in simulation refers to the realism or truthfulness - and is important for "buy-in" and educational effectiveness (and presumably for validity and effectiveness for simulation used for purposes other than education)

Fidelity is often considered under 3 headings:

- environmental
- technical – engineering/equipment
- psychological

High fidelity in all 3 aspects may not be necessary (or affordable) for all learning activities and is dependent on the desired learning outcomes and the type of skill/competency being learned/practiced and the volume of skills training opportunities required.

Simulation can therefore be:

- "high-tech high-fidelity" e.g. in immersive simulations using SimMan3G, associated AV gear/video-recording for debriefing, in a realistic simulated clinical environment such as an ED resuscitation bay or OT and with believable clinical scenarios and believable story/roles for participants

- "low-tech high-fidelity" e.g. using simulated patients (highly trained actors) in realistic simulated clinical environments such as an OP clinic with realistic presentations and responses, or relatively simple (from a technical point of view) but realistic (high-fidelity) part-task trainers for specific skill acquisition
- "low-tech low-fidelity" e.g. using a foreign body placed within a sock and asking students to palpate it and describe what they feel, using an airway trainer in a "generic" (non-clinical) teaching space to teach/learn airway management skills
- "high-tech low-fidelity" (at least of some aspects) – e.g. maybe - using a high tech simulator such as SimMan3G but without environmental fidelity – e.g. in a room rather than a simulated clinical environment, or maybe (I'm not recommending this) using SimMan3G
- with participants expected to "role play" outside of their normal roles i.e. low psychological fidelity

"It has been shown in aviation that, when used to explore team interactions, the physical fidelity of the simulation is less important than the psychological fidelity. The aim is to develop an environment that enables the participants to perform naturally, so that they can gain insight into the complexity of the actual workplace. … The realism is fundamental to the concept of having the participants reflect on their behaviours during the debriefing sessions." (Flanagan 2004)

Hybrid simulation or multi-mode = the combination of a part-task trainer with a person (volunteer or simulated patient). This allows concentration on a specific basic (usually procedural or examination skill) but puts the learning in context by also requiring human interaction during performance of the skill

Immersive simulation where individuals or teams of health professionals have the opportunity to manage realistic patient conditions and scenarios in realistic clinical environments aim for fidelity in all 3 components including the very important psychological fidelity which relies on participants being able to "play" themselves (as opposed to "role-playing" outside of their normal roles) and on the "story" and characters in the story (the simulated patient and the rest of the cast) being believable. This type of simulation often also incorporates a high-tech component which is not about the high technical fidelity of the simulator itself and equipment used in the scenario as such but also involves audio-visual recording equipment and software and the ability to incorporate these recordings in the debriefing process i.e. high-tech from another point of view.

In-situ simulation = simulation which is conducted within the normal working/clinical care environments (as opposed to within dedicated teaching/learning spaces). This type of simulation has both advantages and disadvantages/limitations but there is a trend to increasing in-situ simulation

Mastery Learning = an instructional methodology that states that nearly all learners can achieve subject or skill mastery when provided adequate time, individualised feedback to address learning needs based on formative assessments, and progress through the subject in an organised manner, typically in smaller units that permit a step-wise approach to mastery level

"In mastery learning, trainees must achieve a defined proficiency in a given instructional unit before proceeding to the next unit. Thus, all trainees will meet the same objectives, although learning time typically varies. By contrast, traditional instruction fixes the learning time and allows outcomes to vary." (Cook, Brydges et al. 2013)

"The central tenets of mastery learning are that (1) educational excellence is expected and can be achieved by all learners, and (2) little or no variation in measured outcomes will be seen among learners in a mastery environment." (McGaghie 2015)

Key characteristics of this model include: (1) use of an assessment with an established/set minimum passing standard for each educational unit, (2) clearly defined learning objectives aligned with the passing standard and sequenced as units usually of increasing difficulty, (3) baseline assessment or diagnostic testing, (4) engagement in educational activities (e.g., deliberate skills practice, calculations, data interpretation, reading) and instruction that targets learning objectives, (5) reassessment after instruction, (6) progression/advancement to the next unit only after achievement of the passing standard, and (7) continued practice if the minimum passing standard was not achieved, and until achieved.(Cook, Brydges et al. 2013, McGaghie 2015)

Observing participant/learner – in Healthcare simulation there are frequently Observing and Active Participants owing to limited resources and because a typical clinical event has fewer providers than the number of students. Observing participants learn by observing the simulation with active participants actively undergoing the scenario. The debriefings typically involve both observing and active participants.

Patient Safety = has to do primarily with the avoidance prevention and amelioration of adverse outcomes or injuries stemming from the processes of healthcare itself. (World Health Organisation 2008). It focuses on the interplay between humans, technology and the organisations in which health care is delivered. The AMC specifies that graduates must have 'an appreciation of the systems approach to healthcare safety and the need to adopt and practice healthcare that maximises patient safety'.

Procedural simulation - a training method that utilizes simulation to teach the technical skills and cognitive knowledge required for the safe execution of a clinical procedure, spanning a range of techniques ranging from individual skill training to group and multidisciplinary training.

Self-regulated learning allows trainees to monitor and respond to their own instructional needs." (Brydges, R and Butler D cited in (Cook, Brydges et al. 2013))

Team = two or more individuals with specialised knowledge and skills who perform specific roles, and complete interdependent tasks, to achieve a common outcome or goal. (Baker et al, 2005)

Teamwork is "comprised of the individual team members' interrelated thoughts, actions, and feelings which allow them to function as a team and promote coordinated, adaptive performance that leads to value added outcomes. Key features of teamwork have been distilled to the "Big Five": (1) team leadership; (2) performance monitoring; (3) backup behaviour; (4) adaptability; and (5) team orientation. Shared mental models, "closed loop" communication, and mutual trust support the coordination of these team processes. Team processes such as effective communication and coordination promote team cognition, a multilevel phenomenon influenced by individual mental models and environmental cues;" (Eppich, Howard et al. 2011)

Teamwork Skills = cognitive functioning and observable behaviours that underpin safe and effective clinical practice, including communicating (patient-doctor, team) leadership, teamwork, situational awareness and decision making, resource management, safe practice, adverse event minimization/mitigation and professionalism.

Virtual Reality = a system that enables one or more users to move and react in a computer simulated environment." (Encarta® Online Encyclopedia, 2000)

APPENDIX TWO: DRIVERS AND JUSTIFICATIONS FOR SBE [14]

MAJOR DRIVERS FOR SIMULATION:

The major drivers for simulation arose predominantly from changes to healthcare practice, increasing pressures on service delivery, greater focus on patient safety and quality of services, and comparisons with other 'high-risk' industries where simulation was already well established. In healthcare, simulation offered potential to replace or substitute for lost 'clinical training' time and opportunity. While these drivers remain present and convincing, emerging education theory and evidence suggest that there are additional justifications for simulation. Rather than simply replacing learning that had traditionally been acquired by clinical training and service, simulation offers opportunity for both improved learning and for additional 'new' learning not otherwise available. It appears that there are in fact some outcomes that are 'better, best and only' learned by simulation. Clinical training might not in fact be the 'gold standard' that it has in the past been perceived to be.

At all levels, from undergraduate education through to ongoing/continuing education, use of SBE in many contexts tends to be haphazard, and poorly planned and coordinated. In addition, it is still challenged by some and controversial as an education tool or method for a variety of reasons. At least some of the resistance to simulation probably stems from individuals who fear the personal and professional vulnerability that can be experienced during simulation, and from experiences of poorly practiced SBE. At organisational and political levels it is likely that the two greatest challenges come from the resource and service implications. These are significant, especially if SBE is required or mandated for all healthcare professionals. And yet the overwhelming evidence for its effectiveness alongside other justifications, argues increasingly and convincingly for SBE becoming a fully integrated component not just of health professional education, but of health care systems. Some would say that the resource implications of not fully embracing SBE are more concerning than the costs of engaging with mandatory SBE. Whatever the reasons, the progress of SBE in healthcare has, in the eyes of many, been frustratingly slow. Somewhat disconcertingly it has been suggested that one of the critical differences in the approaches between simulation in the aviation industry and in health care is that "the pilots are always the first people at the scene of the accident, whereas in health care we just call for the next patient."[15]

DRIVERS FROM HEALTH CARE PRACTICE

The drivers for simulation in healthcare professional training arising from the changing face of clinical practice and service delivery are well known and published. They focus primarily on simulation as a means of filling the gaps and cracks that are perceived as appearing in the traditionally held 'gold standard' of clinical training, as above.

Recognised drivers and justifications for SBE include:

- Reduced medical trainee work hours resulting in reduced patient contact time and reduced learning opportunity

[14] This Appendix, and the two following (Three and Four) are exerts from a Research and Study leave report specifically focusing on SBE in undergraduate medical education

[15] An observation made by David Gaba during a presentation at the NYSIM Simulation Fellows Symposium April 2016

- Reduced patient inpatient lengths of stay, high inpatient acuity, and greater ambulatory/outpatient care all reducing trainee access to patients as learning resources
- Reduced instructor/supervisor time and availability, and reduced continuity in trainee-supervisor relationships
- Increased complexity in healthcare, both technical and decision-making components (including ethical decision-making)
- Increased recognition and focus on healthcare delivery as a 'team game' and on healthcare systems, with the corresponding need to train and maintain team functions, and team/systems competence (not just individual competence)
- Greater focus on patient safety and injury/risk reduction, and changing attitudes about tolerable risks and the (un)acceptability of 'learning on' patients
- Recognition of the costs of 'failures' in service and poor patient outcomes and the potential for simulation to contribute to cost reduction (as well as risk reduction) (Ziv, Small et al. 2000)

These service delivery pressures, alongside increased numbers of undergraduate students, have resulted in increased pressure on clinical placements across all professions including medicine, and the interest in 'replacing' clinical time with simulation experience. The disparity in individual student learning as a result of the opportunistic and serendipitous nature of much clinical learning has also long been recognised, and is increasingly difficult to ignore.

"Simulation-based education requires educators to take a proactive approach to clinical exposure by designing an optimal learning environment and curriculum to serve the educational objectives. Whereas the apprentice method and learning from actual clinical encounters are constrained by chance, availability, and conflict with clinical operations, simulation-based education provides the opportunity to have full control over the curriculum in terms of content, degree of difficulty, sequence, clinical setting and variety of clinical scenarios." (Ziv, Small et al. 2000)

The approach of using simulation experiences to replace clinical training time remains contentious. A nationwide longitudinal randomised controlled study in nursing concluded that the results provided "substantial evidence that substituting high-quality simulation experiences for up to half of traditional clinical hours produces comparable end-of-program educational outcomes and new graduates that are ready for clinical practice." (Hayden, Smiley et al. 2014). One of the critical points is that the simulation needs to be high quality. This appears to be the one single study that has specifically addressed this issue.

A major report commissioned by Health Workface Australia (HWA) in 2010 (Sutton, Bearman et al. 2010) was specifically tasked with investigating the use of simulated learning environments (SLEs) as a means of increasing clinical training capacity across twelve health professions. The absence of a 'national' medical curriculum and the absence of 'mandated hours of clinical contact' for medical training were noted. Eighteen Australian medical schools were surveyed. "There was a common, but not universal, perspective within the medical school representatives, that almost any element of the curriculum could be supplemented through the use of simulation. However, there was a universal view that the use simulation could not simply replace clinical placements. It was seen as an adjunct, where important skills could be practiced and learned." Interestingly, both the Australian Medical Council (AMC) and the Medical Deans of Australia and New Zealand (MDANZ) were "supportive of the idea that SLE could be used to enhance, support and even in certain circumstances replace some direct clinical involvement."

An Association of American Medical Colleges (AAMC) survey in 2011 (Association of American Medical Colleges 2011) did not specifically address the issue of replacing clinical contact time with simulation.

One of the foremost authors in the field of SBE captures the essential inability of SBE to ever fully replace clinical training. "Encounters with real patients will always remain essential in exposing health providers to the full complexity of practice. SBME is thus a complimentary educational modality rather than an attempt to replace real patient training encounters."(Ziv, Wolpe et al. 2003).

While SBE can facilitate the move away from the traditional 'see one, do one, teach one' approach to medical training, and prevents skills being performed for the very 'first time on patients' there will always be a 'first time on a real patient' for any skill; procedural, cognitive and interpersonal. What SBE does is ensure that the student or trainee is much better prepared and more competent with the skill or task itself before that first real patient encounter. The 'first time' of performing a particular skill, or having a particular conversation, involving a real patient will always remain. These experiences, along with meeting the vast and subtle variation in the human condition, and the profound sense of responsibility, accountability and duty that accompany medical practice with real patients will never be fully replicated or replaced by simulation, but SBE experience is the 'closest thing to the real thing' that students can get.

