Executive Summary – The Health Sciences Simulation Center (HSSC) at Samuel Merritt University

The Health Sciences Simulation Center (HSSC), in operation on the Oakland campus of Samuel Merritt University (SMU) since 2006, is an 11,000 square foot facility designed to facilitate immersive and simulation-based learning (SBL). “Simulation is a technique that uses a situation or environment created to allow persons to experience a representation of a real event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions. Simulation is the application of a simulator to training and/or assessment.” The term immersive evokes in participants a sense of being completely engaged in an activity and/or setting as if it were the real world. The HSSC’s physical layout (comprised of 4 simulation suites, 9 standardized patient rooms and 4 large multipurpose rooms configurable for a wide range of immersive activities) allows for the simultaneous implementation of various types of health care SBL for different learner groups. The Center’s robust simulator and equipment inventory includes: 57 advanced patient simulators (14 of which utilize high level technology and the balance, mid level technology); a full array of task trainers ranging from the latest computerized cardiopulmonary assessment trainers to the standard types of clinical skill trainers used for over 50 years; and current medical equipment (including mobile electronic health record workstations) used to create highly realistic clinical care settings. At present, the HSSC’s simulator inventory does not include surgical simulators however, when required for a learning activity (e.g., laparoscopic training for gynecologic procedures), the proper equipment is obtained via collaboration with the appropriate vendors. A state of the art audiovisual and data management system (comprised of cameras, microphones, computers, wireless AV control panels and servers all managed by an integrated software system with a web-based component) provides the infrastructure required to record events, easily retrieve recordings, manage Center operations and gather data for the purposes of documentation, assessment and research.

The physical resources of the HSSC make it comparable, in terms of the deliverable sophistication level of SBL, to simulation centers at the University of California, San Francisco (UCSF), Los Angeles and Davis, Stanford University, Oregon Health & Science University and the University of Washington—some of the aforementioned centers are considerably larger than SMU’s therefore can accommodate larger volumes of customers. What distinguishes the HSSC from other simulation centers, irrespective of size, is the presence of a dedicated, highly functional, professionally diverse personnel team responsible for ensuring the optimal use of the University’s simulation assets—the 8-member HSSC faculty and technical staff have clinical backgrounds in the fields of nursing, medicine, advanced practice nursing (anesthesia, adult care) and physician assistant. Furthermore, the team is well educated and experienced in the tenets of SBL and experiential learning in general, and truly understands that the success of a simulation center is not based on the technology that exists in a physical space, rather on expert, evidence-based use of the technology. In 2013, approximately 25,000 customers utilized the facilities/services of the HSSC, which has a 90% utilization rate. The vast majority of the customers are students/faculty in 9 SMU academic programs; other users are first and second year medical students in the Joint Medical Program of UC Berkeley/UCSF, community outreach organizations (mostly serving youth interested in the health care professions) and clinical partners of the University (Sutter Health and Kaiser Permanente.)

Simulation research – the state of the science
The use of simulation as a method of learning in the health care domain is a relatively new approach—experts agree that simulation research is still in its nascent stage. In January 2011, the Society for Simulation in Healthcare (SSH), an organization that currently represents the voice of the international simulation community, held a Simulation Research Consensus Summit (Summit). Invited participants of

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1 Definition endorsed by the Society for Simulation in Healthcare’s Council for Accreditation of Healthcare Simulation Programs, retrieved January 2014 http://ssih.org/about-simulation

2 The HSSC is responsible for all simulation activity/equipment on the three campus locations (Oakland, San Francisco Peninsula, Sacramento) thus the inventory is housed across all locations; the majority of high level advanced patient simulators are on the Oakland campus
the Summit were simulation and research experts from a wide range of countries, health care professions, research approaches, and practice settings (both academic and clinical.) The product of this Summit was a research agenda for simulation-based health care education intended for adaptation by any simulation program (Isenheim, et al., 2011). From the work of the Summit expert groups, three major themes for simulation research are evident: 1) instructional design, 2) outcome measures, and 3) translational research. The HSSC environment is an ideal setting for many of the research topics and questions included on the SSH-endorsed research agenda. Many of the topics on the simulation research agenda represent timely opportunities to conduct studies that would fall into some of the categories included in the Sutter Research Enterprise Transition Integration Functional Chart (TIFC): Health Services, Patient Decision Making, Social & Culture Factors, Outcomes and Comparative Effectiveness Research, and Education Development and Training.

The rest of this summary describes examples of research topics as well as some research questions categorized according to the aforementioned three major themes of the SSH-endorsed research agenda. All of these potential studies could be conducted completely in the academic setting of the HSSC, or—assuming that a collaborative approach is taken between SMU and SH researchers—completely in a clinical setting (i.e., a SH affiliate), or via a hybrid approach.

