Individual Expertise

Procedural Expertise

Systems Expertise

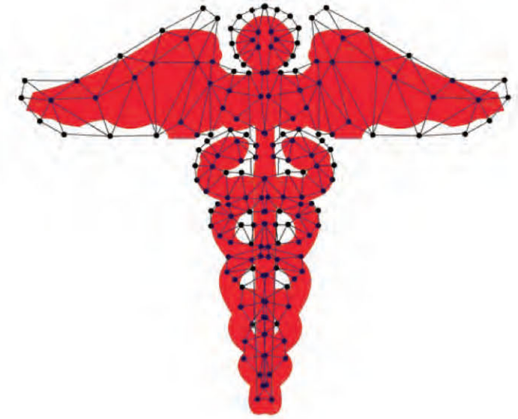
Team Expertise

Academic Emergency Medicine Consensus Conference

The Science of Simulation in Healthcare: Defining and Developing Clinical Expertise

May 28, 2008

The Science of Simulation in Healthcare: Defining and Developing Clinical Expertise



Academic Emergency Medicine Consensus Conference

May 28th, 2008
Washington D.C.

James A. Gordon, MD, MPA and John A. Vozenilek,MD
Conference Co-Chairs

AEM
Academic Emergency Medicine
SAEM

Michelle Biros, MD, MS
Editor in Chief

About the Logo:

In medical simulation we seek to provide an immersive experience which allows the participant to build insights and skills without risk to actual patients. We strive as educators to provide realistic stimuli and detail sufficient to suspend the learner's disbelief. We create a framework to provide context for our events. This framework in turn provides support to the house of medicine, allowing trainees to develop fully into professional competence.

About the Consensus Conference Co-Chairs
cochairs@patientsimulation.net

James A. Gordon, MD, MPA, is Director of the G.S. Beckwith Gilbert and Katharine S. Gilbert Medical Education Program in Medical Simulation at Harvard Medical School, where he is an Associate Professor of Medicine and a Scholar in the Academy of medical educators. Dr. Gordon practices and teaches in the Department of Emergency Medicine at Massachusetts General Hospital (MGH), and is on faculty at the MGH/Partners Institute for Health Policy. He is also co-founder of the Institute for Medical Simulation at the Center for Medical Simulation in Cambridge, MA.

After earning a bachelor's degree in intellectual history at Princeton, Dr. Gordon attended medical school at the University of Virginia and completed his training in emergency medicine at the University of Michigan. Following residency he completed a fellowship in the Robert Wood Johnson Clinical Scholars Program, also receiving a master's degree in public administration. His academic interests blend medical education (patient simulation) and health policy (medicine and social welfare).

Dr. Gordon lectures nationally and internationally, is supported by federal and foundation grant funds, and publishes regularly. He has received the Young Investigator Award from the Society for Academic Emergency Medicine and the Morgan-Zinsser Teaching Fellows Award at Harvard Medical School. He is a founding member of the Board of Directors of the international Society for Simulation in Healthcare, and sits on the editorial board of its new journal, Simulation in Healthcare.

John A. Vozenilek, MD, is a board-certified emergency physician who works clinically in the three hospitals of Evanston Northwestern Healthcare (ENH) and is an expert in the use of simulation for training and evaluation. Dr. Vozenilek has founded two simulation centers within the ENH system and is Director of the Northwestern McGaw Simulation Network, which serves the Feinberg School of Medicine, where he is faculty. He has developed focused training at nearly every level of expertise, including in-situ patient safety efforts designed to increase situational awareness and efforts to reduce injury during labor and delivery shoulder dystocia events.

Currently Dr. Vozenilek is engaged in the integration of simulation training into patient safety efforts as PI on the AHRQ funded grant, Simulation-based Training Program to Augment EMR-based Handoff Tool. Dr. Vozenilek is Co-Investigator on the three-year Emergency Medical Services for Children (EMSC) Targeted Issue Grant to develop a simulation–based pediatric emergency medicine curriculum for emergency medicine residents.