JUSTIFICATIONS FROM EDUCATION THEORY AND TRENDS

The justification for simulation as useful (or necessary) to supplement and/or replace traditional in-service 'clinical training' is valid and important. However it fails to fully consider the additional opportunities that SBE provides.

The emerging weight of education theory and evidence not only explains why SBE can be used to supplement traditional clinical training, but also suggests that SBE can provide additional new learning opportunities. It is more than just a replacement for lost or limited opportunities. Understanding the relevant underpinning education theory is essential for determining 'where, when and for what' SBE is used, and for optimising outcomes where SBE is used.

Theories and recent trends in education which support the use of SBE include some which highlight flaws and limitations in traditional training approaches, and others which highlight the new features and opportunities arising from SBE:

- Move to **competency based education** and curricula in large part from the recognition that length of training and quantity of exposure alone are insufficient to ensure mastery of skills and achievement of core competencies (Frank, Snell et al. 2010) (Englander, Cameron et al. 2013) (Harris, Snell et al. 2010)
- **Deliberate practice** (Ericsson 2004) (Ericsson 2008) where the goal is expert performance and mastery based on deliberate practice and not on experience alone. Deliberate practice is recognised as applicable to cognitive, complex, communication and teamwork, and interpersonal skills as well as psychomotor skills

- **Experiential learning** theory (Kolb 1984) where active participation (concrete experience), feedback and reflection (reflective observation), abstract conceptualization and (re)application of theory and learning to new experience (active experimentation) are all components of the cycle of learning
- Theories of **reflective practice** including Schon's approach to reflection 'in action' and reflection 'on action'. In SBE this equates to reflection during the simulation participation experience (in-action) and during the post-session feedback and debriefing (on-action)
- **Spiral learning** where components of the curriculum are deliberately scheduled/planned to be met by students in a repetitive, coordinated and progressive fashion throughout the programme of learning
- **Mastery based learning** (McGaghie 2015) where the goal is for every learner to achieve predetermined standards of practice or mastery, and to progress at the rate determined by their achievement and not by a predetermined timeframe for the programme of learning
- Greater **focus on 'learner'** rather than on 'teacher' and individualised training rather than programmes
- Greater focus on and targeting of 'learner needs' as distinct from 'patient needs' (as is essential in the service context) while still incorporating the patient perspective (Perkins 2007)
- Emphasis on **'teacher enabled'** learning rather than 'teaching'
- Increased inclusion and use of **'enabling' technology**
- **Adult learning theory** where critical features include the recognition of the student/learner (participant in simulation) as a resource in their own learning, and where learning activities are most valued and appreciated when they focus on solving practical problems and applying theory to actual practice (Knowles) (Taylor and Hamdy 2013). The ability of SBE to recreate realistic clinical situations taps into the added motivation that students experience when they identify the learning as practically important and relevant.
- **Social learning theory** as one justification for the commitment to realism in simulation. SBE allows the deliberate representation and inclusion of realistic representations of the psychosocial interactions which play a large role in the evolution and management of dynamically evolving clinical situations in real clinical practice. (Flanagan 2004)
- **Situated learning** which focuses on the fact that learning is culturally and contextually specific, and holds that some knowledge in relation to a task is only present in the location or context of the task. (Kaufman and Mann 2007)
- **Emotional learning** (Posner, Russell et al. 2005) This theory, and emerging evidence, focuses on the relationships between emotions/affective states and learning (and performance). It is well recognised the SBE can generate powerful emotions in students/participants and these need to be consciously considered and managed in effective SBE. Much more research in needed in this area.
- **Focus on instructional design** in medical education including in SBE (Chiniara, Cole et al. 2013) (Schaefer, Vanderbilt et al. 2011)

The Confederation of Postgraduate Medical Education Councils (CPMEC) summarised the overriding education theory and principles in relation to the Australian Curriculum Framework for Junior Doctors, (Confederation of Postgraduate Medical Education Councils (CPMEC) 2009) and these, in essence, apply also to SBE.

"The widely accepted principles of adult learning form a basis for the Curriculum Framework. Inherent in these is the need for respect of prior learning and experience, a requirement for the provision of clear learning outcomes, regular feedback on performance and the need to provide opportunities for reflection." (Confederation of Postgraduate Medical Education Councils (CPMEC) 2009).

Others have also summarised the key education theory underpinning SBE.

"Simulation is a learner-centred rather than patient-centred educational experience. In the immediate simulation context, the learner's needs receive highest priority. Conflicts with patients' needs to avoid errors in care are eliminated, as well as the accompanying stress on trainees. With live patients, learning time is limited, access is sporadic and the 'fit' of the learning experience to the trainee's level and needs is often suboptimal. In simulation-based medical education, trainees may receive controlled exposure to a complete range of designated, predesigned clinical encounters in a systematic curriculum fairly applied to all. This method is also consonant with important principals (sic) of adult learning whereby trainees learn at different paces and in different styles."(Ziv, Small et al. 2000)

"Simulation-based education requires educators to take a proactive approach to clinical exposure by designing an optimal learning environment and curriculum to serve the educational objectives. Whereas the apprentice method and learning from actual clinical encounters are constrained by chance, availability, and conflict with clinical operations, simulation-based education provides the opportunity to have full control over the curriculum in terms of content, degree of difficulty, sequence, clinical setting and variety of clinical scenarios. Opportunities exist also for using similar methods to train teachers, offer high-level feedback, and assess competences." (Ziv, Small et al. 2000)

SBE assists students to meet the 'obligation to learn' while removing the potential for conflicts of interest and needs between students and patients. It also assists with teaching faculty tensions between their service obligations and teaching obligations. Simulation specifically addresses the "conflict between 'the imperative to give patients the best possible care and the need to provide novices with experience'." (Gawande A. Complications. *A surgeon's notes on an imperfect science. London: profile books Ltd, 2002.* Cited in (Flanagan 2004).

SBE also potentially accommodates a greater degree of individualisation of learning and accommodation of the range of preferred styles and pace of learning than is possible in traditional clinical placement learning, especially if blended and integrated with other teaching and learning methods.

SBE AND LEARNING OUTCOMES

Simulation is most readily seen to be of value in bridging the gap between 'knowing' and 'doing', and between 'theory' and 'practice'. In fact simulation can make visible that gap, to the students and to others including teaching faculty, and at the same time provide the opportunity to close the gap by providing "training to practice and improve the actual work skills and behaviours required to perform tasks and functions on the job." (Flanagan 2004). As such SBE operates at the upper levels of the Millers pyramid of levels of learning outcomes. (Miller 1990). Following this approach SBE activities usually provide opportunities for prior theoretical knowledge and skills to be applied in a simulated context. It is however also likely that SBE itself has significant value in the acquisition of new learning, not only experiential learning, but also the acquisition, consolidation and subsequent access and recall of new knowledge, including new theories and concepts. This is an area warranting further research. It is the theories of emotional engagement and activation from simulation which suggest this additional benefit from SBE and which might hold the keys to understanding the power and 'magic'[16] of simulation based learning. "The simulator is 'the wand not the magic'. As with any tool, in order to be effective, it must be used appropriately." (Flanagan 2004). Understanding and applying underpinning education theory in SBE is crucial to maximising benefit and optimising learning.

RESEARCH EVIDENCE

It is not the intention of this report to summarise or comprehensively review the existing literature in relation to the research evidence for SBE. Others have already done this. (Issenberg, McGaghie et al. 2005, Okuda Y, Bryson EO et al. 2009, McGaghie, Issenberg et al. 2010, Sutton, Bearman et al. 2010, Cook, Brydges et al. 2013, McGaghie 2015). In a relatively recent issue of the Medical Education journal the 2010 seminal paper by McGaghie, Issenberg et al. was revisited. In the introduction it is stated that "today's academic medical community educates 21st-century physicians using 19th-century thinking, methods and technology" and concludes "there is no longer any doubt that SBME can be a powerful educational intervention when it is used under the right conditions." (McGaghie, Issenberg et al. 2016). [17] It also states that "research and writing about SBME is growing exponentially. The field is always changing. Hence we will never have a fully definitive, contemporary account of SBME research because the topic is a moving traget."

A similar conclusion about the effectiveness of SBE was reached from a meta-analysis of technology-enhanced simulation in health professional education published in 2011. It concluded that the evidence for effectiveness was sufficiently convincing as to "question the need for further studies comparing simulation with no intervention (i.e., single-group pretest-posttest studies and comparisons with no-intervention controls)." In addition the paper also concluded that "The important questions for this field are those that clarify when and how to use simulation most effectively and cost efficiently." (Cook, Hatala et al. 2011). A subsequent meta-analysis focusing specifically on mastery learning and SBE came to similar conclusions. SBE with mastery learning is consistently associated with better outcomes than no intervention and associated with higher outcomes than SBE without a mastery element. And the authors draw the same conclusions again, that the research focus needs to move on from the question of whether or not SBE (with or without mastery elements) is effective, to clarifying when and how to use these educational techniques. The authors remind us that "educators must thus consider the efficiencies and comparative value of potential training activities, including both the benefits training and the costs in terms of time (of trainees, instructors, and other personnel), money, and lost opportunities (other worthwhile activities that could be pursued)." (Cook, Brydges et al. 2013). This same stance is reiterated in the most recent paper where it is stated that "the challenge for the medical education research community is to figure out how to use SBME efficiently and cost effectively to educate and evaluate individual doctors and healthcare teams." (McGaghie, Issenberg et al. 2016)

In summary, there is now substantial and sufficient research evidence to move on from the question of whether or not SBE works (and should therefore be included in undergraduate

[16] A simulation educator Julie Settles at the Laerdal SUN meeting in 2010 referred to simulation as "magic pixie dust" in that we know it works, but we don't altogether understand why and how it works.
[17] The best single paper overview of the evidence is the McGaghie, Issenberg et al. 2010 paper. Another useful reference is the AMEE Guide No 82 by Motola et al.

medical programmes on the grounds of effectiveness) to addressing the questions of 'where, when, how and for what' it should be used. And for the focus in implementation strategies to also consider the balancing of the drivers, justifications and other motivations for use of SBE against the feasibility and implementation issues.

OUTCOME MEASUREMENT IN SBE

Before proceeding however, it is worth noting that most studies measure outcomes according to Kirkpatrick's classification or some modification of this, and the majority of evidence for SBE is at the lower levels. In the Kirkpatrick classification the four levels of evaluation of a learning event or opportunity consist of (1) reaction (how the learners react to the learning process), (2) learning (the extent to which the learners gain knowledge and skills), (3) behavior (capability to perform learned skills while on the job), and (4) results (impact of the training program—e.g., on patient safety). (Boulet, Jeffries et al. 2011). There are a growing number of research studies showing transfer of SBE training to real clinical settings with improved health professional performance (level 3) and also improved patient outcomes (level 4). (DeVita, Schaefer et al. 2005, Draycott, Crofts et al. 2008, Okuda Y, Bryson EO et al. 2009). At this point in time it is also true that most of evidence for effectiveness is for SBE used for procedural skills training and for protocol or guideline driven patient management, for example in managing cardiac arrest or managing shoulder dystocia. (Nishisaki, Keren et al. 2007).

As with all things 'evidence-based' we need to remember that the absence of evidence does not necessarily equate to the absence of effect, and in the field SBE gathering the evidence of effect at the higher levels of outcome, especially patient outcomes, and for the more complex skills, will be an ongoing challenge for the research community. "As Gaba has pointed out, 'no industry in which human lives depend on the skilled performance of responsible operators has waited for unequivocal proof of the benefit of simulation before embracing it.' " (Issenberg and McGaghie 1999) (Gaba DM. Improving anaesthesiologist's performance by simulating reality. *Anaesthesiology.* 1992; 76:491-494)

More importantly it should be noted that the evidence in favour of SBE applies to simulation which is high quality and "when it is used under the right conditions." (McGaghie, Issenberg et al. 2016) Simulation is not a single homogeneous entity which is, of itself, intrinsically good and effective. Like all educational interventions it can be implemented in a way that is consistent with current evidence and best-practice where it is therefore reasonable to presume optimum outcomes. It can of course also be implemented in contexts and formats where there is no guarantee of the desired learning being achieved, and indeed where there are significant risks including 'negative learning'. For these reasons it is important that SBE is implemented with an understanding of this risk and deliberate strategies to minimize and mitigate this and other risks.

