Report of the
Committee on Clinical Skills and Simulation Centers:
The Development of a Simulation Center at UCSF

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Summary

Simulation of clinical experiences is an important part of the education of health professionals. Simulators are particularly useful for training interdisciplinary teams to provide coordinated care and for refining skills in the use of particular technologies. Simulation experiences are increasingly recommended, and at times required, by a wide variety of health care regulatory organizations, including LCME, RRCs, and JCAHO. Across the country, many health professions schools, hospitals, and other health care facilities are developing simulation programs.

UCSF currently has many relatively small and dispersed simulation activities. Due primarily to lack of space and resources, the use of simulation experiences at UCSF is underdeveloped. The consolidation of simulation experiences and equipment into a central unit has many educational and economic advantages. A central simulation facility for the professions schools and Medical Center at UCSF would promote excellence in clinical learning and practice, competency maintenance, and inter-professional education, and would ensure that all campus learners have an opportunity to practice and evaluate learning and clinical competence without compromising patient safety. Resources required include space, staff salaries, equipment, and supplies. A central unit provides significant economies of scale, with start-up and operating costs depending on the type of simulation included.

The Committee recommends the serious consideration of a central Clinical Skills and Simulation Center at UCSF. Next steps include educating UCSF leadership in all four professional schools and the Medical Center of the advantages of and need for a central simulation facility; identifying a small group of key leaders to oversee the development of a central simulation facility; and, the creation of concrete plans for the types of simulation to be included, and the location and funding of the center.
Goals and Objectives

A Clinical Skills and Simulation Center is a venue for teaching, learning, assessment and research excellence committed to improving patient care and safety through realistic simulation. The goals of a center are to maintain and enhance quality care and patient safety by:

- Developing high quality simulation experiences based on the needs of clinicians and reflective of current and future health care practices.
- Allowing learners opportunities to practice and develop skills in order to achieve competency without putting patients at risk.
- Developing inter-professional team training for routine and complex situations.
- Providing opportunities for credentialing for practice.
- Conducting research necessary to validate the use of simulation as an effective method for obtaining competency.
- Facilitating learning beyond the center.

The Need for A Simulation Center At UCSF

Simulation of clinical experiences is becoming an important part of the education of health professionals, particularly for teaching teamwork and clinical decision-making. A wide variety of simulation experiences are being incorporated into educational processes in undergraduate and graduate medical and nursing education and other health professions, such as emergency medical technicians.

Simulation experiences range from standardized patients to the use of mannequin simulators. According to a recent survey by Columbia University, approximately 40 percent of all US medical schools use mannequin simulators. Simulators are particularly useful for training interdisciplinary teams to provide coordinated care and for refining skills in the use of particular
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technologies. Anesthesiology and cardiology, in particular, are leaders in the use of simulators and simulation techniques.

The Liaison Committee on Medical Education (LCME) expects that students will have simulation experiences. Some Residency Review Committees (RRCs) require simulation as part of training, and hospitals need to train and certify professionals for various roles. International, national and local initiatives in educational reform in health care professions are also forces driving simulation center development.

The Joint Commission on Accreditation of Health Care Organizations (JCAHO) supports interdisciplinary collaboration for facilitation of patient safety. In a White Paper entitled *Healthcare at the Crossroads: Strategies for Improving the Medical Liability System and preventing patient injury*, JCAHO suggests inter-professional teamwork and improved communication between health professionals during patient care planning and provision for improved safety and quality. An article published in 2005 in JCAHO’s *Journal on Quality and Patient Safety* reported that simulation-based training reduces errors and improves patient safety when appropriately designed and delivered. Positive patient outcomes may be facilitated through individual and inter-professional simulation use.

The consolidation of simulation experiences and equipment into a central unit has many educational and economic advantages. The high cost of simulation equipment mandates collaboration across departments, schools and institutions. Equipment purchased for one program when placed in a simulation center may be used in unanticipated ways for other learners. There are learning experiences that require training across disciplines and professions and, without a simulation center, performance in these areas is difficult to improve.

**Simulation Centers at Other Major Institutions**

Members of this committee visited nearly a dozen simulation centers at other universities and medical centers. These include Harvard, Stanford and Toronto as well as our University of California colleagues at Davis and Los Angeles. Stanford provides an example of a major medical center that has developed an organized simulation center model. Stanford has structured their simulation efforts under the leadership of David Gaba, MD, Associate Dean for Immersive & Simulation-Based Learning. Their center unifies several entities, including the Center for
Advanced Pediatric Education (CAPE), Simulation Center at VA Palo Alto Health Care System, Center for Simulation in Medicine, and Stanford University Medical Media and Instructional Technology (SUMMIT) Labs. The VA Palo Alto center has been in operation for over a decade, and all are recognized pioneers in the use of simulation for health care training.

