Legacy Institute for Surgical Education and Innovation: Current Progress and Future Direction

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INTRODUCTION

The ultimate goal for the team of individuals caring for a patient requiring surgery is to provide safe, quality health care. In the daily practice of surgeons, this goal is often achieved, despite the rising demands of patient expectations, the declining health care reimbursement, and the proliferation of litigation. To maintain the quality of care within this challenging environment, surgeons have to continue training and practicing to cure disease without introducing surgical errors.[1]

Legacy Health is the largest nonprofit, community-owned health system in Oregon and in the Vancouver, Washington region. Legacy Health has 6 hospitals; more than 50 clinics; Oregon's only burn center; clinical laboratories; and a research institute funded by the National Institutes of Health (NIH), Department of Defense, private foundations, and industry. It provides hospice care as well. Legacy Health consists of 2500 physicians on the medical staff and more than 9000 employees.

Surgical education, quality, and patient safety have been a central element of Legacy Health's mission. Surgeons and nurses collaborate closely to provide state-of-the-art surgical care. Surgeons, human factor scientists, and nurse educators continue to work together to design curricula for surgical training at all levels to ensure quality and patient safety. Three distinct educational programs within Legacy Health were merged to create the Legacy Institute for Surgical Education and Innovation (LISEI). These include the Advanced Trauma and Life Support (ATLS) Program/Trauma Center, founded in 1981; the Legacy Research Department of Comparative Medicine, founded in 1998; and the Carl Peterson Education Center, founded in 2005. The American College of Surgeons (ACS) first accredited LISEI, as a level I educational institute on June 25, 2008. Since that time, LISEI continues to grow, evolve, and deliver outstanding educational activities. We underwent a change in leadership, expanded the scope and mission, as well as completed a strategic planning process required to plan for the future.

In 2009, the Director of LISEI was transitioned from Dr George A. Cioffi to Dr P. Ashley Wackym, with his recruitment to Legacy Health. Dr Wackym was recruited from the Medical College of Wisconsin where he served as Chair of the Department of Otolaryngology and Communication Sciences for over a decade. Dr Wackym also serves as the Clinical Vice-President of Research. Dr Duncan R. Neilson, Jr serves as the Surgical Program Director. Dr Neilson also serves as the Clinical Vice-President of Surgical Specialties. These leaders are practicing surgeons and Dr Wackym is a fellow of the ACS.

HISTORY AND AVAILABLE RESOURCES

Department of Comparative Medicine

The Department of Comparative Medicine (DCM) is housed within the Legacy Research Institute and is led by Gregory B. Timmel, DVM, DACLAM. There is currently a staff of 11, including the recent addition of a dedicated surgical technician who brings more than 20 years of operating room experience within a level I trauma center to our program. The DCM revenues have averaged $720,000 per year over the past 5 years. LISEI is physically located in the DCM. The Legacy Research Institute is housed within a 158,000 sq ft building; the DCM space allocation is 6980 sq ft for the surgical training facility and 9548 sq ft are devoted to the vivarium. Our facility provides training of nursing students, nurse residents, Legacy operating room personnel, surgeons, surgical residents and fellows, podiatrists, and others in techniques and new procedures and technologies. Community-based health care providers also use our facility for research and instructional projects, including many surgical studies funded by the Department of Defense. Similarly, a wide range of leading manufacturers in the device and technology industry contracts with DCM to use our surgical