OTHER JUSTIFICATIONS AND BENEFITS OF SBE

The collective strength of evidence and arguments in favour of SBE have led some to consider simulation as more than just a good idea and a logical evolution in heath professional training. It has been described as an ethical and moral imperative. (Ziv, Small et al. 2000, Ziv, Wolpe et al. 2003). This perspective arises from a 'view' of the drivers and justifications from a different lens or perspective. Several of the drivers already listed in the clinical practice, education and research sections when considered from a different perspective form overarching themes that are both 'cause and consequence', i.e. arguments for SBE and benefits arising from it. This section attempts to summarise the alternate lenses though which we can view SBE.

PATIENT SAFETY AND RISK REDUCTION

The arguments for SBE arising from the patient safety and quality perspectives have been eloquently and convincingly articulated by others already. (Ziv, Small et al. 2000, Flanagan 2004, Rall and Dieckmann 2005, Rall and Dieckmann 2005, Ziv, Ben-David et al. 2005) It is now widely acknowledged that failures in 'non-technical skills' or 'human factors' contribute to a majority (60 to 70%) of adverse patient outcomes, and that training can improve performance, reduce these failures and improve patient outcomes. As with other areas, there is both a theoretical base and a growing evidence base for SBE for team training (Eppich, Howard et al. 2011) and in related areas that contribute to patient safety. Given the high proportion of adverse outcomes where failures of communication and teamwork are key contributors, and that SBE is well-suited to communication and team-based training, it seems difficult to justify not incorporating SBE focused on these skills and competencies for all health professionals, beginning in undergraduate training.

While much of the focus in patient safety has appropriately been on the need to redesign the current 'error inducing' systems in health care which are characterised by unnecessary complexity, variation and opacity in process, many opportunities also exist for risk reduction through training. Much of the literature in this area focuses on simulation in the context of continuing medical education, however the same principles apply to undergraduate education. These 'newer' curriculum elements, including patient safety and quality improvement, are recognised as increasingly important in undergraduate medical programmes. This broadening scope of undergraduate medical curricula is consistent with the 'Otago Medical Course of the Future curriculum masterplan' and the section focusing on recently developed and emerging themes. (Otago Medical School MBChB Curriculum Committee 2015)

At both undergraduate and continuing education levels the learning outcomes related to patient safety, including teamwork and communication, understanding and managing human factors, and error recognition and management, are well suited to learning by SBE and supported in the evidence and best-practice literature. (McFetrich 2006, McGaghie, Issenberg et al. 2010). The HWA report also identified these elements of the undergraduate medical curriculum as well-suited to SBE/SLEs. It is increasingly difficult, if not impossible, to justify ongoing 'learning on' and 'practicing on' real patients where there is significant risk of harm, when we now have effective alternatives including SBE.

"The reality of medical training is still that health professionals, whether novices or experts, are expected continuously to acquire new knowledge and skills while treating live patients. The mode of training for gaining proficiency at risky procedures, as well as achieving and maintaining competence in handling rare, complex and critical problems, has been the classic on-the-job apprenticeship model based on *ad hoc* exposure to patients. Patient free environments such as medical simulation will contribute to improving the training of health professionals in traditional skills while minimising harm to patients. The patient safety imperative has raised expectations regarding the responsibility of medical educators and decision-makers to ensure providers competences in new areas. These include error management, inculcating safety culture, teamwork, and improving performance in complex systems. Simulation offers options for teaching these skills as well as supporting improved methods for demonstrating and documenting competencies."(Ziv, Small et al. 2000). In addition, "exposure to debriefing in simulated scenarios educates health professionals to recognise the important role it should play in their daily practice and ongoing efforts to improve quality of care. Thus, simulation with proper debriefing can help break the culture of silence or denial in medicine over mistakes and the implications for competence." (Ziv, Small et al. 2000)

"A pivotal feature of this educational technique is that it can improve medical care by providing medical students and professionals with an opportunity to learn through (rather than from) their own and others' mistakes. …. SBME creates conditions in which making mistakes is not harmful or dangerous to patients but is, rather, a powerful learning experience for students and professionals. They are permitted to err and are provided with the opportunity to practice and to receive constructive feedback which it is hoped, will prevent repetition of such mistakes in real-life patients. Belief in this approach should lead SBME educators to set an important additional goal: training professionals to manage their errors and to be accountable for them." (Ziv, Ben-David et al. 2005)

Simulation thus not only enables some of these newer learning outcomes to be deliberately included in medical curricula and targeted in SBE activities, it also provides an opportunity to take a substantially different approach to the 'whole' of medical training.

LEARNER SAFETY

SBE is not only safer for patients, it is also safer for students, and for already qualified health professionals. It is worth noting the shift away from describing SBE as intrinsically 'safe' to an obligation on educators to create a 'safe container' in which learning can occur. We can never guarantee that any activity, including SBE, is entirely safe or free of risks to students/participants. SBE that is poorly executed can actually be quite harmful and many participants experience it as significantly stressful and anxiety provoking. The stressors are likely less, and different, from the stress of learning on real patients, and of being ill-prepared to practice medical care with real patients. They do still need careful consideration however, not only from the perspective of protecting and respecting the students, but also to ensure maximum learning.

"Unlike patients, simulators do not become embarrassed or stressed; have predictable behaviour; are available at any time to fit curriculum needs; can be programmed to simulate selected findings, conditions, situations, and complications; allow standardized experience for all trainees; can be used repeatedly with fidelity and reproducibility; and can be used to train both for procedures and difficult management situations." (Issenberg and McGaghie 1999)

The controlled conditions that can be achieved during SBE, and the removal or at least reduction of the stress for students from 'learning on' real patients are key benefits and justifications of SBE.

LIFE-LONG LEARNING

An additional benefit to students from a strong, integrated simulation curriculum in the MBChB programme will be in preparation for ongoing life-long learning. Medical school lays the foundation for life-long learning and professional development not only in establishing a sound knowledge and experience base, but also a base in knowing and learning 'how to learn'. Undergraduate medical education contributes to establishing professional attitudes about learning and familiarity with life-long reflective practice. Early coordinated and repeated exposure to SBE, with its emphasis on experiential and adult learning elements, will help prepare future graduates for their ongoing professional development and training. Simulation is already well established in the continuing professional development programmes of several of the Australasian colleges and has recently become mandatory for those training with ANZCA (Australian and New Zealand College of Anaesthetists). There is no doubt that there is a 'learning curve' for the process of learning by simulation and the further along this curve that medical students are at the time of graduation, the more likely they are to be able to take maximum benefit from ongoing simulation-based learning opportunities.

CULTURE CHANGE

The arguments for simulation as a 'moral imperative' arise from attention to the rights and interests of all parties. They focus on patient safety, learner safety and the cultures in which both health care delivery and healthcare professional training occur.

In practice the fundamental right of patients to direct their own care and to choose freely to be involved in medical education, or not, are often violated. A subset of patients bear an undue or disproportionate burden of the risks associated with participating in medical education and training. These are often our most vulnerable patients including those with impaired autonomy (including the elderly and those with mental illness), individuals from minority and disadvantaged populations, and those with the rare and 'interesting' medical conditions. SBE offers an opportunity to contribute to reducing this inequity of burden and reinforcing the fundamental ethical principles underpinning medical practice. Patients are not our commodities for learning on. Respect for 'patients as persons' is a fundamental value in medicine and not open to sacrifice for the sake of learning. SBE in essence is both patient 'protective' and patient respecting.

"The use of simulation wherever educationally feasible conveys a critical message to the clinician: patients are to be protected whenever possible, and are not training commodities. It is therefore an ethical obligation to make all efforts to expose health professionals to clinical challenges that can be reasonably well simulated prior to allowing them to encounter and be responsible for similar real-life challenges. From the patient's perspective, simulation reduces the exposure of patients to health professionals that are less experienced, and thus contributes to better protection of patient rights to receive quality care that focuses on the patient's needs rather than care compromised by training needs. This is a key component of building the trust of patients and stakeholders in health professionals and the system they operate, a precious value that drives the patient safety movement." (Ziv, Small et al. 2000)

SBE therefore offers an opportunity to 'walk the talk' in terms of respecting patient's rights and reinforcing the fundamental respect that must underpin all medical practice. A commitment to SBE and reducing risk to patients reinforces quite powerfully the ethical principle articulated in the New Zealand Medical Association Code of Ethics (New Zealand Medical Association 2002, New Zealand Medical Association 2014): "Consider the health and well being of the patient to be your first priority." At the same time SBE also addresses the obligations and motivations that students have to learn, and that clinicians and teachers have to facilitate learning.

Concerns that simulation can encourage or create unprofessional attitudes and behaviours in students, because the patient is not real and there are no real consequences, are not unreasonable but can be addressed. If realism is sufficient and students/participants are expected to engage in the 'fiction contract' that surrounds SBE, and to perform always in a manner which is consistent with professional practice, then SBE reinforces professionalism. SBE activities can also be specifically constructed to provide opportunities for students to encounter, practice, reflect on and learn about some of the more challenging and complex aspects of professional practice.

"SBME should also emphasise basic humanistic values such as honesty, humility, transparency and trust."(Ziv, Ben-David et al. 2005)

The conclusion then is that not only do the limitations of the current cultures and contexts of health care delivery and health professional training provide drivers for SBE, i.e. cause, in addition as a result of SBE we may effect 'culture change' i.e. consequence. In this respect Gaba refers to it as an "enabling technique." "Those working on the development and use of simulation in health care largely share a common vision of a future revolution in health care organisation, with simulation as a key enabling technique." (Gaba 2004)

Simulation thought of in this way is a 'change agent', or at least those using simulation as an educational method, as change agents. This is a potentially powerful and exciting concept, the thought that the way we train medical students might well be able to change the healthcare contexts in which they are placed, learning, and subsequently working. However we should be mindful of the risks that can incur from placing undue expectation on students, individually and collectively, to influence the workplace environment. What might be more reasonable as an expectation is that by greater inclusion of academic and clinical teaching staff in effective, respectful and protective SBE learning activities we will achieve a ground swell brought about by increasing numbers of change agents committed to continually improving quality of healthcare and patient outcomes.[18]

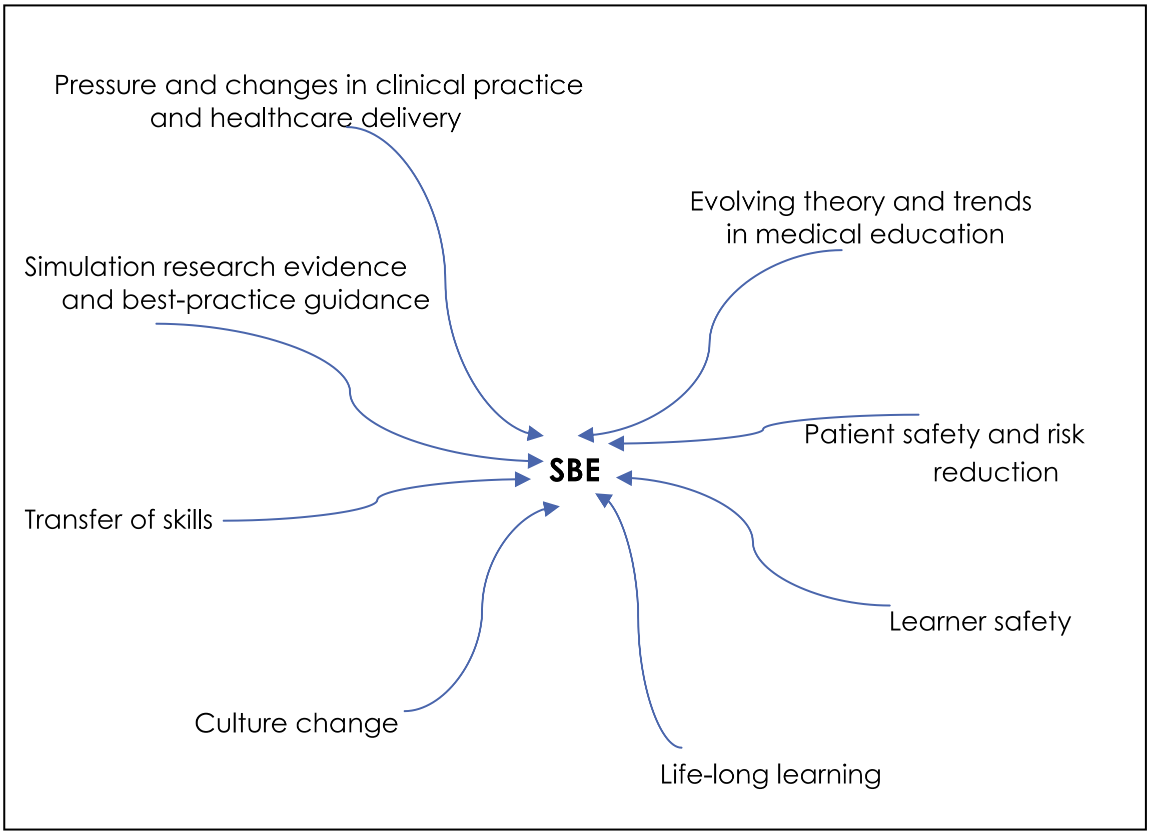
DEVELOPMENT AND TRANSFER OF TEACHING SKILLS

SBE is at times, and by some people, seen as a standalone teaching method. It is however just one of the many teaching tools that we have available to us. The utility and transferability of the teaching skills acquired in the practice of SBE to other learning contexts and formats is often underappreciated. Most particularly, the feedback skills including formal simulation debriefing, have much wider applicability than often appreciated. Feedback is an integral component of many teaching and learning activities from case-based tutorials and small group discussions through to more traditional bedside clinical teaching. Debriefing skills are also transferable to the clinical environment and useful for clinicians in reflecting on and debriefing real clinical events. One of the recommended simulation debriefing models, "Debriefing with good judgment" (Rudolph, Simon et al. 2008) is increasingly recognised and utilised for clinical event debriefing. (Salas, Klein et al. 2008) Both debriefing of 'real-life' events and 'in-situ' simulation have been shown to be effective in changing patterns of behaviour. (Scherer et al cited in (Fanning and Gaba 2007). This transfer of skills, along with SBE sessions designed specifically to include feedback skills within their learning objectives, are further examples of the potential for SBE to effect culture and practice change within overall health care delivery systems.