Dr. Vozenilek is nationally active in simulation education for emergency medicine. He has created an online national collaborative repository for peer review of simulation based training and serves as Associate Editor for the Association of American Medical Colleges' MedEdPORTAL. He is the Past Chairman of the Simulation Interest Group for the Society for Academic Emergency Medicine, and is a member of that organization's Committee on Medical Education Technologies. He has served as Medical Advisor for the Chicago testing center for Part 2 CS of the United States Medical Licensure Exam (USMLE) since its opening in 2003.

MAJOR FUNDING for The Science of Simulation in Healthcare Consensus Conference

Was Provided By:

Federal Government::*

Agency for Healthcare Research and Quality
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Foundations:

Josiah Macy, Jr. Foundation
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Cambridge, Massachusetts

Medical Associations:

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MedEdPORTAL
Washington, DC

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Medical Education Technologies, Inc. (METI)
Sarasota, Florida

Laerdal Medical Corporation
Wappingers Falls, New York

Academic/Affiliated Programs and Institutions

Rhode Island Hospital Medical Simulation Center
Department of Emergency Medicine
Warren Alpert Medical School of Brown University

Mayo Clinic
Department of Emergency Medicine
Rochester, Minnesota

University of Texas at Houston Medical School
Surgical & Clinical Skills Center
Houston, Texas

Academic/Affiliated Institutions, cont.

Center for Simulation Technology and Academic Research (CSTAR)
Evanston Northwestern Healthcare
Division of Emergency Medicine
Evanston, Illinois

EM-STAT Center
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Yale University School of Medicine
Section of Emergency Medicine, Dept. of Surgery
New Haven, Connecticut

Allegheny General Hospital
Department of Emergency Medicine
Emergency Medicine Residency Program
Pittsburgh, Pennsylvania

Michael S. Gordon Center for Research in Medical Education
University of Miami Miller School of Medicine
Miami, Florida

Mount Auburn Hospital
Department of Emergency Medicine
Cambridge, Massachusetts

The Consensus Conference was also endorsed by:

The Society for Simulation in Healthcare

American College of Emergency Physicians

American Academy of Emergency Medicine

**This conference was supported by grant number R13HS017656 from the Agency for Healthcare Research and Quality. The content of this program is solely the responsibility of the conference participants, and does not necessarily represent the official views of the Agency for Healthcare Research and Quality.*

ADDITIONAL FUNDING for The Science of Simulation in Healthcare Consensus Conference

Was Provided By:

Peter M. Winter Institute for Simulation, Education and Research (WISER)
University of Pittsburgh School of Medicine
Pittsburgh, Pennsylvania

University of South Florida
Emergency Medicine Residency
Simulation Program
Tampa, Florida

University of Rochester Medical Center
Department of Emergency Medicine
Rochester, New York

Wake Forest University
Emergency Department Simulation Program
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Mount Sinai School of Medicine
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Simulation Center and Bioskills Lab
Michigan State University
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MetroHealth Medical Center
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CIMIT
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Kyoto Kagako Co., Ltd.
Kyoto, Japan

AEM Academic Emergency Medicine SAEM

Contents of this Syllabus

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Consensus Conference Agenda

08:00- 08:30 Introduction: Conference Co-chairs and Journal Editors

Plenary
Mariott Salon 1

James A. Gordon, MD, MPA
Director, Gilbert Program in Medical Simulation, Harvard Medical School
Associate Professor of Medicine
Department of Emergency Medicine
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John A. Vozenilek, MD, FACEP
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Director, Northwestern McGaw Simulation Network
Assistant Professor of Emergency Medicine
and Medical Education
Feinberg School of Medicine, Northwestern Universtiy
Evanston Northwestern Healthcare