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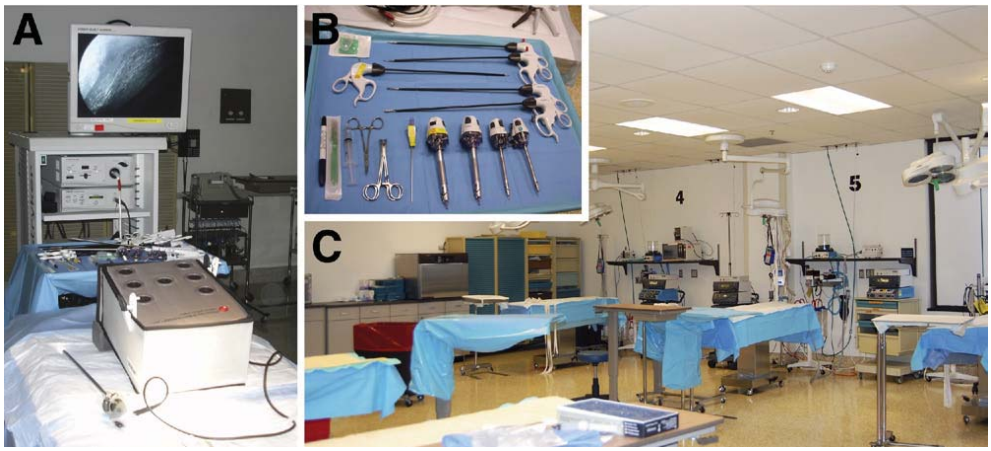

FIGURE 1. Surgical education facility for animate, inanimate, and cadaveric training and research. (Published with permission, copyright © 2011 P. A. Wackym, MD.) **A,** A laparoscopic/endoscopic tower with a high-definition monitor being used for an inanimate exercise. **B,** Complete laparoscopic instrumentation arranged on a Mayo stand before an animate training course. **C,** The large surgical training space with 6 complete operating room setups accommodates up to 24 simultaneous learners.

facilities to work with experimental models. In 2010, 344 health care professionals used the DCM facility for purposes related to LISEI. Of those, 302 were physicians and 42 were nurses.

A wide variety of surgical training courses reflecting the spectrum of engaged surgeons (outlined below) incorporate specialty specific resources, eg, minimally invasive techniques and robotic surgery. The courses are organized by Legacy Health surgeons, as well as surgeons from the Oregon Health and Science University (OHSU) and are conducted in animate, cadaver, and simulation models. Training curricula are designed for improving skills at both team and individual levels. The DCM program annually hosts continuing medical education (CME) and general medical education (GME) courses to train a wide range of surgeons and at different levels of experience and training. Residents from OHSU in the disciplines of general surgery, obstetrics and gynecology and urology train in our facility at approximately 6-week intervals. A maximum of 24 trainees can be trained at one time (Fig. 1).

The surgical laboratories are equipped with current technology, such as harmonic scalpels, intracorporeal ultrasound, C-arms, operating microscopes, 11 complete endoscopic/laparoscopic towers, and associated equipment, as well as a da Vinci surgical robot (Intuitive Surgical Inc., Sunnyvale, California) (Figs 1-4). This realistic training environment gives learners the opportunity to practice a wide range of surgical skills (eg, site exploration and knot tying to anastomosis and liver resection) as well as provide operating room team training.

In addition to multiple faculty surgeons representing the subspecialties of surgical oncology, obstetrics/gynecology, orthopedic surgery, otolaryngology, oral and maxillofacial surgery, podiatry, general surgery/minimally invasive surgery, trauma surgery, urology, neurosurgery, and ophthalmology, the DCM program has a human factor/team training collaborator, a surgical educator, a program coordinator, and a clinical coordinator who help to develop surgical education programs. Dr Bin Zheng has led the work in team training that has recently resulted in 3 publications.[2-4]

The inanimate training laboratory possesses 8 sets of standard, minimally invasive surgery devices that allow trainees to practice fundamental laparoscopic technique skills daily. The laboratory uses valid physical and computer-generated simulation, including Fundamentals of Laparoscopic Surgery (FLS), and we are the certifying program in Oregon. Lap Mentor (Simbionix Ltd, Cleveland, Ohio) is also used for helping assess surgeon competence in laparoscopic surgery.

The surgical training center includes a multifunctional conference room with advanced audio and video equipment, which allow for running didactic course and broadcasting live surgery

FIGURE 2. GE Model OEC9900 Elite C-arm (GE Healthcare, Piscataway, New Jersey) prepared for an animate training course. (Published with permission, copyright © 2011 P. A. Wackym, MD.)