[18] For a comprehensive but slightly disheartening overview of this perspective see the 2004 paper "The future vision of simulation in healthcare" by David Gaba.

CONCLUSIONS

Taking into consideration all of the drivers, justifications, evidence and benefits it can be concluded that SBE offers significant advantages and opportunities in the context of health professional training, including undergraduate medical and nursing training, and postgraduate and 'in-service' health professional training.



APPENDIX THREE: FEEDBACK AND DEBRIEFING IN SBE

While feedback in SBE is only one of the features identified as important for effectiveness it does warrant specific comment. Feedback is a critical element in SBE, and debriefing in simulation is a "special kind of feedback process".(Fanning and Gaba 2007) This section expands a little on simulation debriefing given its critical place in effective and 'best-practice' SBE.

One leading simulation educator has suggested that "simulation is just an excuse to debrief". [19] The point he was making is that participation in a simulated activity or scenario without subsequent feedback, reflection and facilitated learning fails to maximise the learning that can be achieved from SBE. He, and others, might even be suggesting that the more important and more substantial learning actually occurs during the debriefing. Others have referred to debriefing as "the heart and soul" of the simulation experience. This view, that debriefing is critical, is consistent with experiential learning theory and approaches. Simulation training sessions with specific learning objectives and designed to include active experience followed by facilitated debriefing, offer the opportunity for students to go through the stages of the experiential cycle of learning in a structured manner. Combining the action/actual experience of the experiential component of the simulation with a subsequent analysis and reflection on the experience, aims to facilitate incorporation of learning into changes in future practice. "This experiential learning is particularly suited to professional training where integration of theory and practice is pertinent and ongoing. … The concept of reflection on an event or activity and subsequent analysis is the cornerstone of the experiential learning experience. Facilitators guide this reflective process. Indeed, this ability to reflect, appraise and reappraise is considered a cornerstone of lifelong learning. … In practice, however, not everyone is naturally capable of analysing, making sense, and assimilating learning experiences on their own, particularly those included in highly dynamic team-based activities. The attempt to bridge this natural gap between experiencing an event and making sense of it led to the evolution of the concept of the "post experience analysis" or debriefing. As such, debriefing represents facilitated or guided reflection in the cycle of experiential learning." (Fanning and Gaba 2007).

The Institute for Medical Simulation (IMS)[20] and Center for Medical Simulation (CMS) in Boston have defined debriefing as "a conversation between 2 or more people to review a real or simulated event in which participants analyze their actions and reflect on the role of thought processes, psychomotor skills, and emotional states to improve or sustain performance." (Rudolph, Simon et al. 2008). The defining feature is that debriefing is a 'facilitated learning conversion' where the teacher/instructor and the students/learners work together to achieve new learning. And in order for this to happen the environment, and teachers, need to be

[19] Paediatric simulation educator David Grant at the Laerdal SUN Conference 2010. David Grant also refers to simulation as a "loaded gun" reinforcing the message about needing to 'handle with care' and be aware of potential risk from poorly executed SBE

[20] The Institute for Medical Simulation (IMS), evolved from research developed through a collaborative project between the Center for Medical Simulation (CMS) and the Harvard-MIT Division of Health Sciences and Technology funded by a grant from the Josiah Macy, Jr. Foundation. The IMS offers courses for simulation leaders, educators and researchers who want to develop and maintain high-quality healthcare simulation programs within their organizations. They are considered to be among the leaders in healthcare simulation internationally.

considered trustworthy. This is the concept of 'creating a safe container' in which students can take risks and learn.

"To ensure a successful debriefing process and learning experience, the facilitator must provide a 'supportive climate' where students feel valued, respected, and free to learn in a dignified environment. Participants need to be able to 'share their experiences in a frank, open and honest manner.' ….. An awareness of the vulnerability of the participant is needed, which must be respected at all times. This is highlighted by a recent study regarding the barriers to simulation-based learning, where approximately half of the participants found it a stressful and intimidating environment and a similar proportion cited a fear of the educator and their peers' judgement." (Fanning and Gaba 2007)

"I hear and I forget
I see and I remember
I do and I understand"
(Confucius)
"I trust and discuss"
(Fanning, Gaba) [21]

For debriefing discussions which follow participation in a simulated case or scenario (fully immersive simulation) one of the best known models is the "Debriefing with good judgment" model. (Rudolph, Simon et al. 2008). This model originated from the IMS/CMS group and has a long empirical and experiential history. It is grounded in "evidence and theory from education research, social and cognitive sciences, experience drawn from conducting over 3000 debriefings, and teaching debriefing to approximately 1000 clinicians worldwide." (McGaghie, Issenberg et al. 2010) The model casts the facilitator/teacher as a 'cognitive detective' approaching the debriefing discussion with a stance of 'genuine curiosity' in trying to uncover the students 'frames'; or put another way, to uncover the very good and rationale reasons that the students will have had for doing what they did in the simulation. Having helped the student understand their own performance, and contributed their own 'expertise' and 'point of view', the teacher/facilitator can then assist the student to change behaviours and performance in the future. The ultimate aim, of course, being to close the performance gap between the actual performance and the ideal or desired performance, not just in simulation but also in clinical practice.

Integral to this debriefing model, and to creating a 'safe container' for learning, is a further concept: the 'basic assumption'. In addition to the stance of genuine curiosity, the CMS facilitators commit to a fundamental belief about their learners. The 'basic assumption' is expressed and displayed throughout the Boston Center as follows: "We believe everyone participating in activities at the Center for Medical Simulation is intelligent, well-trained, cares about doing their best, and wants to improve.''[22]

There are of course several other feedback and debriefing models described in the literature and one of the important considerations in SBE is to match the debriefing/feedback model to the learner, including their stage of training, the learning objectives, and the specific format or

[21] Taken from the IMS Simulation Instructors Course 2012
[22] Center for Medical Simulation (CMS) Boston

type of SBE activity. Another well-known model is the ‘plus delta’ model which focuses on what went well and what would change or be improved on in the future. It is also important to remember that feedback can originate from several sources. In addition to the simulation teacher/facilitator/instructor, feedback can originate from the simulator tool itself (model, manikin, sophisticated full-body human simulator or simulated patient), and peers (other learners). More work is needed to identify optimum models, ‘dosing’ and timing of feedback and to ensure standards and quality in the feedback process. In addition there is limited guidance in the research literature on the use of video-recordings of the simulation experience during the debriefing discussion. There are several good theoretical reasons for incorporating video, but as with all other aspects of SBE it is important to understand potential benefits and risks and to consider best-practice guidance where it does exist.

It is however almost certainly true that just as matching the simulation method to the learning objectives and stage of training of the learners is crucial, so too is matching the debriefing model. SBE sessions using part task trainers and focusing on procedural skills almost certainly do not require the same investigative debriefing approach as fully immersive case-based clinical simulations where in addition to case assessment and management, including clinical reasoning and decision making, other important learning outcomes relate to teamwork and communication skills and professional attitudes and behaviours.

“When it comes to reflecting on complex decisions and behaviours of professionals, complete with confrontation of ego, professional identity, judgement, motion, and culture, there will be no substitute for skilled human beings facilitating an in-depth conversation by the equally human peers.” (Dismukes et al, cited in(Fanning and Gaba 2007))

As with all teaching methods, simulation feedback and debriefing are improved when the teacher has opportunity to acquire, practice and improve their own skills through deliberate and repetitive practice. Faculty training /staff development in this aspect of SBE is particularly important and helps teachers negotiate some of the challenges that arise in SBE. One common example is the “tension between making participants active and responsible for their own learning versus ensuring they address important issues and extract maximum learning during the debriefing. Data from surveys of participants indicates that the perceived skills of the debriefer have the highest independent correlation to the perceived overall quality of the simulation experience. As the skill of the debriefer is paramount in securing the best possible learning experience, training and facilitation as vital.”(Fanning and Gaba 2007)

APPENDIX FOUR: RISKS AND LIMITATIONS OF SBE

The potential risks and limitations of SBE are well documented and discussed in the literature. They essentially fall into 2 categories: risks to and from learning, known as 'negative learning', and risks to the learner. Often the risks arise from some common limitations and misunderstandings about SBE.

ORIGIN OF THE RISKS AND LIMITATIONS

Most of the risks and limitations arise from failures to follow 'best-practice' guidance in SBE and from the limitations inherent in the technology.

- Confusing the tool with the technique i.e. the simulator or model or gear with the educational method. Educators need to be clear that the technology, including the simulators, "is 'the wand not the magic'. As with any tool in order to be effective, it must be used appropriately."(Flanagan 2004)
- Failing to appropriately match the method, including the technology, with the learning outcomes and stage of training of the learners
- Failure to integrate SBE into the overall curriculum: "The common mistake is to use simulation without an effective curriculum. This can lead to disjointed learning without planned opportunities for review and consolidation of knowledge." (Ziv cited in (Perkins 2007))
- Where focus is too much on "rare cases" and infrequent but important critical presentations we can create "a 'simulation adventure playground' where only rare and perhaps irrelevant scenarios can be simulated often in a spectacular manner. The learning goals may then be in the background making less effective educational use of simulation. " (Rall and Dieckmann 2005)
- Issues in relation to fidelity and realism: the fact that the patient/situation is not real will always mean that students will inevitably approach a simulator differently to real life. Two common changes in attitude can occur: (a) hypervigilance, which causes excessive concern because one knows an event is about to occur; and (b) cavalier behaviour, which occurs because it is clear no human life is at stake. (Flanagan 2004) If this is not recognised and explicitly managed it can produce negative learning. In addition the limits to fidelity/realism can impact negatively on student engagement and learning. Understanding and managing these issues is important to optimise learning outcomes.
- Failure to have planned and targeted strategies for facilitating the transfer of the knowledge, skills and learning to clinical practice
- Insufficient resourcing to ensure optimum outcomes: SBE clearly requires high initial capital costs and substantial ongoing operational costs and resourcing including staff development and support to ensure trained simulation educators.

NEGATIVE LEARNING OR NEGATIVE TRANSFER

For every education method and individual teaching/learning session there is never any guarantee that students actually learn what the teachers intend them to learn, or indeed learn anything at all. The evidence and theory behind SBE does suggest that participants do learn from SBE, and that very often the learning matches that intended. However there is also recognition that in SBE there is a real risk of what has been referred to as 'negative learning' or 'negative transfer'. In these situations the learning that the student takes away from the session poses a risk to patients if it is transferred to the clinical environment. I suspect the same applies to other teaching and learning methods but there is more focus on this in relation to SBE.