Michelle H. Biros, MD, MS
Professor, Emergency Medicine
Vice Chair of Research
Department of Emergency Medicine
University of Minnesota

08:30- 09:00 Special Remarks: Simulation and Board Certification in Medicine

Plenary
Mariott Salon 1

Kevin B. Weiss, MD, MPH,
President and CEO, American Board of Medical Specialties

09:00- 10:00 Developing Clinical Expertise

Plenary
Mariott Salon 1

How to Attain Expert Performance: Deliberate Practice in Medicine
K. Anders Ericsson, PhD, Florida State University

Research Opportunities in Simulation-Based Medical Education Using Deliberate Practice
William McGaghie, PhD, Northwestern University

10:15- 11:45 Concurrent Consensus Tracks: Developing Clinical Expertise
Identifying the most effective approaches to simulation-based Education

Break-out Rooms

Choose one Morning Session to Attend

Individual / Cognitive Expertise: Global Provider Competency

William Bond, MD,
Lehigh Valley Hospital & Health Network

Delaware A and B

Group Expertise: Effective Teamwork and Communication

Rosemarie Fernandez, MD,
Wayne State University
Paul Phrampus, MD,
University of Pittsburgh

Virginia A

Technical Expertise: Procedural and Surgical Skills

Ernest Wang, MD,
Feinberg School of Medicine,
Evanston Northwestern Healthcare

Virginia B

System Expertise: Effective Simulation at the Organizational Level

Leo Kobayashi, MD,
Brown University

Virginia C

Program Continues...







Consensus Conference Agenda Continued

12:00- 1:00p Luncheon: Training and Transference to the Real World

Plenary
Mariott Salon 3

Simulation and Team Training
Eduardo Salas, PhD,
University of Central Florida

Medical Simulation from An Insurer's Perspective
Robert Hanscom, JD,
Harvard Risk Management Foundation

1:15p- 2:15p Defining Clinical Expertise

Plenary
Mariott Salon 1

Formative Assessment in Medicine:
Simulation-Based Debriefing
Jenny Rudolph, PhD,
Harvard/Massachusetts General Hospital

Summative Assessment in Medicine:
The Promise of Simulation for High Stakes Evaluation
Jack Boulet, PhD,
Foundation for Advancement of International Medical Education & Research

2:30p- 4:00p Concurrent Consensus Tracks: Defining Clinical Expertise

Break-out Rooms — Identifying the most effective approaches to simulation-based Evaluation

Choose one Afternoon Session to Attend

Individual / Cognitive Expertise: Global Provider Competency

Linda Spillane, MD,
University of Rochester

Delaware A and B

Group Expertise: Effective Teamwork and Communication

Marc Shapiro, MD,
Brown University

Virginia A

Technical Expertise: Procedural and Surgical Skills

Richard Lammers, MD,
Michigan State University

Virginia B

System Expertise: Effective Simulation at the Organizational Level

Amy Kaji, MD, PhD,
Harbor-UCLA

Virginia C

4:15p- 5:00p Discussion and Summary

Plenary
Mariott Salon 1

Consensus Communications Features

Co-Chairs James A. Gordon, MD, MPA and John A. Vozenilek, MD

Each of our session rooms has wireless Internet access. We provided this connection in order to facilitate consensus building among conference participants. You may also choose to speak at the microphones provided.

Each speaker and each consensus track has been given a temporary email account.
This account will be actively *monitored during and for a few weeks following* the conference.

