REFERENCED PUBLICATIONS


A Message from the Executive Director of ASTEC

Our healthcare still is largely dependent upon handwritten records, abbreviated notes, and telephonic orders. Medicine has remained one of the last institutions to resist wholesale and standardized computer integration. However, this situation is changing rapidly.

Growing consumer outrage at the escalating toll of medical errors and the growing socio-economic awareness of the rising cost of the most expensive healthcare system in the world are fueling a radical change in the foundation of American healthcare. Medical adverse events now represent the fifth leading cause of death in the United States. Currently, one out of every five dollars spent in healthcare is related to medical errors. The synchronicity of these powerful forces will create “the perfect storm,” bringing medicine into the twenty-first century’s “digital revolution” and integrating technology to improve our medical outcomes.

The Arizona Simulation Technology and Education Center (ASTEC) provides training in a risk-free, supportive environment using simulation and virtual reality. We research, develop, and evaluate high-fidelity technologies to find new ways to train the doctors of tomorrow to eliminate the mistakes of today.

Allan J. Hamilton, MD, FACS
Executive Director, ASTEC
Professor of Surgery
Professor of Psychology-Surgery
Clinical Professor of Radiation/Oncology
Professor of Electrical and Computer Engineering
Executive Overview:

- ASTEC has completed its third year of operation.
- From 2006-2007 to 2007-2008 ASTEC has doubled its volume of participant education training hours. This was achieved with no increase in budget or operating costs.
- 70% of ASTEC’s attendance consists of AHSC participants.
- ASTEC is now utilized by all four classes (years 1-4) of the College of Medicine (CoM) and services 7 separate Departments within the CoM.
- ASTEC is approaching maximum levels of scheduled training with up to 70% of its available teaching time allotted to a 40-hour work week.
- ASTEC participated in a joint simulation, which included 260 students from the CoM, College of Nursing and the College of Pharmacy.
- ASTEC has added 5 new training modules to accommodate the needs of Internal Medicine, Emergency Medicine, Pediatrics, Pulmonology and Urology.
- In 2007-2008 ASTEC’s research involved 1 PhD dissertation, 1 MS thesis, 4 graduate students, 4 medical students and 2 international visiting fellows.
- ASTEC was recently selected as 1 of 10 mentoring simulation institutions in the United States by Medical Education Technologies, Inc.

Ongoing is ASTEC’s research to develop and perfect bio-synthetic materials used for surgical dissection, intravenous therapy, suturing, and microsurgery simulation. We now serve seven separate departments with simulated tissue. In addition to our extensive use of ballistic gelatin, silicone and thermoplastic elastomer have been added to better meet departmental needs while maximizing the fidelity of simulation technology.

Finally, Mike Hudson, MD, Department of Emergency Medicine, also is leading a project evaluating the use of standardized clinical scenarios to measure the performance of Emergency Medicine residents.

FUTURE INITIATIVES

ASTEC is working with the CoM to find additional space for a larger, centralized simulation facility to serve the current and future needs of the CoM. Currently ASTEC is serving all four classes of CoM students, as well as residents. The current ASTEC facility covers less than 1,500 square feet. More space and centralizing all of the simulation equipment would produce significant savings in support and teaching personnel, allowing the simulation capacity of ASTEC to more than double.

A non-inferiority study lead by Dr. Mike Hudson will look at traditional simulation teaching versus the use of a more specifically selected debriefing style.

ASTEC’s staff is participating in the development of a simulation lab at the Phoenix CoM Campus for the purpose of further integrating telemedicine and telecommunications. This will be a vital component of telemedicine initiatives currently underway.

Finally, ASTEC was recently selected as one of 10 national mentoring simulation institutions by Medical Education Technologies, Inc (METI). ASTEC’s innovation with simulation training will play an integral role in establishing a formal curriculum for national use.
Under the leadership of Dr. Jerzy Rosenblit, head of the Department of Computer & Electrical Engineering (ECE), graduate students continue to collaborate with ASTEC on the development of a prototype bi-manual surgical-assisted laparoscopic trainer that has miniaturized sensors embedded in the tips. The second generation Computer Assisted Surgical Trainer (CAST) allows for the measure of two handed sub-millisecond analysis of movement with an additional component of randomly presented targets. The sensors permit computers to track technical errors in instrument handling, as well as generating quantitative data of the efficiency of learning with standard “monocular” versus “binocular” scopes. We hope to develop computers that not only “track” individual instruments, but also to potentially prevent inadvertent movements and mishaps before they can occur. A basic research grant is projected to be submitted by ECE researcher Chuen Feng, PhD for 2009.

RESEARCH

In 2007 - 2008 ASTEC has been involved in a variety of research initiatives that included one PhD dissertation, one master’s thesis, four graduate students, four medical students and two international visiting fellows. The following is a brief overview of what is underway.

ARIZONA SIMULATION TECHNOLOGY AND EDUCATION CENTER

ASTEC has begun its fourth year of operation since opening on August 5, 2005. Since that time, the lab has provided a consistently high volume of simulation technology and education services for numerous Arizona Health Sciences Center (AHSC) Departments, as well as external first responder organizations. Most notably, this past Academic Year ASTEC has more than doubled its annual participant hours from Academic Year 2006 - 2007 (See Chart 1).