Examples of negative learning/negative transfer include:

- 'Attitudinal and behaviour' change in students as a result of the absence of a real patient and real consequences
- 'over confidence' as a result of SBE
- Embedding 'habits of practice' which are 'poor' rather than 'good practice' e.g. where students are allowed, or indeed required, to breach sterile technique in simulation, often to reduce consumables/operating costs
- Unrealistic expectations of actual clinical practice as a result of 'time frames' for assessment, intervention and responses in the management of patients being modified and unrealistic in simulation to accommodate teaching timetables/time constraints
- Perpetuating and creating unprofessional attitudes and behaviours by deliberately or inadvertently 'caricaturing' or stereo-typing individuals and groups from a particular medical specialty or health profession in simulated cases/scenarios e.g. doctors as cold and clinical nurses as caring, surgeons as 'difficult' and pediatricians as 'kind'

While these risks might well be mitigated by being made explicit and considered in the specific design, development and delivery of SBE, this is an area which warrants further research and considered caution and care.

RISKS TO LEARNERS

There is no doubt that many students, and indeed qualified health professionals, find participating in simulation significantly stressful and anxiety provoking. The sources of stress appear to be at least two fold: a performance anxiety and an anxiety generated when the learner has 'bought into' the simulation and is aware of their own limitations.

"The realism of high fidelity simulation means that participants take their roles seriously and are highly motivated because their performance reflects the way in which they see themselves both as a person and as a clinician. They also see the impact of their actions on the ability of other team members to achieve the common goal of safe patient care." (Flanagan 2004) .

It is this 'display' of oneself as an individual and a healthcare professional, the 'putting oneself and one's identity out there' and on the line, that generates a significant source of stress and anxiety for participants and which, if not handled appropriately can cause harm to the learners and students that we are endeavouring to help. While the emotional engagement and activation engendered by SBE is considered one of the contributors to the effectiveness of the learning, it can also be a contributor to poor learning and cause harm to students/learners. Just as it is known that there a stress-response/performance curve and relationship, so too there is a relationship, less well understood, between stress/anxiety and learning. This is another area which warrants further research, and considered caution and care.

APPENDIX FIVE: CORE LEARNING OUTCOMES FOR A PROPOSED MBCHB SIMULATION CURRICULUM

The following proposed MBChB simulation core curriculum has been developed by selecting from the learning outcomes and core elements as currently described in the MBChB curriculum map and priority themes identified in the Curriculum Masterplan and combining these with a filtering process which focuses on outcomes that either 'can only' be learned to the required level of learning using SBE or are 'better or best' learned' by SBE. This provides a potential curriculum which can then be reduced to a minimum or core or essential SBE curriculum which logically should be prioritised in implementation of an overall strategy for SBE in the MBChB.

Outcomes which 'can only' be learned to the required level by SBE can be identified from those which we know cannot be safely and/or sufficiently learned via current and alternative education methods including traditional beside teaching and supervised clinical opportunities. These include:

- Skills for which it would be impossible, inappropriate and unacceptable for students to learn by experimental 'practice' on real patents. This would include skills where the student might at best be able to observe the skill performed by health professionals, such as advanced and complex communications including end-of-life conversations and examination for confirmation of death, and knowledge and skills required for managing rare or infrequent and critical presentations
- Aspects of teamwork such as leadership
- Clinical reasoning and decision-making early in the course of patient assessment and management of acute, undifferentiated, complex and potentially serious presentations
- Completion of legal documents including death certification
- Skills specifically required for transition from learner to graduate where the focus is on work-readiness and on collaborative (interprofessional) practice

Outcomes 'better or best' learned by SBE include those which can be learned in other ways, including traditional bedside sessions, but which might be better learned by simulation. SBE adds value from:

- Opportunities for repetitive practice with observation and feedback/debriefing
- Break-down of component parts of a skill or task and then re-integration into whole and also sequential learning of components and tasks in order on increasing difficulty
- Reducing risk and harm to patients e.g. invasive procedures with potentially harmful complications where risk to patients is significant and significantly reduced by prior SBE, and time critical skills including therapeutic procedures where performance impacts significantly and directly on patient outcome
- Reducing harm and risk from procedures which are uncomfortable or difficult for patients including sensitive examinations and procedures
- Reducing risk and harm to learners by enabling them to learn particularly challenging skills first in simulation before on real patients

The Core Presentations (CPs) and Core Professional Activities (CPAs) represent 'integrating' elements within the map and therefore could form the focus of case-based (and ideally) immersive simulations. Specific clinical skills and other learning outcomes can also contribute to case-based simulations or form the focus of skills-specific activities such as defined part-task training sessions.

The development and delivery of a planned, coordinated and progressive simulation curriculum with specific SBE activities being scheduled in a deliberately staged fashion over the course of the MBChB programme would ensure all students at all sites had opportunity to meet the required learning outcomes.

CORE PRESENTATION LIST

From the total CP list of 133 presentations the following would be well-suited to SBE:

1. Palpitations/abnormal heart rhythm
2. Chest pain
3. Shock
4. Shortness of breath
5. Respiratory distress in a child
6. Obstructed airway
7. Multiple trauma
8. Head injury
9. Spinal injury
10. Chest/abdominal/pelvic injury
11. Confusion/altered mental state
12. Loss of consciousness
13. Altered level of consciousness
14. A medical complication in pregnancy
15. Complications of labour
16. Sick newborn/infant
17. Cardiorespiratory arrest

Additional CPs suited to simulation using SPs include:

18. Anger/aggression
19. Anxiety/agitation/stress
20. Psychosis/hallucinations/delusions
21. Self-harm/suicidal intent
22. Risk-taking behaviours such as alcohol and other drug use, and risky sexual activity
23. Request for help with behaviour/life style change
24. Request for preventive health information
25. Patient and/or family requiring community support/respite care
26. Request for sexual health information/help with sexual dysfunction
27. Infertility
28. Request for contraception/sterilisation
29. Discussion about termination of pregnancy

A planned SBE programme would ensure that all students 'encountered' each of the core presentations, even if only in a simulated context. In conjunction with guidance from the curriculum map students would have opportunity to acquire the knowledge and skills required to manage these core presentations, even if they have not had the fortune and opportunity to have observed or experienced a real patient with the specific presentation. The simulated encounter/experience would facilitate learning not only the underpinning theory but also the transfer of knowledge and skill to future clinical practice.

CORE PROFESSIONAL ACTIVITIES (CPAS)

From the current list of 43 CPAs the following are well suited to SBE:

1. Complete a doctor-patient consultation addressing the patient's needs and perspectives, including cultural aspects, while also completing the medical tasks and duties.
2. Be flexible in order to adapt the assessment and management approach to take account of context, patient factors, population risks and prevalence rates.
3. Recognise and initiate management of the acutely unwell and/or deteriorating patient.
4. Use appropriate assessment and management strategies in circumstances where the patient has impaired communication, comprehension and language difficulties, and/or disability.
5. Recognise and appropriately manage a situation when the interaction with the patient is challenging or difficult.
6. Share information and decision-making with a patient, and when appropriate, their family/whānau or chosen others, in order to construct an acceptable management plan which incorporates the patient's preferences and values.
7. Contribute to the effective provision and receipt of handover of care of a patient.
8. Function competently as a member of a health care team including respectful and effective communication, and calling for help and/or closer supervision when appropriate.
9. Contribute to discussions with patients, and when appropriate their family/whānau or chosen others, in relation to poor prognosis, advance care planning, end-of-life care, and resuscitation status including DNACPR orders (do not attempt cardiopulmonary resuscitation)
10. Recognise and manage systems and/or individual factors where there is a risk of error, harm or sub-optimal care and manage occasions when these have occurred.

All of these CPAs represent integrated knowledge, skills and practice. SBE is recognised as an 'integrating' educational method and tool, and as such is well-suited to these types of learning outcomes. A carefully planned SBE programme would provide students with deliberately constructed opportunities to experience and practice these core professional activities. This would reinforce their learning from other methods such as independent learning of theoretical knowledge, observation of real practice and facilitated discussion with peers and tutors.

CLINICAL SKILLS (CS) DOMAIN LEARNING OUTCOMES

The MBChB curriculum includes 249 core clinical skills. All of the skills listed within the set 'Communication skills within the doctor-patient consultation' clearly lend themselves to SBE approaches using SPs and are already largely introduced in ELM using SPs.

In addition the following CS, selected predominantly from the subset of overall skills with the highest level of learning at the end of the TI year (either 'does' or 'shows how' using the modified Miller's pyramid approach to levels of learning) would fit well within a specified 'simulation curriculum'. Several on this list have been identified in the CS mapping exercise undertaken by the CS subcommittee to be currently learned by serendipity or opportunistically only, or to be 'at risk' or potentially vulnerable as defined by the fact that students have limited learning opportunities over the course of the MBChB programme. (Moore ML (on behalf of the Faculty Clinical Skills Subcommittee) 2014) A recent review has identified 102 of the total 251 clinical skills which are either not assessed at all 3 ALM campuses and/or have limited teaching and learning opportunities such that students might not have sufficient opportunity to achieve the required level of learning by the end of the TI year. Preliminary analysis of results from a survey of student self-reported competence at these skills reinforces the concern that teaching and learning opportunities are currently insufficient to achieve the desired levels of learning for these core skills. Many of these skills are well-suited to acquisition through SBE. Delivery of an agreed core simulation curriculum would thus be able to address many of these apparent deficits and gaps in the current programme and ensure all students had opportunity to achieve competence in all core clinical skills.

A list of 102 CS learning outcomes to be included in a 'simulation curriculum' is proposed below. They are grouped by themes (as indicated in the list title) and also should be read bearing in mind the two predominant SBE methods: simulated patients (SPs) and technology-enhanced simulation using models (including part-task trainers)/manikins/full body human simulators, and the range of formats and methods for SBE sessions.) Some of the CS are best suited to SP sessions, others to task focused sessions using part-task trainers/models, and others to fully immersive simulation in mocked up clinical environments and including either, or both, of (technological) human simulators and SPs. From this list a shorter list for priority implementation can be identified.

1. Communication skills within the doctor-patient consultation (10)

1.1 Initiating the clinical interview: Re-checking consent for student learning/participation, confirming correct identification of the patient, opening the consultation, setting the agenda & eliciting and considering the patient's perspective

1.2 Establishing and building a relationship with the patient: using appropriate non-verbal communication and empathic reflection, demonstrating respect and concern regardless of the patient's problems or personal characteristics

1.3 Gathering information: using appropriate screening questions, balancing open and closed questions, avoiding leading questions, listening attentively, responding to cues, facilitating discussion, using structure signposting and prioritising within the consultation

1.4 Summarising and closing the interview

1.5 Managing time within the consultation

1.6 Conducting an age-appropriate consultation with an adult

1.7 Conducting an age-appropriate consultation with a child

1.8 Conducting an age-appropriate consultation with a parent/guardian of a young child/infant/baby

1.9 Conducting an age-appropriate consultation with an elderly person

1.10 Conducting culturally appropriate and sensitive consultations with individuals from diverse backgrounds including specifically, Māori and Pacific people.

2. Integrated assessment and management skills incorporating clinical reasoning (24)

2.1 Assess responsiveness, signs of life (need for CPR) (and proceeding to resuscitation/management as per the Procedural skills listed below)

2.2 Focused and timely assessment (history and examination) and initial management of the acutely unwell patient presenting with an undifferentiated problem

2.3 Taking a history in more challenging circumstances when the patient is not communicating clearly
2.4 Focused and timely assessment and initial management of a patient presenting with reduced or altered conscious level
2.5 Focused and timely assessment and initial management of a patient presenting with shock
2.6 Focused and timely assessment and initial management of a patient presenting with common cardiac emergencies - chest pain, arrhythmia, cardiovascular compromise
2.7 Focused and timely assessment and initial management of a patient presenting with acute respiratory distress
2.8 Focused and timely assessment and initial management of a patient presenting with acute major trauma
2.9 Focused and timely assessment and initial management of a patient presenting with acute abdominal emergencies including abdominal pain and GI blood loss
2.10 Focused and timely assessment and initial management of a patient presenting with common obstetric emergencies
2.11 Focused and timely examination in the acutely unwell patient presenting with an undifferentiated problem
2.12 Psychiatric examination including mental state exam, assessment of suicide risk, violence risk, cognitive impairment and substance abuse

Specific Clinical reasoning skills including:

2.13 Experiential knowledge of clinical reasoning (including practice of forward and backward reasoning, articulating and receiving feedback on the reasoning process, accumulating illness scripts and pattern recognition)
2.14 Influence of clinical workplace conditions, norms, and policies including the impact of facilitators, and limitations and restrictions on the health professional on clinical reasoning
2.15 Focused and flexible information gathering guided by diagnostic possibilities, context and urgency
2.16 Acknowledge and communicate diagnostic reasoning, including uncertainty, when formulating management plans with patients
2.17 Recognising and synthesising diverse and apparently divergent, contradictory or inconsistent information
2.18 Broad and dynamic approach to differential diagnosis
2.19 Distinguish and prioritise multiple problems according to urgency, and whether active or inactive and new or established
2.20 Reasoned and dynamic generation of investigation and management plan and management priorities
2.21 Capacity and strategies to manage one's own uncertainty in relation to clinical decision making
2.22 Evaluation, including by reflection, and analysis of diagnostic accuracy and errors

3. Advanced and specific communication and teamwork skills (18)

Most of these are best suited to SBE with specifically trained SPs, but several could routinely be included in fully immersive case/scenario-based simulations targeting integrated skills and practice.