Morning Speakers:

Conference Co-Chairs	cochairs@patientsimulation.net
Kevin Weiss MD	keynoteweiss@patientsimulation.net
K.A Ericsson PhD	keynoteericsson@patientsimulation.net
William McGaghie PhD	keynotemcgaghie@patientsimulation.net

Morning Consensus Tracks: Developing Clinical Expertise

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Group-Team	developingteam@patientsimulation.net
Procedural-Skills	developingskills@patientsimulation.net
Systems	developingsystems@patientsimulation.net

Afternoon Speakers:

Eduardo Salas PhD	keynotesalas@patientsimulation.net
Robert Hanscom JD	keynotehanscom@patientsimulation.net
Jenny Rudolph PhD	keynoterudolph@patientsimulation.net
Jack Boulet PhD	keynoteboulet@patientsimulation.net

Afternoon Consensus Tracks: Defining Clinical Expertise

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Group-Team	definingteam@patientsimulation.net
Procedural	definingskills@patientsimulation.net
Systems	definingsystems@patientsimulation.net

We hope that this will enhance your participation in today's event.
Please identify yourself and your affiliation on correspondence or when speaking.

Welcome Message from the Co-Chairs

Dear Participants in AEM Consensus Conference 2008:

Each year, *Academic Emergency Medicine* (AEM) sponsors a research consensus conference on the day before the Society for Academic Emergency Medicine (SAEM) Annual Meeting. This year, we are pleased to present the topic: "The Science of Simulation in Healthcare: Defining and Developing Clinical Expertise."

Together with colleagues across healthcare, Emergency Medicine has played an important national role in the development of medical simulation as an academic discipline. We hope that this conference—perhaps the first of it's kind in the field—will help set a simulation research agenda that applies broadly across specialties and disciplines. As usual, the conference will be accompanied by a special topic/proceedings issue of the journal, to be published in November. This year, nearly 40 original manuscripts were submitted for review by the Editorial Board, almost twice the number seen in prior years; conference attendance is also expected to double. We are pleased that the topic has generated so much interest!

You may know that a Bill was recently introduced in Congress that proposes enhanced federal commitments for simulation-based training (HR 4321). The timing of this Consensus Conference in Washington DC represents a unique opportunity to help identify priority funding areas.

An expert panel of cognitive scientists and educators will serve as keynotes to help guide our deliberations, which begin with special remarks from the

President and CEO of the American Board of Medical Specialties, the parent organization for the American Board of Emergency Medicine and other medical specialty boards. The federal Agency for Healthcare Research and Quality, the Josiah Macy, Jr. Foundation, the Assocation of American Medical Colleges's MedEdPORTAL, the Risk Management Foundation of the Harvard Medical Institutions, and 30 medical organizations/academic departments nationwide are providing funding support, along with unrestricted educational grants from major simulator manufacturers. The program has been endorsed by the Society for Simulation in Healthcare, the American College of Emergency Physicians, and the American Academy of Emergeny Medicine.

We look forward to working together with you to help define a national agenda for simulation research in undergraduate, graduate and continuing medical education.

Welcome, and enjoy the conference!

James A. Gordon, MD, MPA

John A. Vozenilek, MD,

Co-chairs, AEM Consensus Conference 2008

The Science of Simulation in Healthcare

Keynote Speaker

Kevin Weiss, MD

Simulation and Board Certification in Medicine

Join in the Consensus-building.
Contact this speaker: keynoteweiss@patientsimulation.net

Dr. Kevin B. Weiss is President and CEO of the American Board of Medical Specialties (ABMS). Dr. Weiss also is a professor of clinical medicine and holds appointments in the Division of General Medicine and in the Institute for Healthcare Studies in the Feinberg School of Medicine at Northwestern University. Most recently, Dr. Weiss was the director of the Institute for Healthcare Studies at Northwestern University; and was also the director of the Center for Management of Complex Chronic Care at Hines and Chicago Veterans Administration Medical Centers.

He began his academic career as Assistant Professor of Medicine at the George Washington University School of Medicine while also serving as a special assistant to Program Director for the Division of Allergy, Immunology, and Transplantation at the National Institute of Allergy and Infectious Diseases, NIH. From there he served as Associate Professor of Internal Medicine at Rush Medical College and Director of the Center for Health Services Research at the Rush Primary Care Institute, Rush-Presbyterian-St. Luke's Medical Center in Chicago. Dr. Weiss received his MD from the University of Health Sciences/Chicago Medical School, clinical training in Internal Medicine at Cook County Hospital in Chicago, an MPH from the University of Illinois School of Public Health and a Master's in Health Services Administration from Harvard University School of Public Health. He did his post-doctoral training fellowship at the National Center for Health Statistics of the Centers for Disease Control

and Prevention. He was also a Robert Wood Johnson Generalist Physician Faculty Scholar.