FIGURE 3. Hands-on surgical robotic training using a cadaver for a laparoscopic gynecologic procedure. Digital recording is available within the slave tower. Inset, detail of pelvis as viewed on the slave monitor. (Published with permission, copyright © 2011 P. A. Wackym, MD.)

via an Internet2 (I2) connection. All conference rooms are equipped with ceiling-mounted projectors, built-in DVD players, Internet access, and Mac (Apple, Inc, Cupertino, California)/PC computers.

The ATLS Program/Trauma Center

Legacy Emanuel Medical Center has been a level I trauma center accredited by the State of Oregon since 1988 and is 1 of 2 ACS verified trauma centers in the Pacific Northwest. Legacy Emanuel Medical Center has been an authorized ATLS site since January 16, 1981. Dr Seth Izenberg directs the ATLS Program/Trauma Center. Other faculty members for the ATLS classes are composed of physicians with current ATLS Instructor status monitored by the Oregon State ATLS Coordinator, and all physicians abide by the standards prescribed by the American College of Surgeons. The ATLS coordinator role is combined with the trauma nurse coordinator role. Currently there is one ATLS coordinator. A total of 114 courses has been presented since 1981.

The most recent International ATLS course was held in Portland, Oregon in November 2010. A typical class size of 16 physicians attended the ATLS classes at Legacy Emanuel Medical Center. Of the attendees, 4 physicians were from Pakistan, and after the successful completion of the 3-day course, they took a 2-day course designed to prepare them to teach ATLS to physicians in their own country.

The main location for hosting the ATLS training course is the Lorenzen Conference Center located on the Legacy Emanuel Medical Center campus. The Lorenzen Conference Center includes a large auditorium as well as 2 large classrooms that can be revised into 4 smaller classrooms. All classrooms are equipped with the following audiovisual (AV) equipment: ceiling-mounted projectors, DVD players, Internet access, and computers.

The physical simulations used in ATLS class include TraumaMan from Simulab Corporation (Seattle, Washington) and Chester Chest (Laerdal Medical, Wappingers Falls, New York), and IV Torso (Laerdal) and Femoral Access Trainer (Laerdal) for central and femoral line simulation. A Laerdal Mr Hurt model is utilized for training in facial fractures. In addition, moulage is used to have live models simulate traumatic injuries in both the student and refresher classes.

During 2009 we implemented the Rural Trauma Team Development Course (RTTDC), which was been developed by the ad hoc Rural Trauma committee of the ACS Committee on Trauma to help rural hospitals with development of their trauma teams. Since then, we conducted 7 courses with team training of 202 nurses and surgeons. We hope the course will improve the quality of care in their community through a team approach that addresses the common problems in the initial assessment and stabilization of the injured. It is the purpose of RTTDC to increase the efficiency of resource use and improve the level of care provided to the injured patient in the rural environment.

Carl Peterson Clinical Education Center

In May of 2005, Legacy Health opened the Carl Peterson Clinical Education Center (CPEC) on the Emanuel Medical Center campus of Legacy Health. Funded by the Good Samaritan Foundation, with grant support from the Oregon Simulation Alliance and other private foundations, the CPEC was built to offer a state-of-the-art simulation-training environment for health care professionals within the organization and the broader community. Legacy Health incorporates high-fidelity simulation training in the development of their health care professionals. Simulation-based curriculum has been developed

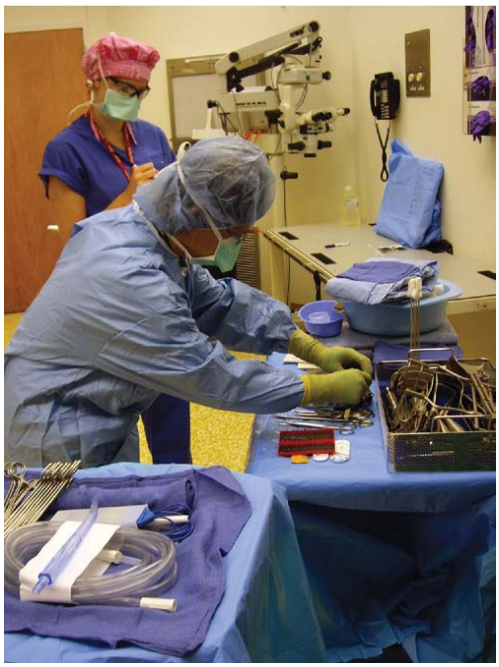

FIGURE 4. One of the 2 large and dedicated operating rooms within the Department of Comparative Medicine during a team training exercise. (Published with permission, copyright © 2011 P. A. Wackym, MD.)