3.1 Breaking bad news
3.2 Communicating effectively with individuals with communication difficulties/impairments

3.3 Conducting consultations within emotionally laden situations
3.4 Conducting consultations/communications requiring the use of an interpreter
3.5 Documentation of a patient death – including entry in the clinical notes, and completion of death and cremation certificates
3.6 End-of-life conversations e.g. including advance care planning, advance directives; DNACPR discussion; discussion about transition from curative to palliative care
3.7 Handover of care (ISBAR)
3.8 Functioning competently within a team by performing delegated tasks and seeking clarification of role/tasks where necessary
3.9 Functioning competently within a team by managing time and prioritising tasks effectively
3.10 Functioning competently within a team by showing initiative and contributing positively to team functioning
3.11 Functioning competently within a team by communicating effectively and respectfully
3.12 Functioning competently within a team by recognising and managing conflict
3.13 Functioning competently within a team by monitoring own impact on other team members, and modifying behaviour as and when necessary
3.14 Notification of a patient death to the coroner
3.15 Specific demands and adaptations required by telephone conversations
3.16 Taking a history and discussing where needed for potentially sensitive and/or stigmatizing topics/issues/problems
3.17 Taking a history in more challenging circumstances when the patient is not communicating clearly
3.18 Verbal (including telephone) referral of a patient to another specialty

4. Developing competence and safe, high quality 'habits of practice' in the acquisition and maintenance of Sensitive examination skills (7)

The approach would generally be to provide SBE learning opportunities for the individual skills first, and then to subsequently incorporate the skill into either hybrid simulation with a trained volunteer or SP, or a human simulator, or a fully immersive scenario.

4.1 Rectal examination
4.2 Gynaecological examination including a bimanual pelvic exam
4.3 Gynaecological examination including a speculum examination of the vagina and cervix
4.4 Breast examination
4.5 Perineum and external genitalia examination in a male
4.6 Perineum and external genitalia examination in a female
4.7 Confirmation of death examination (and communication with family/whānau/NOK)

5. Developing competence and safe, high quality 'habits of practice' in the acquisition and maintenance of patient management and procedural skills, both diagnostic and therapeutic, and for transfer to clinical practice (43)

As above, the approach would generally be to provide SBE learning opportunities for the individual skills first, and then to subsequently incorporate the skill into incorporate the skill into either hybrid simulation with a trained volunteer or SP, or a human simulator, or a case-based or fully immersive scenario.

Safe practice

5.1 Hand washing/hand hygiene

5.2 Safe handling and disposal of sharps
5.3 Safe handling of clinical waste
5.4 Safe handling of commonly required biological specimens
5.5 Universal precautions/personal protective equipment
5.6 Request, obtain, handle and dispose of all biological specimens in a culturally appropriate manner

Specific management skills

5.7 Advanced life support (ALS)
5.8 Advanced airway management - laryngeal mask airway (LMA)
5.9 Advanced airway management - endotracheal intubation (ETT)
5.10 Basic life support (BLS)
5.11 Bag-valve-mask (BVM) ventilation
5.12 Defibrillation and AED use
5.13 External haemorrhage control
5.14 Normal vaginal delivery
5.15 Paediatric Resuscitation Skills
5.16 Safe patient handling: including transfer of elderly or disabled patient from bed to chair

Specific procedural skills

5.17 Arterial puncture
5.18 Aseptic/sterile technique
5.19 Blood culture specimens
5.20 Cervical/vaginal specimens (swab/smear)
5.21 Drawing up and checking IV drugs
5.22 Finger prick sample and measurement of blood glucose
5.23 Infiltrate wound with local anaesthetic
5.24 Instrument ties
5.25 Intramuscular injection
5.26 Nasogastric tube insertion
5.27 Nebuliser administration
5.28 Oxygen administration
5.29 Peripheral intravenous cannulation
5.30 Prescribing, checking, and administering blood products
5.31 Primary wound closure, using steristrips, tissue adhesive and sutures
5.32 Pulse oximetry recording
5.33 Setting up an intravenous infusion
5.34 Spine immobilisation techniques
5.35 Subcutaneous injection/infiltration of local anaesthetic prior to procedures such as IV cannulation or arterial blood sampling
5.36 Subcutaneous injection of medications (other than local anaesthetic) e.g. anticoagulant
5.37 Surgical knots
5.38 Suture removal
5.39 Temperature recording
5.40 Universal precautions/personal protective equipment (HOP)
5.41 Urethral catheterisation – female
5.42 Urethral catheterisation – male
5.43 Venepuncture - for routine blood tests

LEARNING OUTCOMES FROM OTHER DOMAINS:

Given the considerable number of specific learning outcomes within the curriculum map which lend themselves to learning via SBE this section includes only 'themes' of learning from the remainder of the domains i.e. professional practice, population health and epidemiology, science scholarship and research, diagnostics and therapeutics, and Hauora Māori.

Every SBE session, especially case-based and fully immersive simulation scenarios, provides an opportunity to facilitate and embed key learning outcomes in relation to:

1. **Professional development and behaviour**
    1.1. Ethical practice, including fundamental respect for patients
    1.2. Commitment to practice and lifelong learning
    1.3. Recognising and managing personal and professional limitations

The very fact that simulation is, of itself, often stressful and anxiety provoking, and can activate a broad range of other emotions in students means that it also provides valuable opportunities for students to experience these emotions in a context where there is risk mitigation for both patients and students. Debriefing provides a powerful opportunity to reflect and learn. Students can learn in general terms about the impacts of affect, emotions and stress on performance and clinical practice, and can in addition learn at a personal level to recognise and manage stress and other emotions they experience.

2. **Patient safety and quality improvement**
    2.1. Appreciation of human factors
    2.2. Understanding of health systems
    2.3. Error recognition and management

There is no doubt that "The patient safety imperative has raised expectations regarding the responsibility of medical educators and decision-makers to ensure providers competences in new areas. These include error management, inculcating safety culture, teamwork, and improving performance in complex systems. Simulation offers options for teaching these skills as well as supporting improved methods for demonstrating and documenting competences."(Ziv, Small et al. 2000)

3. **Transfer of skills and transition to authentic workplace activities**

This theme includes teamwork, interprofessional collaborative practice (IPCP) and practice in complex systems. SBE sessions can be specifically designed to provide training for "coping with ambiguity, time pressure, changing workload, interpersonal issues, and adaptability in problem solving." (Small L. , 1999a cited in (Ziv, Small et al. 2000)

SBE is recognised as most valuable for bridging the gap between 'knowing and doing' (Flanagan 2004) and for providing training to "practice and improve the actual work skills and behaviours required to perform tasks and functions on the job". (O'Brien et al cited in (Flanagan 2004). It is often pitched therefore at the higher levels of Millers pyramid.

"There are clearly many potential applications for high-fidelity simulation. Although the entire spectrum of uses for simulators is valuable, the greatest impact will come from using simulators to teach things that cannot easily be taught in any other way, including some aspects of teamwork, communication, stress management decision-making and task prioritisation."(Flanagan 2004)

"In addition, there was a repeated view simulation should be used towards over-arching clinical learning goals, across different domains in curricula. Participants *(in the HWA report)* described the use of simulation to:

- Ensure work readiness, including issues such as familiarising equipment.
- Ensure competency through standardised repetitive practice; competency could be based on progress rather than 'time on-task'
- Understanding the complexity and nuance of clinical practice through using simulation in integrated, holistic approach to patient care.
- Provide the opportunity to 'make it real', in bridging theory to practice." (Sutton, Bearman et al. 2010)

One of the greatest challenges in implementing a comprehensive simulation curriculum will be to ensure transfer of learning from simulated practice and contexts to actual clinical practice.

Note: a piece of work as yet outstanding is an attempt to ensure articulation between the undergraduate medical curriculum, including clinical skills and simulation-based education components, and the ongoing curriculum for junior doctors as articulated in the Medical Council of New Zealand New Zealand Curriculum Framework for Prevocational Medical Training. (Medical Council of New Zealand 2014)

CONCLUSION:

Inclusion of a skill or learning outcome in the proposed 'simulation curriculum' is based on:

1. the curriculum integrating elements of core presentations, and core professional activities
2. selected core clinical skills which are 'better, best, or only' learned by SBE
3. selected learning outcomes from other domains which are also are a 'good fit' ' with SBE
4. areas in the curriculum identified as current and future priorities, which also fit with SBE

To determine the priority list for SBE activities within the MBChB a comprehensive stock take of current activities and outcomes, and a full needs assessment would be required.

A 'MINIMUM' CORE SBE CURRICULUM

At the risk of perpetuating the belief that simulation is only useful for procedural skills training and thus undermining the message about its enormous value in a much broader range of equally important learning outcomes it is suggested that all students have opportunities to learn and maintain the following examination, patient management and procedural skills through SBE with part-task training models, resuscitation manikins and human simulators.

1.1 Advanced life support (ALS)
1.2 Advanced airway management - laryngeal mask airway (LMA)
1.3 Advanced airway management - endotracheal intubation (ETT)
1.4 Basic life support (BLS)
1.5 Bag-valve-mask (BVM) ventilation
1.6 Defibrillation and AED use

1.7 Paediatric Resuscitation Skills
1.8 Rectal examination
1.9 Gynaecological examination including a bimanual pelvic exam
1.10 Gynaecological examination including a speculum examination of the vagina and cervix
1.11 Breast examination
1.12 Perineum and external genitalia examination in a male
1.13 Perineum and external genitalia examination in a female
1.14 Arterial puncture
1.15 Blood culture specimens
1.16 Cervical/vaginal specimens (swab/smear)
1.17 Infiltrate wound with local anaesthetic
1.18 Intramuscular injection
1.19 Nasogastric tube insertion
1.20 Peripheral intravenous cannulation
1.21 Primary wound closure, using steristrips, tissue adhesive and sutures
1.22 Subcutaneous injection/infiltration of local anaesthetic prior to procedures such as IV cannulation or arterial blood sampling
1.23 Subcutaneous injection of medications (other than local anaesthetic) e.g. anticoagulant
1.24 Urethral catheterisation – female
1.25 Urethral catheterisation – male
1.26 Venepuncture - for routine blood tests

More work needs to be done to determine a minimum list of case-based and ideally immersive scenarios, and the timing and sequencing of these, to truly gain optimal benefit from an investment in SBE.

Inclusion of a particular skill or learning outcome in the 'simulation curriculum' is not to suggest that the particular skill/learning outcome should be exclusively or even primarily addressed using SBE. Indeed, it is most likely that SBE will only be one of a variety of teaching and learning opportunities for the acquisition of the specific skill or outcome. The possible exceptions to this would be those skills associated with rare and critical presentations, and the assessment and management of these, where we know that currently students may not encounter these situations in real clinical practice, and that SBE might therefore be the only way of guaranteeing exposure and learning opportunity for all students. The associated theoretical knowledge, underpinning science and principles should still be covered, regardless of whether or not the student actually encounters the situation in real clinical practice. A simulated experience, in the absence of an actual clinical exposure, is likely to facilitate improved acquisition, understanding, retention and subsequent recall and application of the theoretical knowledge in future practice. A SBE programme sitting alongside a facilitating and guiding curriculum map would undoubtedly benefit student learning. The greater goal of improving the quality of health services and patient outcomes through improved training is also in sight.

EMBEDDING THE CORE SBE CURRICULUM

The agreed curriculum (in terms of content and outcomes) is only one of four critical elements for successfully embedding SBE into the MBChB. The second is dedicated space/facilities and equipment, the third is guaranteed ongoing resourcing including appropriately trained staff and the final, and perhaps most crucial element, is time within the curriculum.