One example of a large independent private not-for-profit hospital that developed its own simulation center is Riverside Methodist Hospital in Columbus, Ohio. Riverside has a 20,000 square foot Center for Medical Education and Innovation medical education facility simulation training center. The Center allows multidisciplinary training of medical professionals along the full continuum of care. Paramedics and emergency technicians, residents, nurses and attending physicians utilize the center together or individually to learn, to practice, to become re-credentialed, to do research. Through the use of human patient simulators and other advances in medical education technology, the Center enables Riverside Medical Education to simulate patients and the patient experience in a wide variety of clinical situations.

There are key characteristics at other facilities and centers that UCSF should emulate. First, a clear mission is important to each center. Second, the centers emphasize teaching and research. Third, the centers tend to be flexible in how to use space and to meet the needs of the users. Fourth, there has to be strong and consistent commitment to such centers, supporting innovative thinkers in these centers. Many of these centers are members of professional organizations, e.g., the Society for Medical Simulation, committed to simulations, and share freely their recommendations for excellence in such centers. Flexible space is important, room for debriefing is essential, the use of high end technology to record and transmit simulations is helpful, and there seem to be unlimited ways to think about how to use simulations to reach diverse learners (from school age to practicing professionals).

**Survey of Needs at UCSF**

The committee used a web-based survey to document the types of simulations being used at UCSF. Chairs, residency and clerkship directors, and faculty from dentistry, nursing, and pharmacy, and physical therapy provided descriptions of simulations currently in use. Reports were received of simulations at multiple UCSF sites, including Parnassus, SFGH, Mt. Zion, Fresno, and Laurel Heights. Over 20 different simulations were described. These simulations
generally were to develop decision-making, conceptual understanding, technical skills and attitudes and behaviors. Many of these are simulations for individual learners, and nearly half involved a crew, team, or unit. Four simulations are used by non-UCSF medical professionals. As many as 76 students per month use one of the simulations to a low of about one learner per month. Most of UCSF’s simulations are conducted with concurrent critique. Six simulations have post-hoc debriefing through videotape review.

The resources needed include space and faculty. Most sessions need at least one faculty member often with assistance and with a low faculty to student ratio. The standardized patient scenarios need actors and trainers. Simulation spaces currently include classrooms, classrooms with laboratory space, the UCSF clinical skills center, and operating room. The simulations are for education, training and assessment.

The respondents provided descriptions of current and future needs. Most expressed a clear need for simulation to provide more practice for learners particularly in critical care situations. Indeed there is a recognized need for learners to practice a variety of skills in an environment where they will receive feedback. There is increasing need for fellows and health professional students to develop skills for difficult situations. As noted earlier accrediting agencies expect learners to have developed skills on simulators.

A variety of specific simulation areas not currently available to all schools included a bioskills unit with orthoscopic/flavoscopic digital OR capability, BCLS/ACLS mock codes, Code Blue training, medical and medication error training, and modeling of drugs (e.g., pharmacokinetic and pharmacodynamic). Respondents identified a need for real-time interprofessional simulation exercises in clinical decision-making and communication skills among teams.

Space was also identified as a need. Currently, overflow facilities are used for observed structured clinical examinations (OSCEs) of medical students. There is inadequate space for teaching physical examination skills. There are schools, such as nursing and pharmacy, that need, but do not have, such simulation space. Pharmacy has expressed a desire to use OSCEs for their student training, but lack space and resources.
Overall, the survey identified some simulation resources at UCSF, underdevelopment of simulations due to lack of space and resources, and a minimal amount of inter-professional education, education identified as needed particularly for patient safety. Compared to what we know is being done at other comparable institutions, our current simulations are primitive at best. In fact, they fail to capitalize on the fullest potential of our multi-disciplinary health care environment, thereby denying optimal training for students and staff, and failing to secure the safest possible environment for our patients.

**Opportunities for a Central Facility at UCSF**

A central Clinical Skills and Simulation Center to be used by the professional schools and Medical Center at UCSF will promote excellence in clinical learning and practice, competency maintenance, and inter-professional education. The facility will ensure that all campus learners (students and health care providers) have an opportunity to safely practice and evaluate learning and clinical competence without compromising patient safety. The current environment in 21st century health care dictates a need to provide mechanisms for learning that are not based on hospital census. There is a need for increased inter-professional collaboration to break down existing silos that may negatively affect safe patient care.

A central Simulation Center could, for example, address important educational needs of the Medical Center’s Nursing Department:

- Recent nurse graduates – review of vital signs, phlebotomy, IV starts, central line care, patient assessment particularly heart and lung sounds, ECG strips etc;
- Experienced staff who need refreshing on a particular skill; and,
- Provide flexible in-service training.