ASTEC continues to increase the number of participants while maintaining the same number of faculty and staff, the same amount of workable space, and the same operational budget since its opening. This makes ASTEC one of the top medical simulation labs in the nation in terms of high utilization with low overhead costs. In addition, through ongoing research and development initiatives, ASTEC continues to enhance its educational components by customizing new simulation modules to better accommodate AHSC departmental needs. As a result, internal participants used 70% of ASTEC’s educational resources in the 2007 - 2008 Academic Year (See Chart 2).

EDUCATION & TRAINING

ASTEC’s weekly schedule is filled more and more with reoccurring training. Half of this time is by CoM students. The remaining half represents the following:

- Surgery Residents
- Emergency Medicine Residents
- Pediatric Residents
- Urology Residents
- Anesthesiology Residents
- The College of Nursing Acute Care Nurse-Practitioner Program
- Emergency Medicine Club
- Surgery Club
- CoM Faculty
- Pre-Med UA Students
- Grad & Undergrad UA Students

Recent additions to ASTEC’s regular schedule include:

- Family Practice Residents
- Internal Medicine Residents
- Pulmonary Residents
- Obstetric and Gynecology Residents
- Medical Students Mentorship Program (Society Program)
Non-UA participants that continue to occupy ASTEC’s regular schedule are:

- Tucson Fire Department Emergency Medical Technician Program
- AirEvac® Helicopter Program
- LifeNet® Helicopter Program

Below is an example of a typical week at ASTEC:
Faculty proctoring is encouraged for all scheduled trainings and is considered an essential component for simulating cases and providing debriefing.

Recently, Emergency Medicine initiated a “Train the Trainers” demonstration for IG of the department’s faculty members as part of a long-term plan for faculty involvement in all future clerkship and resident trainings. In addition, efforts are underway to schedule residents to serve as mentors during medical student simulation trainings.

The Accreditation Council for Graduate Medical Education (ACGME) has now instituted mandated laparoscopic training for general surgery certification to take effect in 2009. Coordination has begun between ASTEC and the Department of Surgery to ensure that the simulation curriculum meets accreditation standards. The ASTEC website (www.astec.arizona.edu) also will have a Laparoscopic CD-ROM Library that will house simulation software for residents to access.

ASTEC recently participated in an advanced life support resuscitation training held simultaneously with the College of Medicine, College of Nursing and College of Pharmacy. The simulation training involved 280 students and 25 faculty members from all three colleges and already has received national attention.

This past year ASTEC also provided paramedic and EMT continuing education training for Life Net® and Air Evac®, as well as state certification requirements for the Tucson Fire Department. These efforts generated approximately $15,000 in revenue for the 2007 – 2008 fiscal year. ASTEC continues to be a primary resource for community first responder simulation training.

ASTEC’s popularity is demonstrated by the enthusiastic and positive data generated from “feedback” and “satisfaction” survey data. On standardized, anonymous feedback questionnaires, ASTEC has consistently scored in the 90th percentile as a favorable educational experience by medical student and resident respondents.

NEW TRAINING MODULES

Heather Cahan, MD, (Department of Pediatrics, Section of Neonatology) was granted a Virginia Furrow Award for her training proposal: “SimBaby: Putting the Practice Back into Medical Practice.” The award provided a grant to purchase a high-fidelity newborn simulator, SimNewB (Laerdal Medical), which recently arrived for use in ASTEC. The baby simulator also will be part of outreach programs scheduled for Nogales, Pinetop and Sierra Vista.

To better accommodate Emergency and Internal Medicine training needs, a central-line simulator is now available in ASTEC. This module allows participants to train on subclavian, supraclavicular and internal jugular central line access. It also provides an opportunity for participants to practice strict sterility protocols.

Currently, Emergency Medicine is working with Urology residents using a “Percutaneous Nephrolithotomy Trainer.” This new training model teaches and improves resident’s skills on percutaneous kidney procedures. Obtaining access is one of the most difficult aspects of performing these procedures and involves placing a long access needle through a patient’s back into the renal collection system using X-ray guidance. Made with silicone gel, the model mimics the anatomy of the renal collecting system in 3D. The resident can practice inserting the access needle into various parts of the renal collecting system, and because the gel is clear, the anatomy is visible without the need for an X-ray.

Residents follow a structured program in which they gain access to the different parts of the kidney using the same instruments that are used in surgery. Benefits include better understanding of the anatomy, the freedom to learn without exposing patients to increased operative time, the avoidance of X-ray radiation to the patient or staff during learning, and minimization of injury to the patient. After gaining proficiency with the trainer, the residents will apply these techniques to actual procedures in the operating room.

One of several coordinated education and research initiatives with Karl Storz Endoscopy, Inc., the development of ASTEC’s bronchoscopy prototype allows participants to orient themselves and improve their navigational skills using a fiber-optic bronchoscope. The model functions with various routes and calibers and allows for the ability