For more than 20 years, Dr. Weiss has devoted his medical career to quality and access issues in primary care, conducting epidemiological and health services research projects related to guideline implementation, chronic care management, outcomes measurement and quality improvement, with a specific emphasis on asthma. Recognizing the importance of patient safety and quality of care in his community, Dr. Weiss helped found the Chicago Patient Safety Forum and served as its first chairperson. He also developed the Masters in Patient Safety and Healthcare Quality at Northwestern University. He currently serves on the Clinical Performance Measures Committee of the National Committee for Quality Assurance (NCQA) and represents the American College of Physicians (ACP) at the National Quality Forum (NQF) and the American Medical Association's (AMA) Physicians Consortium for Performance Improvement. He also serves on NQF's Consensus Standards Approval Committee, and chairs the Performance Measures Committee of the AQA Alliance. Dr. Weiss also is a Board of Regents member of the ACP. He has served on Institute of Medicine Committees which developed the reports, “Crossing the Quality Chasm,” and “Identifying Priority Areas for Quality Improvement.”

Keynote Speaker

K. Anders Ericsson, PhD

How to Attain Expert Performance: Deliberate Practice in Medicine

Join in the Consensus-building.
Contact this speaker:keynoteericsson@patientsimulation.net

K. Anders Ericsson, PhD, is presently Conradi Eminent Scholar and Professor of Psychology at Florida State University. After his Ph. D. in Sweden, he collaborated with Herbert A. Simon on verbal reports of thinking and wrote "*Protocol Analysis: Verbal Reports as Data*" (1984). Currently he studies the cognitive structure of expert performance in domains such as music, chess and sports, and how expert performers attain their superior performance by acquiring complex cognitive mechanisms and physiological adaptations through extended deliberate practice. He edited "*Toward a General Theory of Expertise*" (1991), "*The Road to Excellence: The acquisition of expert performance in the arts and sciences, sports, and games*" (1996), *Expert Performance in Sports* (2001) and "*Cambridge Handbook of Expertise and Expert Performance"* (2006). He is a Fellow of the *Center for Advanced Study in the Behavioral Sciences*, of the *American Psychological Association* (Division 3) and the *Association for Psychological Science*.

Keynote Speaker

William C. McGaghie, PhD

Research Opportunities in Simulation-Based Medical Education Using Deliberate Practice

Join in the Consensus-building.

Contact this speaker: keynotemcgaghie@patientsimulation.net

Dr. McGaghie is the Jacob R. Suker, MD, Professor of Medical Education and Professor of Preventive Medicine at the Northwestern University Feinberg School of Medicine in Chicago, Illinois where he has served since 1992. He has previously held faculty positions at the University of Illinois College of Medicine at Chicago (1974 to 1978) and at the University of North Carolina School of Medicine (1978 to 1992). Dr. McGaghie's research and writing in medical education and preventive medicine ranges widely including such topics as personnel and program evaluation, research methodology, medical simulations, attitude measurement, medical student selection, concept mapping, curriculum development, faculty development, standardized patients, and geriatrics. He serves on the editorial boards of six scholarly journals including *Evaluation and the Health Professions, Medical Teacher, Advances in Health Sciences Education, Teaching and Learning in Medicine, College Teaching,* and *Simulation in Healthcare.* Dr. McGaghie served on the Research Advisory Committee for *Academic Medicine* (1999 to 2001) and reviews manuscripts for many other scholarly journals including the *Annals of Internal Medicine, JAMA,* the *New England Journal of Medicine,* and *The American Statistician*. He has been awarded research and training grants from a variety of NIH Institutes (e.g.,