Competency assessment needed for training in the health profession schools at UCSF and the Medical Center will be best accomplished with a centralized facility. Optimal training will capitalize on the strengths of the unique but integrated schools and the Medical Center in team training and critical decision making for safe patient care. Rather than a focus on training solely for independence, simulation facilities can be the place to instill teamwork thinking, practice, and communication. Sophisticated academic uses of simulation training can allow a variety of
alternative clinical scenarios that reflect the full range of patient diagnoses and pathologies providers will see in practice. On the other hand, scenarios that are rarely seen can be practiced to ensure competence. A central facility can meet these multiple goals by creating a dedicated space for bringing students and health care providers together.

To accomplish this vision, a center should have the following characteristics:

- Available for use by all four health professional schools and Medical Center at UCSF.
- Simulated patient space that includes patient rooms, work stations, control room, waiting spaces for learners and standardized patients.
- Procedural skills practice space.
- High fidelity simulation space with full body (adult, child and infant) and part simulators.
- Portable simulator equipment.
- Classrooms attached to simulation areas.
- Classrooms fitted for remote/distance education.
- Research area for the development of new simulations and simulators, and testing of new protocols.
- Some of the space available 24/7.
- Secured assessment and credentialing process.
- Data management to provide timely reports on use and outcomes of simulation and data necessary for research.
- Appropriately staffed facility with office space.
- Modular space to accommodate varied simulations and levels of users.
- Audiovisual technology to support high quality data collection from simulation.

A simulation center will need identified leadership and an advisory committee. There will need to be strong coordination if all components of the center cannot be co-located. Portable equipment may be useful to introduce groups to simulation. Funding is needed to support leadership and staff positions, travel to meetings, equipment and supplies.
A central simulation facility can be managed by a single director and staff who would facilitate materials management, replacements, repair, software update, problem solving, record keeping, and user access. Central facilities generally utilize high fidelity simulation rather than low fidelity. Schools benefit from a central facility by cooperative investment and identification of similar learning needs.

One example of a local initiative in simulation is the proposed development of regional simulation centers in 9 Bay Area counties (Moore Foundation Grant submitted 12/05). Even though funding is expected, partnership simulation sites already are being developed. The Bay Area System Collaborative is the regional organization governing this local initiative with a focus on nursing education. Partnerships are being developed between schools of nursing and hospitals, instant responder organizations, medical schools, respiratory therapy programs, physical therapy programs, and other organizations/professions where health care focus is primary. The first two regional centers are scheduled to open in Alameda County in 2006-07. Central simulation facilities are being developed for a variety of purposes.

**The Threat of Not Having a Central Simulation Center at UCSF**

If simulation training facilities proliferate at UCSF, they will continue to create inefficient use of space, time, and personnel. A culture change and commitment to safe and high quality patient care are needed to design and use simulation in education that will broadly encompass the teaching of patient care through technology as well as enforce the need for teamwork training. A fundamental review of the way we currently educate health care providers suggests collaborative simulation training is optimal. A non-central facility will result in duplication of effort raising costs due to lack of collaboration and a scattered approach. When facilities are not centralized, they often comprise a narrow focus (e.g., intubation simulator) and can be susceptible to an “object” focus rather than a person focus. To meet the stated goals of the IOM for patient safety and the PEW Foundation for creating health providers for the 21st century, the option of inter-professional training facilities must be realized. On a space constrained campus such as UCSF, a centralized facility makes sense. Placing trainees and educators in close proximity to each other will ensure a dedicated collaborative environment. Essentially all of the virtual care and simulation units at other major health sciences centers are inter-professional.
**Organizational Structure of a Central Simulation Center**

A consortium consisting of the various schools and the Medical Center might be attracted to make the initial investments in the Center. Other possible funding sources are indicated below. Such a consortium would clearly dictate the organizational structure. These investors/partners would need to have seats on a Board of Directors/Oversight Committee. The Director of the Center would report to this Board. If the primary funding came from one or few sources then special consideration would be required regarding the management and direction for the Center.

**Space**

Space is always a problem at UCSF. At least one portion of the center should be located in the Medical Center complex so that housestaff, nurses, pharmacists, and physicians could steal away time to go to the center during their busy days. The remainder of the space could be off-site, but needs to be convenient. Certainly, Mt. Zion, China Basin, Laurel Heights, or Mission Bay are possibilities, although Parnassus would be much preferred. The Center could be opened initially with as little as 3,000 ft², but this would not be enough space for a sustainable and viable Center. The space requirements for a robust Simulation Center could be 12,000 ft² or more, assuming larger classrooms would be located elsewhere and connected via high-quality video and audio systems.

A typical layout would include space for the following:

- OR, trauma, ICU, and standard patient rooms with a central control area. The walls should be removable to make the space more flexible. These rooms use mannequins (adult and pediatric) as well as body part simulators for specialized functions and minimally-invasive surgery.