Simulation research potential for Samuel Merritt University and Sutter Health

1. Potential education research related to instructional design include the topics listed below; studies can be done in the context of any of the health profession specialties (but particularly in medicine and nursing), or preferably—given the pervasive drive for interprofessional education—as collaborative endeavors. There are many drivers at play to transform how continuing education (CE) is facilitated (from passive learning via pedantic lectures to active, participatory approaches like SBL); and in some specialties (e.g., anesthesiology) simulation-based CE courses are mandatory for maintenance of certification. The following list offers a sampling of potential research topics on instructional design—a plethora of research questions related to address issues in these topics exist:
   • Learning acquisition, skill retention, cognitive load
   • Debriefing – relevant features for effectiveness, optimal format, effective use of video recordings
   • Learner characteristics
   • How learning theory grounds educational practice
   • Resource requirements/challenges, the role of the instructor in instructional design
   • Simulation program implementation

2. The HSSC’s capacity (both physical and due to personnel), as well as the presence of many SMU faculty who work in both the academic and clinical setting and who are capable of conducting rigorous research, also offers significant potential for studies focused on outcome measures. This research category should align well with opportunities for Outcomes and Comparative Effectiveness Research listed as a subcategory under the Research, Development and Dissemination box on the TIFC.

The Kirkpatrick framework for evaluating educational/training interventions is commonly used to develop research agendas and organize literature reviews. Kirkpatrick’s premise was that outcome evaluation should go well beyond the reaction of the learners and he established four levels for evaluating the effect of training: reaction, learning, behavior, and organizational results. A sampling of potential simulation research questions—categorized according to the Kirkpatrick levels—are listed below:

Kirkpatrick Level 1 - Reaction
   • What are the short- and long-term, intended and unintended reactions to SBL beyond mere satisfaction—among learners, instructors, and institutions?
   • What kind of data and measurement instruments can be identified or should be developed to measure broad aspects of reactions to SBL?
   • How do results from measuring these reactions inform the design, conduct, and evaluation of
SBL and assessment programs?

**Kirkpatrick Level 2 - Learning**
- What kind of learning needs assessment is required regarding SBL, and what instruments need to be developed to better estimate learning needs accordingly?
- Which personal (e.g., motivation, self-efficacy), neurobiological (e.g., gender, stress hormones), and contextual (e.g., simulation versus clinical setting, formative versus summative formats) factors influence test-enhanced skills learning and in what way?

**Kirkpatrick Level 3 - Behavior**
- What are the enabling and hindering factors, beyond learning decay, to application of SBL outcomes in healthcare practice?
- How do we measure the complexity of behavior at the individual, team, and organizational level and the interconnections between those levels in their influence on behavior?

**Kirkpatrick Level 4 - Organization**

*Improvement in patient safety and quality of care* sums up what might be the overall purpose of outcome measures studies for collaborative projects between the HSSC and SH focused at the organizational level. To date, only a few studies demonstrate the effect of SBL on the quality of patient care and safety making this a highly desired research area. Some potential questions are:
- What is the impact of SBL on healthcare organizations regarding clinical practice, work organization, quality of care, and patient outcomes?
- What kind of databases regarding learners’ educational needs, experience, and performance can be identified or should be developed to monitor and associate educational variables and organizational outcomes?

The ongoing collaboration between the HSSC and SH’s Perinatal Patient Safety Program is a prime example of a potential research opportunity at this level of outcome evaluation.

3. The potential for research collaborations between SMU (and specifically the HSSC) and SH physicians, as well as all other health care professional groups, for the ultimate purpose of improved patient care is perhaps best represented by the opportunities in translational research. The potential for the development of interprofessional practice among health care teams by using simulation methods to teach and to conduct research cannot be overstated. Space limitations do not allow for a deep discussion of the translational research potential, but the following SSH-endorsed simulation research agenda item implies the far-reaching possibilities that exist: “Translational science research in the healthcare professions should not only address the acquisition and maintenance of procedural skills but also such thorny research targets as clinical judgment, decision-making, mental workload, comparative and reflective analysis, and other cognitive and affective outcomes. The ability to engage a family in a difficult conversation about end-of-life issues is a clinical skill amenable to SBL just like inserting a chest tube” (McGaghie, et al., 2011, p. 5).

**Research priorities of the Health Sciences Simulation Center**

Our priorities are in the area of instructional design and in particular any project involving interprofessional education (IPE) among groups of student/faculty learners. An active partnership with the Joint Medical Program of UC Berkeley/UCSF makes for exciting IPE research opportunities at the HSSC.

**References**


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3 The HSSC is contracted by SH (through the Risk Management Division/Office of the General Counsel) to facilitate in situ simulation team training to reinforce the establishment of a TeamSTEPPS® system in all 18 SH affiliates with perinatal services. This project is expected to be active through mid 2015.