NHLBI, NIA) and eight private foundations (e.g., Josiah C. Macy, Jr., Foundation, Charles E. Culpeper Foundation). McGaghie has served on several National Institutes of Health and Agency for Healthcare Research and Quality Study Sections (NHLBI, NIA, HUD) and as a grant application referee for several private foundations including the NBME Stemmler Fund and the Spencer Foundation. He has served as a consultant to a variety of professional organizations including the National Board of Medical Examiners, the American Board of Internal Medicine Foundation, the American Physical Therapy Association and to universities and medical schools worldwide. Dr. McGaghie has authored or edited seven books and has published more than 200 journal articles, textbook chapters, and book reviews in health professions education, simulation-based education, preventive medicine, and related fields.

Consensus Group Leader:
Developing Individual/Cognitive Expertise

Contact this group: developingindividual@patientsimulation.net

William Bond, MD
William Bond MD is a faculty member of the Lehigh Valley Hospital Emergency Medicine Residency and serves as Medical Director for Education Technology and Research in the Division of Education at Lehigh Valley Hospital and Health Network. His role is to create and support educational opportunities for the network, including simulation-based training. He holds the rank of Associate Professor of Clinical Emergency Medicine at Pennsylvania State University College of Medicine. Dr. Bond has published in the areas of medical simulation, patient safety, and terrorism preparedness.

Writing Team:
Emily Binstadt MD
KA Ericsson PhD
Gloria Kuhn DO
Mark Quirk EdD
Matthew Tews DO
Teresa Wu PhD

Consensus Discussion:
Question 1: Emily Binstadt

1. How can simulation be combined with other metacognitive strategies such as 'think aloud' or interview (reflection and self-assessment) to effectively identify expert behavior (including problem-solving and decision-making), thus creating training targets (benchmarks) for more junior learners?

Question 2: Teresa Wu

2. Can simulation-based training produce more competent physicians (not just in procedures) or can we reach a given level of competency in a shorter time frame? What is the influence of simulation on the learning curve?

Question 3: Mark Quirk

3. What is the optimal teaching strategy for simulation cases? When should they be brief so that they are more reproducible and get to a very clear set of objectives? When should they be longer and more complex so as to be realistic? What are the preferred debriefing techniques for training in emergency medicine?

(This is not so much a broad conceptual question, but rather a nuts and bolts question of "how, where, when" should it be used.)

Question 4: First part: Gloria Kuhn, Second part: Matthew Tews

4. Can simulation be used to diagnose and remedy decision-making and other learning problems? Can simulation be effectively used as a remediation tool?

Question 5: Emily Binstadt

5. Can we think of an effective methodology and measurable outcomes in emergency medicine that prove that transfer of learning to the real environment has occurred?

Question 6: Mark Quirk

6. Is there evidence to suggest that simulation is best for those of a certain learner style? Is discerning learner style useful so that simulation and debriefing techniques could be used more for those who benefit the most?

Glossary of Terms for Developing Individual/Cognitive Expertise Breakout Session

Affective:
Refers to the experience of feeling or emotion. An angry counter-transference response occurs in the affective domain, but may have cognitive implications.

Cognitive:
One of the aspects of the mind that refers to information processing. It also refers to the way we construct our view of the world. Clinical and other decision-making is often referred to as part of the cognitive domain.

Constructivism:
A learning theory that states that humans construct meaning from knowledge structures. This argues for segmented knowledge introduction, at the appropriate time, and within a greater framework.

Deliberate practice:
Goal-directed training activities, often designed by teachers or coaches with the explicit goal of improving specific aspects of an individual's current performance.

Domain of expertise:
An organized set of activities where individuals recognize an accumulated body of shared (teachable) knowledge and criteria for assessment of mastery (e.g., Chess, Medicine, Golf, and Ballet).

