

James C. Eisenach, M.D., Editor

## Medicine, Technology, and Human Factors in Trauma Care: A Civilian and Military Perspective. Baltimore, Maryland. November 15–16, 2001.

This symposium was divided into three multidisciplinary sessions over 2 days in which innovations in organization, coordination, data capture, use of technology, and new approaches in emergency care of the injured were discussed. Military and civilian anesthesiologists and surgeons, field care providers, nurses, psychologists, computer scientists, technologists, and human factor engineers presented.\*

In the first session, Yan Xiao, Ph.D., of University of Maryland's Human Factors and Technology Group (<http://hfrp.umm.edu>), described studies carried by the Group on human and technology factors for coordination occurring along the event timeline of emergency medical care from the field to a dedicated trauma center. Dr. Xiao's presentation highlighted issues in remote decision making, preparation for incoming trauma patients, and coordination among care providers managing operating rooms.

Next, Michael McNeese, Ph.D., of the Pennsylvania State University's School of Information Sciences and Technology, identified futuristic concepts for human factors in information systems (such as Living Lab) to illustrate the need for a variety of research methodologies in designing medical information systems. Colin Mackenzie, M.D., of the University of Maryland's National Study Center for Trauma and Emergency Medical Services, described development of best practices for brief, risky, beneficial procedures (e.g., airway management, chest tube insertion) using video taping methodology. In comparison with traditional methods, videotaping allows detailed examination of performance, and practices that may be otherwise difficult to capture. Nancy Foster, M.S., of Agency for Healthcare Research and Quality, presented the Agency's initiatives in reduction of errors in medicine and described the funding of initiatives this year by the Agency on health system reporting, clinical informatics, working conditions, and centers of excellence for patient safety research.

Stephen Schimpff, M.D., of the University of Maryland Medical Center, presented his view as Chief Executive Officer on patient safety in reducing medication errors, nosocomial infection, implementing best practices, 24/7 physician coverage of intensive care units, and improving resident supervision, as well as plans to adopt the recommendations from the Leapfrog Group. Harvey Magee, M.S., of the Army's Telemedicine and Advanced Technology Research Center (TATRC), presented the Center's strategy of building portfolios of projects on medical simulation technologies in PC-based multimedia simulation, digital mannequins, virtual workbenches, and total immersion virtual reality. John Holcomb, M.D., of the University of Texas, Houston Medical Center, described how his group developed measurements to quantitate the benefits of a 28-day surgical trauma training course using videotaping of simulated patient care. They showed the benefits of training included a shorter time of oxygen desaturation and hypotension during physiologically identical trauma patient management. Darin Via, M.D., of Uniformed Services University of Health Sciences (USUHS), described studies in collaboration with human factors specialists to evaluate performance during simulation. Critical incidents were developed as part of the simulation, and an eye-tracking device

was used to capture visual scanning patterns. A performance evaluation tool kit was used to measure how simulation participants perform during trauma emergencies. General (Rtd.) Russ Zajchuk discussed preparedness for bioterrorism attacks in the context of a video made 5 yr ago of a simulated attack on Wall Street, and the military role in relief operations after the hurricane disaster in Honduras.

In his second presentation, Yan Xiao described the mobile digitally connected doctor (MobiDoc) project in which anytime, anywhere, audio-video and data connections are integrated with a global positioning system data during ambulance transport. The prototype system automatically recognizes ambulance locations, pages team members with estimated time of arrival, and allows access for therapeutic interventions *en route*. Martin MacPhee of the American Red Cross described fibrin sealant as a battlefield surgical dressing for life-threatening hemorrhage. Robert Leitch, as a combat veteran in the Falklands, described the need for small, easy-to-use equipment that was an enabler of battlefield care, not a substitute for inadequate training.

Peter Hu, Director of Information Technology in the University of Maryland Department of Anesthesiology, demonstrated the Telemedicine testbed designed to his many-to-one-to-many architecture, allowing audio-video and data collection and distribution to multiple sites in the clinic, home, primary hospitals, and ambulances through the one single Telemedicine Control Center. Dr. Gary Gilbert from TATRC described future robotics in which devices of several sizes could perform surveillance, minesweeping, and other tasks dangerous for humans. He also was joined by Dr. Lynn Jaffe, who described the technology developed in conjunction with Dr. Peter Safer to allow rapid, central vascular access for brain protection and hemorrhage control in battlefield casualties. In Dr. John Holcomb's second presentation, he discussed noninvasive prehospital data collection with a personal digital assistant (PDA) data collection method to obtain and store waveform data directly from portable, noninvasive patient monitors.

In the third session, future clinical practice for the care of the injured, Col. Dean Calcagni, M.D., described the role of TATRC in developing new approaches to remote military and telepresence techniques. Ellen Mackenzie, Ph.D., gave a comprehensive description of the costs and social consequences of injury, identifying its increased occurrence, economic and social burden, and the need for controlling the event, the injury, and the consequences. David Longnecker, M.D., Chair of the Institute of Medicine Report on Fluid Resuscitation, provided the background and rationale for the findings from this important report and was followed by CDR Peter Rhee, M.D., Navy, San Diego, who added further rationale for choice of resuscitation fluids in context of mediators, neutrophil activation, and up-regulation of immune mediators and discussed how these may be modified to minimize resuscitation injury. Richard Dutton, M.D., of the Shock Trauma Center, described the background and findings from a prospective, randomized clinical trial ( $n = 110$  patients) in which low pressure was compared to higher pressure. Although they were more severely injured, the low-pressure resuscitation patients' mortality rate was the same, but length of hospital stay was greater. Changing surgical practice, including the use of angiographic embolization, fibrin bandage, and factor VIIa, were described by John Hess, M.D., M.P.H., who discussed the use of clot stabilizers, fibrinogen, and combinations of tools with the potential to rapidly control bleeding in the trauma patient.

Lt. Col. Robert Harris, M.D., presented a summary of the significant advances that have occurred in intramedullary and external fixator devices and discussed how donor bone and genetic techniques will be used to solve the orthopedic problems of the third millennium. Craig

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Llewellyn, M.D., M.P.H., from USUHS, discussed the logistics and track record of military support of humanitarian operations. The emerging role of telecommunications in war and peace and investigation of the human factors issues of integrating this technology into clinical practice in the US and the European theater was discussed by David Lam, M.D. Tom Scalea, M.D., of the Shock Trauma Center, discussed the paucity of good resuscitation endpoints and future surrogate markers of successful resuscitation. A review of how prehospital management should be evaluated was submitted from Robert Bass, Executive Director of the Maryland EMS.

The Symposium Proceedings will be available both on-line at <http://nsc.umaryland.edu/> and in hard copy form from the National Study Center for Trauma and EMS, 701 West Pratt Street, Baltimore, Maryland 21201.

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