FIGURE 5. Laerdal Adult SimMan high-fidelity manikin placed in laboratory A of the Carl Peterson Clinical Education Center for a simulation training session. (Published with permission, copyright © 2011 P. A. Wackym, MD.)

and implemented to enhance high-level skill development with a focus on critical thinking, clinical competency, and team building.

Simulation training has been incorporated into the on boarding programs and the ongoing clinical education for the nursing staff of Legacy Health, exposing more than 1000 nurses annually to the simulation-training environment. Simulation training sessions are mandated for Critical Care Residents and Interns before their intensive care unit rotations, with more than 70 attending these sessions annually. The Legacy Health Clinical Simulation Program has developed simulation-based team training for the following initiatives: development of high-functioning rapid response teams for the 6 hospitals, competency validation of Life Flight health care professionals annually, neonatal resuscitation recertification for medical staff, and annual RN Skills Day for a variety of specialty areas. All together, more than 2900 health care professionals are trained annually with simulation-based sessions in the CPEC.

There are 2 full-time simulation specialists in the CPEC dedicated to the development of the Legacy Health Clinical Simulation Program: These simulation specialists are supported in their curriculum development and simulation training by clinical experts, such as clinical nurse specialists, respiratory clinical specialists, and physicians. The simulation specialists are involved in ongoing training to advance their simulation knowledge base and skill level.

The CPEC is composed of 3 conference rooms, 2 simulation laboratories, 2 control rooms, 5 office spaces, 2 storage areas, and a kitchen. Simulation laboratory A (23 ft × 14 ft) has 4 video cameras strategically placed to capture all angles of the simulated clinical events (Fig. 5). Simulation laboratory B (12 ft × 14 ft) has 3 video cameras strategically placed to capture all angles of the simulated clinical events.

Each simulation laboratory has its own control room that contains the most current videotaping and recording devices allowing video-feed into all 3 conference rooms (Fig. 6). The ability to record the clinical event on individual DVDs enhances the ability of self-analysis for the learner after the initial debriefing. Each control room has 2-way mirrors that cover a large portion of the wall, facilitating the viewing and/or recording the simulated clinical events. The control rooms easily accommodate 6 people who can observe, record, or manipulate the manikin's responses to interventions.

The center's 3 conference rooms are used for debriefing, teleconferencing, hands-on training, and didactic sessions. Conference room A has the capacity for 18, conference room B for 30, and conference room C for 16, or one can open A and B to create a combined classroom with a capacity of 50. Conference room C is home to 20 laptop computers, which are used for web-based training. All classrooms are equipped with AV equipment, including DVD and ceiling-mounted projectors, laptops with Internet access, and in-house computers with network access.

The CPEC has the following simulation equipment available for training purposes: 3 adult SimMan high-fidelity manikins (Laerdal), 1 Noelle high-fidelity birthing manikin (Gaumard Scientific, Miami, Florida) with neonate (birthing manikin), 1 SimBaby infant high-fidelity manikin (Laerdal), and other mid-fidelity adult and pediatric manikins. The CPEC has more than 12 intravenous training arms, 2 central line torsos, and a mobile birthing hips simulator. The CPEC also has 3 airway models from Armstrong Medical Industries, Inc (Lincolnshire, Illinois).

The DCM, ATLS Program/Trauma Center, and CPEC have access to all the patient care equipment used in the Legacy acute care hospital or clinical setting, including (but not limited to): beds, stretchers, ventilators, vital sign monitors, intravenous pumps, code cart with medications, and all surgical patient care supplies. Each laboratory contains simulated air, oxygen, and suction access devices connected to compressors. The compressors are located outside the laboratory for noise control. Each laboratory also contains a computer that has access to the electronic medical record training field.