- Endovascular suite with catheter-based simulators for Cardiology, Radiology and others.

- Special simulation equipment for microsurgery, bronchoscopy, endoscopy, pelvic examination and ocular instruments.

- Patient interview rooms with adjacent control spaces for building clinical interviewing skills. These rooms could also be used for computer-based learning sessions.
• Computer-based simulations – requires personal computers. Some should be located in a classroom with instructor using overhead monitor. Others could simply be web-based and accessible anywhere on the network.

• Audio/visual control center.

• Conference rooms with advanced audio/video equipment. Larger classrooms could be located elsewhere.

• Storage for portable mannequins and supplies.

• Administrative and staff offices.

• Research space.

**Capital needs**

The funding for this facility depends greatly on the type of equipment to be utilized. The most sophisticated mannequin simulators cost between $150,000 and $250,000 each, although mid-fidelity mannequin simulators can be purchased for $30,000 to $40,000 that will meet many training needs. The endovascular simulators probably cost around $250,000 each as well although they may be leased. Construction costs are generally in the $250/ft² range.

Software to integrate digital audio/visual recording, live simulator data and performance reports into a web-accessible, center-wide solution. Some types of simulation software use electronic keycards to track, monitor, record, and score teaching encounters, regardless of where they are in the center and what task is being performing. This software can cost from $150,000 to $200,000 depending upon the type of audio/video equipment and the extent of software-to-hardware integration that is desired.

Dedicated microsurgical simulators can be very expensive, as much as $1 million or more. To get started will probably cost $2.5 million. In a few years, additional space and equipment might double that cost.

**Personnel**

To start, the center needs a director, a center coordinator, and dedicated trainers. Center coordination may require more than one position. The coordinator(s) must be able to operate and
maintain all simulation equipment and all audio-video equipment. An audio-visual technician will be required in the design, installation, and maintenance of the center. Most of the trainers will be content experts from the various departments and schools who are trained by the center staff first. As equipment is added and functions expanded, additional staff will be required, especially if the center provides services to non-UCSF trainees.

**Operating Expenses**

Typical operating expenses include maintenance, supplies, utilities, and rent, if in an off-campus location. It is difficult to estimate these costs at this time, but the maintenance will be around $200,000 per year and supplies should be relatively modest.

**Funding Opportunities**

One approach to fund such a Center would be a consortium of users, both within UCSF and outside. The UCSF users would include the schools, departments and the Medical Center.

A number of outside groups will probably want to use the facility, including firefighters, paramedics, the military, and other healthcare facility personnel. Although many would simply pay a users’ fee, some of the other healthcare facilities in the area might be interested in a partnership arrangement, sharing upfront costs. Philanthropic sources should also be pursued.

**Business Opportunities**

The primary business opportunities include charging outside groups as indicated above. In a number of centers across the country, the expectation has been to cover all of the costs by charging users a fee to use the facilities. The most successful programs have not charged internal users in order to encourage use, but have charged outside customers. Groups such as firefighters and paramedics often prefer a fixed contract for the year.

Of course, one other strategy would be to invite investors to participate in a profit sharing portion of the enterprise. Such an arrangement is not easy to accomplish in our University environment.
Next Steps

The Committee recommends the serious consideration of a central Clinical Skills and Simulation Center at UCSF, including the following next steps:

- Educate the UCSF community about the need for and advantages of having a central simulation facility. This should include presentations to the leadership of all four health professions schools at UCSF, hospital administrators, and chairs and ORU directors.

- Identify a small group of core leaders to champion a central simulation center at UCSF, including the development of strategies and long-term plans.

- Under the direction and supervision of the leadership group, staff would develop concrete plans for the creation of a central simulation facility at UCSF.
Selected Resources

Overview of Simulation Centers


Medical Schools and Hospitals

University of California, Davis:  http://www.ucdmc.ucdavis.edu/healthprofessionals/virtual_care/

University of California, Los Angeles: http://www.anes.ucla.edu/simulator.html

Harvard Medical School: http://www.harvardmedsim.org/

University of Illinois, Chicago: http://www.uic.edu/com/mcme/cpcfaq.htm#mis

University of Pittsburgh: http://www.wiser.pitt.edu/

Riverside Methodist Hospital:

Stanford University: http://med.stanford.edu/irt/immersive/

Society for Medical Simulation: http://www.socmedsim.org/

Industry

Laerdal: http://www.laerdal.com/simman/default.htm

MEDISIM: http://www.medisim.org/

Meti: http://www.meti.com/

Selected Citations


2. Dunn, WF. (Ed.) Simulators in Critical Care and Beyond. Des Plaines, IL: Society of Critical Care Medicine, 2004