A recommended model would include a vertical Clinical Skills module beginning with the ELM CS programme and continuing through year 4 to 6 at all ALM campuses. The majority of the teaching sessions within these CS modules are likely to be SBE activities, but need not be. In addition it is recommended that all block modules in ALM include at least one SBE session where the focus would be on integrated learning including outcomes across knowledge and skills and several domains. Ideally exposure to SBE of this sort would begin in ELM and gradually increase of the following years of training with a specific focus in the TI year on 'work readiness' or 'transition to practice'. One of the greatest challenges in SBE is to ensure that knowledge and skills acquired in simulation sessions are transferred to learning and practice in real clinical environments.

APPENDIX SIX: MINIMUM ESSENTIAL FACILITIES AND EQUIPMENT LIST

To deliver a SBE curriculum in keeping with current best-practice within the OMS MBChB programme, and the other health professional training programmes, it would be desirable for all students to have access to a minimum of simulated clinical environments, SBE dedicated physical facilities/spaces and equipment, in addition to simulated patients and adequate teaching and support staff as follows:

1. Simulated clinical environments, at a minimum corresponding to:
   - 1.1. A number of ambulatory care clinic rooms (simulating GP and Outpatient consulting rooms)
   - 1.2. An inpatient ward environment
   - 1.3. An emergency/resuscitation space
2. Part task training models at a minimum including:
   - 2.1. Model arms for venepuncture, and intravenous cannulation
   - 2.2. Model arms for arterial blood gas sampling
   - 2.3. Urethral catheterisation models - male and female
   - 2.4. Female perineum and pelvic examination models
   - 2.5. Male rectal examination models
   - 2.6. Male perineum and genital examination models
   - 2.7. Breast examination models
   - 2.8. Airway trainers – (for advanced airway skills) adult
   - 2.9. BLS trainers - adult, child and neonatal e.g. Laerdal Little Family packs
   - 2.10. Nasogastric tube trainers
3. Resuscitation training manikins - adult e.g. Laerdal Resusci Anne or MegaCode Kelly and child e.g. MegaCode Kid
4. Patient care manikin e.g. Laerdal Nursing Anne
5. Full body human simulators - adult and child e.g. Laerdal SimMan3G, [23]
6. Other training and clinical equipment to support SBE. As an example the current equipment list from the UOC Simulation Centre is included below.

Ideally each of the simulated clinical spaces would be audio-visual (AV)-enabled and fully IT supported including capacity for remote real-time viewing and for recording of sessions. Spaces intended to be used for immersive case-based simulated scenarios also require a dedicated AV/IT control room, and a dedicated pre-brief/debrief room.

While in-situ simulation (i.e. SBE activities within real clinical environments) offers distinct advantages, as well as additional risks and challenges, because of the unreliable and unpredictable access to real clinical environments for education purposes it is unlikely that in-situ spaces will provide the major 'venue' for undergraduate SBE. This means that OMS would ideally provide dedicated, purpose designed SBE spaces or facilities. Depending on geographic location (city/region/town etc) and context such dedicated 'learning spaces' might be within University owned and operated premises or within DHB/health provider facilities and accessible to the University. Ideally SBE spaces are not capable and available for real-patient care or the very real risk is that education activities will be displaced by service needs. Regardless of geographic location there are definite advantages in SBE facilities being located close to the clinical service and teaching environments. This improves access and

[23] While not essential other simulators which would expand teaching and learning opportunities include infant, neonatal and obstetric simulators– SimBaby, SimNewB and SimMom or PROMPT trainer

convenience for both staff and students. An alternate view is that some distance between the clinical workplace and the simulation facility is preferable. Distance encourages a clear distinction between SBE and clinical teaching, and promotes focused commitment to the SBE session with reduced likelihood of tutors being called away to clinical service commitments during the simulation session. Disruptions/interruptions of this type are not easily accommodated or acceptable within SBE.

The design of space and the supporting AV/IT impacts significantly on function and education quality. Having said that, good SBE can also be delivered in a range of spaces, and the space /AV/IT does not of itself, of course, guarantee good education. What does seem sensible is that OMS pools and shares the existing experience and knowledge that already exists and collaborates in future planning, especially where sharing of high-cost facilities and equipment offers cost efficiencies.

A Health Workforce Australia (HWA) report reached the following conclusion about facilities and what they called simulated learning environments (SLEs)(a term inclusive of staff and other resources not just the physical facility).

"There are **ENABLERS AND CHALLENGES** to the development of SLEs) that are frequently very specific to individual institutions and include, location, historical development, jurisdiction, funding base, degree of rurality, access to recurrent funding, the existence of 'champions', and the skill base for staff. In developing these environments it is clear that "one size will **not** fit all", that is, the constraints on SLE development and the conditions for success are radically different from school to school. In one the need may be for increased levels of expertise, and another for the acquisition and development of space."(Sutton, Bearman et al. 2010)

Applied to the OMS contexts, it is likely that the facilities available and developed at each of the 3 main MBChB ALM campuses and at some of the regional sites, will vary significantly. Necessarily and quite properly, they will reflect the nature of the relationship, including funding, with the local District Health Board and any other partners. However a minimum/core of facilities and equipment, and human resources, will need to be available at each site if a core SBE curriculum is to be successfully implemented. This does not preclude individual ALM schools/campuses and other sites providing additional facilities and learning opportunities reflecting local strengths and interests.

FACILITIES/SPACE DESIGN AND REQUIREMENTS:

A guide to the types of spaces required is included below. The total space required will be influenced by the teaching session philosophy and format e.g. the preferred student to bed or student to part-task trainer ratios as well as the types of sessions planned.

An ideal dedicated simulation facility or service would include the following types and sizes of spaces.

1. Ambulatory care clinic type room(s) - small 12m2 (for trid of SP, tutor and student) - to larger 16m2 (to accommodate additional students and/or tutors) - ideally 15 rooms at minimum to accommodate end-of-year OSCE
2. Inpatient hospital 4 bed type room ~40m2
3. Inpatient single hospital room with ensuite ~ 15m2
4. Resuscitation type space ~40-50m2 (ideally flexi so can mimic e.g. ICU, ED, OT)
5. Control room(s) - 10-12m2 each – ideally 1 for each simulated clinical space

6. Prebrief/debrief room(s) ~ 36m2 each - ideally 1 for each simulated clinical space[24]
7. Part-task training space ~ 54m2 plus
8. Permanently set-up 'drop-in' space ~ 30m2
9. Storage space - depends very much on layout but usually recommended to be at least 30% of total space
10. Other specialist simulated 'clinical spaces': staff station, treatment room, sluice, 'green room' for SPs, minor procedures (16m2)
11. Model maintenance and preparation room ~ 12m2
12. Offices ~ 10-12m2 for minimum single occupant
13. Reception ~10-12m2
14. Waiting spaces ~ 15m2 e.g. for students for OSCEs and SPs, volunteers
15. Non-useable flow spaces ~ 10-15% additional space

Total space obviously depends on layout and location but designs of ~ 800m2 have been able to provide for the majority of desired requirements.

SUPPORTING AUDIO-VISUAL (AV) AND INFORMATION TECHNOLOGY (IT) SERVICES:

AV/IT support services and digital recording capacity impact significantly on the quality of SBE and flexibility of formats possible for individual sessions. If video-recordings of sessions are incorporated in to feedback/debriefing sessions this need to be done following a pre-determined planned strategy and by skilled tutors. In addition AV/IT impacts on other aspects such as staff development/training, quality control and improvement, and research. OMS does not currently have a unifying approach or strategy to these support services. To support an SBE programme it is a recommended that a coordinated strategy is adopted. Identical resources and systems is of course neither necessary nor necessarily more efficient and effective, however on the balance of probabilities it is likely that there would be substantial benefit in a shared approach.

Currently both the UOC and UOW campuses are utilising the B-Line Medical digital video-capture system, a web-based system, and ELM and DSM are using other systems. Moving forward a working party to examine, oversee and rationalise the approach and system(s) utilised should be established. Guidance documents on policy and procedures in relation to use of video-technology and recordings should also be developed.

TRAINING EQUIPMENT:

Equipment is likely to constitute a mix of specifically purchased equipment matching that in current clinical use at the relevant local clinical training site, and also 'expired' and 'decommissioned' equipment. 'Consumable' items are also likely to be a mix of new and expired. SBE instructors need to have very clear strategies for managing the use of all equipment and for ensuring that students do not acquire unsafe habits of practice from the use of expired and decommissioned equipment/ consumables. Use of such equipment does undoubtedly reduce operating costs and can be used safely provided the potential complications and negative learning are recognised and explicitly dealt with. It is crucial that planning for an SBE programme incorporates both initial capital outlay for establishing facilities

[24] A simulation suite can be considered to be constituted from 3 rooms: the simulated clinical space plus a dedicated control room plus a dedicated pre-brief/debrief room

and purchasing reusable equipment, and also includes an operating budget taking account of equipment replacement costs and consumables used during teaching sessions.

As an indicative guide the current full list of equipment at the UOC Simulation Centre (UOCSC) is provided below.

CLINICAL EQUIPMENT

- 'Stifneck' Neck Extrication Collars – Adult sizes (tall, regular, short, no-neck) and Paediatric and Baby No-Neck Collar
- Spineboard
- 'Speedblock' Head Immobiliser
- 'Pedi-Pad' - paediatric spine board pad
- Sagar bilateral traction splint
- 'Combi Carrier II' with head immobiliser patient transfer board
- ECG machines
- Suture equipment - Scissors 14cm, Crilewood needle holder 15cm, Scalpel handles
- Alaris GH Syringe Pumps
- Alaris GP Volumetric Pumps
- LifePak 20e Defibrillator and Crash cart
- Dressing forceps 13cm; Gillies forceps 15cm; Adson toothed forceps 12cm;
- Magill forceps (adult)
- Laryngoscope Handle (medium) and Laryngoscope blade size 3 and 4
- Peak flow meters
- Bag Valve Masks (BVMs) – Adult, Paediatric and Newborn
- Paediatric LSR (BMV resuscitator with masks)
- Caresens Blood Glucose Meters
- Trolleys: Dressing Trolleys, IV Trolleys, Catheterisation Trolley, Airway Trolley, and Medicine Trolley.
- Tympanic Thermometers
- Walking sticks, adjustable
- Folding walking frame with front wheels
- Slide transfer sheets
- Lifting and handling belts - Medium and Large
- Vaginal speculum (medium and small)
- WelchAllyn Spot Vital Signs mobile stands with blood pressure cuff, thermometer and SpO_2
- Sphygmomanometers (mercury)
- Heine Gamma sphygmomanometers
- Otoscopes
- Stethoscopes: Adult and Paediatric
- Range of oxygen delivery devices
- Portable 3-panel folding privacy partitions
- Examination lamps
- Scales: digital and manual
- Armchairs with high, adjustable backs
- Self-propelling wheelchairs
- Commodes
- Contour electric patient trolley (resuscitation trolley)
- Hospital wards bed
- Examination couches

The full UOCSC education training equipment/ part-task training equipment list is also included as follows:

1. 'Little Family Pack' – Adult, child (5 year old) and infant (3 months) manikins for CPR training
2. Advanced Adult Airway Trainers - adult upper torso and head for practising intubation, ventilation and suction techniques
3. Infant Airway Management Trainer – anatomy of a three-month-old infant for basic and advanced airway management skills
4. Advanced catheterisation trainers– for urethral and supra-pubic catheterisation plus for teaching self-catheterisation skills
5. Catheterisation trainer interchangeable male and female – for urethral catheterisation (no self-catheterisation stand or suprapubic capacity)
6. Male pelvic trainer – to teach testicular exam and rectal examination of the prostate
7. Rectal Examination trainer – to practise rectal and prostate examination with five interchangeable prostates of differing pathology
8. Arterial arm – for arterial puncture with palpable pulse and realistic backflow of blood into syringe
9. Advanced injection arm – to teach venepuncture and intravenous cannulation, intradermal and intramuscular injections
10. Gynae trainer with 8 uteri of differing pathologies (shared between models) for examination of the female reproductive system - allows use of a speculum allowing procedures such as cervical smears to be practised
11. Hungry manikin – to demonstrate nasogastric tube insertion
12. Advanced breast examination trainer
13. Strap on breasts – for examining breasts axillae and clavicular regions, and for the communication skills involved
14. Breast self-examination model – a breast made from synthetic tissue embedded with five simulated 'lumps'
15. Eye exam simulator – a trainer for practising use of ophthalmoscope, examining the ocular fundus and identifying various eye conditions
16. Ear simulator - for examination of the ear including external acoustic meatus, tympanic membrane and foreign body removal
17. Suture Practice Arm - arm is made with a soft vinyl skin cover over a core of foam which can be sutured
18. Injection trainers (6) (multi-layered soft tissue pads for practising intradermal, subcutaneous, and intramuscular tissue injection techniques)
19. Skin Pad and Jigs (devices which hold the skin pads securely in place
20. Abdominal examination trainer

REFERENCES:

Association of American Medical Colleges (2011). Medical Simulation in Medical Education: Results of an AAMC Survey.