FIGURE 6. Control room of a Carl Peterson Clinical Education Center simulation laboratory. (Published with permission, copyright © 2011 P. A. Wackym, MD.)

ACCOMPLISHMENTS

Activities that Characterize the Educational Programs

Simulation scenarios occur at all 3 sites of LISEI, but each focuses on a different aspect of surgical care. At the DCM, we have the ability to simulate surgical procedures as well as operating room team activities and training. At the CPEC, we can simulate intensive care unit, in-patient bed, and emergency room scenarios, as well as train specific skills using simulation manikins. Finally, within the ATLS Program/Trauma Center, standardized ATLS educational curricula are used for simulation training as well as mass trauma team simulations using moulage with live models.

Animate and cadaveric educational programs are also a unique component of our educational institution. With 2 dedicated operating rooms and the larger training space that has 6 complete operating room setups, both large group and small group training sessions can he provided. The ability to teach new surgical techniques for a wide range of learner levels, as well as to develop new surgical techniques, is a hallmark of our DCM facility.

Recent Growth, New Programs, and the Future

The most exciting development has been the addition of a dedicated da Vinci surgical robot to LISEI, which is housed in Legacy Research's DCM. We have also been updating our endoscopic towers systematically with high-definition monitors as well as updating our C-arms. This has allowed us not only to incorporate new technologies into the ongoing OHSU resident training courses, but also to allow surgeons to practice with the da Vinci robot with established and even new procedures before transferring these skills to direct patient care. We have also been able to provide nursing education so that nurses and nursing students can familiarize themselves with the technology and become facile with the da Vinci surgical robot before entering the operating room with a patient.

Team training remains a priority for LISEI. Interest and involvement in the TeamSTEPPS (U.S. Department of Health & Human Services, Washington, DC) Delivery System[1] by our health care system began in 2010. We are following our site assessment, which identified opportunities for improvement, determining our readiness and potential barriers, and committing the necessary resources with defining the details for planning, training, and implementation of TeamSTEPPS. More than 3 years of operational success with LISEI has facilitated this process.

During 2010, we made a concerted effort to assess our needs, opportunities, and challenges with a combination of 2 retreats, several steering committee meetings, and 3 smaller focus groups. The focus groups included surgical education, simulation, and surgical education research. The Organizational Development group at Legacy Health helped organize and facilitate the meetings. Our first retreat was open to participants of LISEI as well as any community members who may be interested in discussing and providing input related to what we should become over the next 3 to 5 years. More than 50 people participated and the facilitated breakout groups generated excellent ideas and specific timelines to follow.

Challenges

We have been fortunate that we have not been faced with financial challenges. Because of the nature of our animate, cadaveric, and simulation facility, we secured funding from industry for internal corporate training and development that has been used to support some of the infrastructure of LISEI. Likewise, our parent organization Legacy Health commits significant resources each year to our operating budget.

ADMINISTRATION AND FINANCIAL SUPPORT

LISEI is supported by Legacy Health via the Legacy Research Institute (DCM), ATLS Trauma Center, and the CPEC. The organizational structure of LISEI is outlined in Fig. 7. In addition to the leadership of LISEI, the advisory board membership includes representation from research, the Legacy Foundation Board, leadership of the CPEC and ATLS Trauma Center, interdisciplinary clinical experts, and surgical educational experts. The director of LISEI collaborates closely with the DCM, CPEC, and ATLS trauma center to facilitate the educational efforts of surgeons, nurses, podiatrists, clinical experts, and educators. The educational efforts are focused on providing educationally sound programs within an experiential learning environment. The curriculum is simulation based, with progressive exclusion of animal laboratories. Training is targeted at developing skills of both individuals and teams, as well as meeting the learning needs of novice to expert. LISEI is easily accessible for the learner. LISEI evaluates the progress of each individual or team participants objectively to continuously improve the quality of the curriculum to maximize outcomes.