Binstadt, E. S., R. M. Walls, B. A. White, E. S. Nadel, J. K. Takayesu, T. Barker, S. J. Nelson and C. N. Pozner (2007). "A Comprehensive Medical Simulation Education Curriculum for Emergency Medicine Residents." Annals of Emergency Medicine **49**(4): 495-504e411.

Boulet, J. R. P., P. R. P. Jeffries, R. A. M. D. Hatala, J. R. J. M. D. Korndorffer, D. M. M. D. Feinstein and J. P. P. Roche (2011). "Research Regarding Methods of Assessing Learning Outcomes." Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare 6(7) Supplement, Monographs from the First Research Consensus Summit of the Society for Simulation In(Healthcare): S48-S51.

Cant, R. P. and S. J. Cooper (2010). "Simulation-based learning in nurse education: systematic review." Journal of Advanced Nursing **66**(1): 3-15.

Chiniara, G., G. Cole, K. Brisbin, D. Huffman, B. Cragg, M. Lamacchia and D. Norman (2013). "Simulation in healthcare: A taxonomy and a conceptual framework for instructional design and media selection." Medical Teacher **35**(8): e1380-e1395.

Confederation of Postgraduate Medical Education Councils (CPMEC) (2009). Australian Curriculum Framework for Junior Doctors version 2.2.

Cook, D. A., R. Brydges, B. Zendejas, S. J. Hamstra and R. Hatala (2013). "Mastery Learning for Health Professionals Using Technology-Enhanced Simulation: A Systematic Review and Meta-Analysis." Acad Med **88**(8): 1178-1186.

Cook, D. A., R. Hatala, R. Brydges and et al. (2011). "Technology-enhanced simulation for health professions education: A systematic review and meta-analysis." JAMA **306**(9): 978-988.

Cook, D. A. M. D. M., R. P. Brydges, B. M. D. M. Zendejas, S. J. P. Hamstra and R. M. D. M. Hatala (2013). "Mastery Learning for Health Professionals Using Technology-Enhanced Simulation: A Systematic Review and Meta-Analysis. [Review]." Academic Medicine **88**(8): 1178-1186.

DeVita, M. A., J. Schaefer, J. Lutz, H. Wang and T. Dongilli (2005). "Improving medical emergency team (MET) performance using a novel curriculum and a computerized human patient simulator." Quality and Safety in Health Care **14**(5): 326-331.

Draycott, T. J., J. F. Crofts, J. P. Ash, L. V. Wilson, E. Yard, T. Sibanda and A. Whitelaw (2008). "Improving Neonatal Outcome Through Practical Shoulder Dystocia Training." Obstetrics and Gynecology **112**(1): 14-20.

Englander, R. M. D. M. P. H., T. M. A. Cameron, A. J. Ballard, J. Dodge, J. M. A. Bull and C. A. M. D. Aschenbrener (2013). "Toward a Common Taxonomy of Competency Domains for the Health Professions and Competencies for Physicians." Academic Medicine **88**(8): 1088-1094.

Eppich, W. M. D. M., V. E. R. N. Howard, J. M. D. Vozenilek and I. B. A. K. C. M. F. P. G. D. M. E. F. Curran (2011). "Simulation-Based Team Training in Healthcare." Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare 6(7) Supplement, Monographs from the First Research Consensus Summit of the Society for Simulation In(Healthcare): S14-S19.

Ericsson, K. A. (2004). "Deliberate Practice and the Acquisition and Maintenance of Expert Performance in Medicine and Related Domains." Academic Medicine **79**(10 (October Supplement)): S70-81.

Ericsson, K. A. (2008). "Deliberate Practice and Acquisition of Expert Performance: A General Overview." Academic Emergency Medicine **15**(11): 988-994.

Fanning, R. M. M. M. F. and D. M. M. D. Gaba (2007). "The Role of Debriefing in Simulation-Based Learning." Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare Summer **2**(2): 115-125.

Flanagan, B. D. M. (2004). "Crisis resource management Making patient safety the focus: Crisis Resource Management in the undergraduate curriculum." Medical Education **38**(1): 56-66.

Frank, J. R., L. S. Snell, O. T. Cate, E. S. Holmboe, C. Carraccio, S. R. Swing, P. Harris, N. J. Glasgow, C. Campbell, D. Dath, R. M. Harden, W. Iobst, D. M. Long, R. Mungroo, D. L. Richardson, J. Sherbino, I. Silver, S. Taber, M. Talbot and K. A. Harris (2010). "Competency-based medical education: theory to practice." Medical Teacher **32**(8): 638-645.

Gaba, D. M. (2004). "The future vision of simulation in health care." Quality and Safety in Health Care **13**(suppl 1): i2-i10.

Harris, P., L. Snell, M. Talbot and R. M. Harden (2010). "Competency-based medical education: implications for undergraduate programs." Medical Teacher **32**(8): 646-650.

Hayden, J. K., R. A. Smiley, M. Alexander, S. Kardong-Edgren and P. R. Jeffries (2014). "The NCSBN National Simulation Study: Longitudinal, Randomized, Controlled Study Replacing Clinical Hours with Simulation in Prelicensure Nursing Education." Journal of Nursing Regulation **5**(2 Supplement).

Issenberg, S., W. McGaghie, E. Petrusa, D. Gordon and R. Scalese (2005). "Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review." Medical Teacher **27**(1): 10-28.

Issenberg, S. B. and W. McGaghie (1999). "Simulation Technology for Health Care Professional Skills Training and Assessment." JAMA **282**(9): 861-866.

Kaufman DM, Mann KV. 2007 Teaching and learning in medical education: how theory can inform practice. Edinburgh Association for the Study of Medical Education (ASME).

Kolb, D. (1984). Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ, Prentice Hall.

Lammers, R. L. (2007). "Simulation: The New Teaching Tool." Annals of Emergency Medicine **49**(4): 505-507.

Mancini, M. E. (2010). Laerdal SUN Meeting. Sydney.

Mattick, K. and J. Bligh (2006). "Undergraduate ethics teaching: revisiting the Consensus Statement." Medical Education **40**(4): 329-332.

McFetrich, J. (2006). "A structured literature review on the use of high fidelity patient simulators for teaching in emergency medicine." Emergency Medicine Journal **23**(7): 509-511.

MCGAGHIE WC. (1999) Simulation in professional competence assessment: basic considerations, in: A. Tekian, C.H. McGuire & W.C. McGaghie (Eds) Innovative Simulations for Assessing Professional Competence (Chicago, Department of Medical Education, University of Illinois at Chicago).

McGaghie, W. (2015). "Mastery Learning: It Is Time for Medical Education to Join the 21st Century." Acad Med **90**(11): 1438-1441.

McGaghie, W. C., S. B. Issenberg, E. R. Petrusa and R. J. Scalese (2010). "A critical review of simulation-based medical education research: 2003–2009." Medical Education **44**(1): 50-63.

McGaghie, W. C., S. B. Issenberg, E. R. Petrusa and R. J. Scalese (2016). "Revisiting 'A critical review of simulation-based medical education research: 2003-2009'." Medical Education **50**: 986-991.

Medical Council of New Zealand (2014). New Zealand Curriculum Framework for Prevocational Medical Training

Miller, G. E. (1990). "The Assessment of Clinical Skills/Competence/Performance." Academic Medicine **65** (9): S63-67.

Moore, M. o. b. o. t. F. C. S. S. (2014). The Faculty Clinical Skills Map Project: Initial Report, University of Otago, Faculty of Medicine

Motola, I., L. A. Devine, H. S. Chung, J. E. Sullivan and S. B. Issenberg (2013). "Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82." Medical Teacher(35): e1511-e1530.

New Zealand Medical Association. (2002). "New Zealand Medical Association Code of Ethics."   Retrieved 29/10/2007, from http://www.nzma.org.nz/about/ethics.html.

New Zealand Medical Association (2014). Code of Ethics FOR THE NEW ZEALAND MEDICAL PROFESSION.

Nishisaki, A., R. Keren and V. Nadkarni (2007). "Does Simulation Improve Patient Safety?: Self-Efficacy, Competence, Operational Performance, and Patient Safety." Anesthesiology Clinics **25**(2): 225-236.

Okuda Y, Bryson EO, DeMaria S Jr, Jacobson L, Quinones J, Shen B and Levine AI (2009). "The utility of simulation in medical education: what is the evidence?" Mt Sinai J Med **76**(4): 330-343.

Otago Medical School MBChB Curriulum Committee (2015). The Otago Medical Course of the Future: A Masterplan for the Otago Medical Curriculum of the Future, University of Otago.

Palaganas, J. C., J. C. Maxworthy, C. A. Epps and M. E. Mancini (2015). Defining Excellence in Simulation Programs, WoltersKluwer.

Perkins, G. D. (2007). "Simulation in resuscitation training " Resuscitation **73**: 202-211.

Posner, J., J. A. Russell and B. S. Peterson (2005). "The circumflex model of affect: an integrative approach to affective neuroscience, cognitive development, and psychopathology." Developmental psychopathology **17**(3): 715-734.

Rall, M. and P. Dieckmann (2005). "Safety culture and crisis resource management in airway management: General principles to enhance patient safety in critical airway situations." Best-practice & Research Clinical Anaesthesiology **19**(4): 539-557.

Rall, M. and P. Dieckmann (2005). "Simulation and patient safety: The use of simulation to enhance patient safety on a systems level." Current Anaesthesia & Critical Care **16**(5): 273-281.

Rudolph, J. W., R. Simon, D. B. Raemer and W. J. Eppich (2008). "Debriefing as Formative Assessment: Closing Performance Gaps in Medical Education." Academic Emergency Medicine **15**(11): 1010-1016.

Salas, E., C. Klein, H. King, M. Salisbury, J. S. Augenstein, D. J. Birnbach, D. W. Robinson and C. Upshaw (2008). "Debriefing Medical Teams: 12 Evidence-Based Best-practices and Tips." The Joint Commission Journal on Quality and Patient Safety **34**(9): 518-527.

Schaefer, J. J. I. I. I. M. D., A. A. E. Vanderbilt, C. L. P. R. N. Cason, E. B. P. R. N. Bauman, R. J. M. B. C. M. F. Glavin, F. W. D. B. A. Lee and D. D. P. R. N. C. C. N. E. Navedo (2011). "Literature Review: Instructional Design and Pedagogy Science in Healthcare Simulation." Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare 6(7) Supplement, Monographs from the First Research Consensus Summit of the Society for Simulation In(Healthcare): S30-S41.

South Island Workforce Development Hub workgroup (2016). Opportunities for supporting clinical skills and simulation across rural South Island: a snapshot analysis - 2014/2015.

Sutton, B., M. Bearman, B. Jolly, D. Nestel, P. Brookes, B. Flanagan, M. Watson and C. McMenamin (2010). Simulated Learning Environments Medical Curriculum Report Monash University.

Taylor, D. C. M. and H. Hamdy (2013). "Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83." Medical Teacher **35**(11): e1561-e1572.

Weinger, M. B. (2010). "The Pharmacology of Simulation: A Conceptual Framework to Inform Progress in Simulation Research." Simulation in Healthcare **5**(1): 8-15.

Weller, J. M. (2004). "Simulation in undergraduate medical education: bridging the gap between theory and practice." Medical Education **38**(1): 32-38.

Weller, J. M., B. J. Robinson, P. D. Larsen and C. Caldwell (2004). "Simulationn-based training to improve acute care skills in medical undergraduates." New Zealand Medical Journal **117**(1204).

World Health Organisation (2008). WHO PATIENT SAFETY CURRICULUM GUIDE FOR MEDICAL SCHOOLS.

Ziv, A., S. Ben-David and M. Ziv (2005). "Simulation Based Medical Education: an opportunity to learn from errors." Medical Teacher **27**(3): 193-199.

Ziv, A., S. D. Small and P. R. Wolpe (2000). "Patient safety and simulation-based medical education." Medical Teacher **22**(5): 489-495.

Ziv, A., P. R. Wolpe, S. D. Small and S. Glick (2003). "Simulation-Based Medical Education: An Ethical Imperative." Acad Med **78**(8): 783-788.