Financial support to the LISEI comes from several sources. Currently, each unit (DCM, ATLS Trauma Center, and CPEC) has their own budgetary support. Budgets are prepared annually. The steering committee remains responsible for coordinating individual component budgets. It continues to be the case that this structure reduces duplication between programs.

PROJECTED GROWTH

During the past 3 years, we demonstrated our ability to function as an effective surgical education facility striving to meet the needs of a wide variety of learners. We have evolved as health

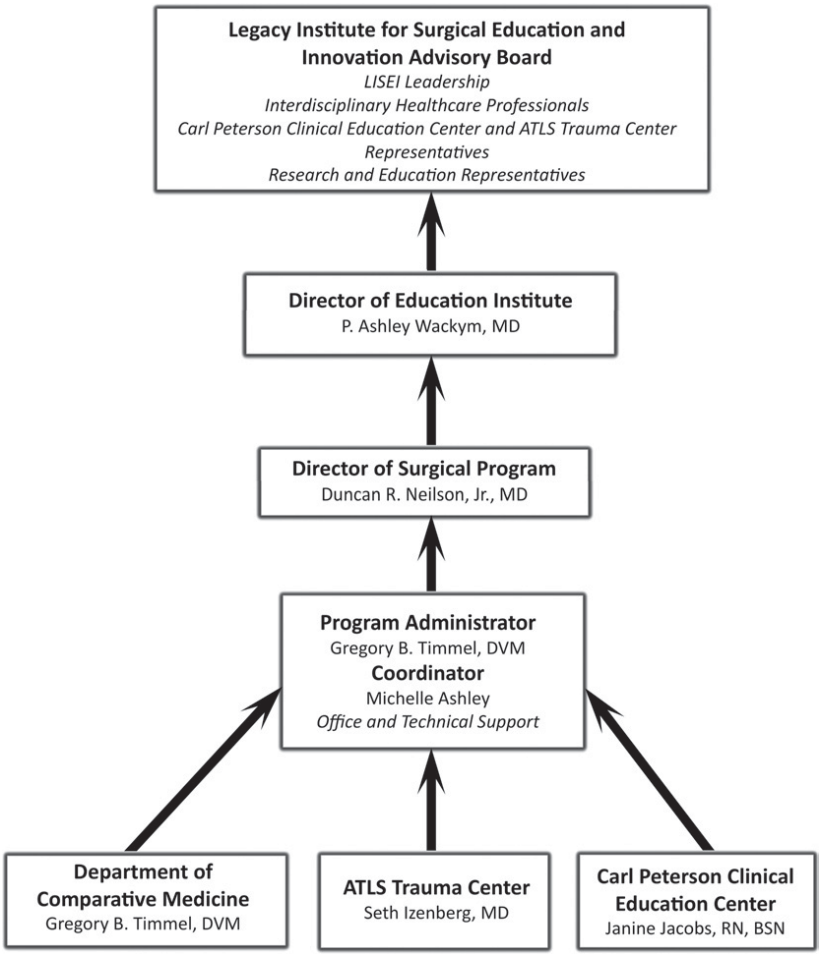

FIGURE 7. LISEI organizational chart. (Published with permission, copyright © 2011 P. A. Wackym, MD.)

care and associated educational needs have evolved in complexity and with technology. We are also committed to reducing errors and to team training.

Expansion of our animal facility is essential to our planned growth. Toward that end, with help from a local architectural firm, we developed a remodel and construction plan that will add 1200 sq ft to our current facility. We have a pending NIH/NCRR G20 grant application currently under review that will provide $500,000 toward this project. We have a commitment from Legacy Health to match this amount with the additional $533,079 necessary to complete this work in support of DCM and LISEI.

In our facilitated retreats, much thought was committed to our future. The 3 main areas of growth during the next 3 years will be in surgical education, simulation, and surgical education research. We plan to identify and recruit an education scientist/investigator who will contribute to our ability to design effective and measurable training/educational programs. An emphasis will be placed on a combination of animate, inanimate, and cadaveric education in DCM and other simulations outside of the operating room setting (ATLS Program/Trauma Center and CPEC).

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