Expert:
An individual who has acquired knowledge and special skill in a particular domain through professional training and practical experience.

Expert performer:
An individual who shows a superior and reproducible performance in representative (typical) activities that capture the essence of a given domain of expertise.

Heuristic:
This is an intuitive judgment or "rule of thumb." As we become more expert, more decision-making may be undertaken at this level as opposed to the more conscious, deliberate, hypothesis testing level.

Meta-cognitive:
Thinking about one's thinking. Analyzing the cognitive process either as it is

occurring or retrospectively during reflection. This can also be described as a form of self-awareness or self-regulation.

Novice:
A person who has received all the necessary knowledge and instruction to be able to perform the basic tasks of the domain at a basic level of performance. They are often used as a reference group for comparisons with more skilled performers.

Regulatory processes:
Specifically, cognitive self-regulatory processes are ways that we control and direct our thinking.

Knowledge transfer:
The ability to transfer knowledge from the educational setting into the clinical or work environment.

Consensus Group Leaders:
Developing Group-Team Expertise

Rosemarie Fernandez, M.D. and Paul Phrampus, M.D.
Contact this group: developingteam@patientsimulation.net

Rosemarie Fernandez, M.D. is an Assistant Professor in Emergency Medicine at Wayne State University School of Medicine (WSU-SOM). She has functioned in the role of Director of Medical Simulation for Emergency Medicine for the past 3 years and was recently appointed the first Director of Healthcare Simulation and Patient Safety at WSU-SOM. In her role, Dr. Fernandez has developed and instituted training programs for over ten different emergency medicine residency programs, as well as internal medicine, pharmacy, dental, and pediatric training programs. Dr. Fernandez has published several simulation-based research reports and has been awarded a grant to study family witness resuscitations using high fidelity simulation. She currently serves as the Secretary for the Simulation in Healthcare Emergency Medicine interest group.

Paul Phrampus, M.D. is the Director of the Peter M. Winter Center for Simulation, Education and Research (WISER) at the University of Pittsburgh. He holds academic appointments in the University of Pittsburgh Departments of Emergency Medicine and Anesthesiology and is co-director of the multidisciplinary quality and safety committee of the University of Pittsburgh Medical Center. Dr. Phrampus led a team that created an airway algorithm and simulation-based emergency medicine difficult airway course for the University of Pittsburgh's affiliated hospitals. In addition, he has developed simulation-based competency assessment measures for prehospital ground EMS and for Stat Medevac, an air medical transport service. Dr. Phrampus serves on the editorial board of the Journal Simulation in Healthcare and on the annual meeting program committee of the Society for Simulation in Healthcare. He has lectured and conducted education programs relating to simulation both nationally as well as internationally in India, Singapore, Japan, China, South Korea, the Philippines, Thailand and Mexico.

Writing Team:
Steve W. J. Kozlowski, PhD
Cullen B. Hegarty, M.D
Ivette Motola, M.D., MPH
William Hamman, MD, PhD
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John Vozenilek, MD

Session Objectives
Review existing team training programs in emergency medicine and other healthcare specialties

Discuss key teamwork competencies (knowledge, skills, attitudes) for emergency medicine teams

Develop a consensus around key principles and theories to guide development of simulation-based team training programs

Discuss future research questions and how the unique characteristics of emergency medicine teams can be utilized to advance team training research

Introduction and Brief Review of Team Training in Healthcare and Emergency Medicine
- Define teams
- Briefly outline team performance cycle
- Review programs in team training

What are the competencies that should be targeted for Emergency Medicine teams?
- Outline of KSAs
- Planning and Preparation
- Action Processes
- Coordination
- Reflection
- Interpersonal Factors
- Coordinating mechanisms
- Leadership

What components are necessary for effective team training?
- Program design
- Instructional approaches to maximize team adaptability
- Simulation-based training design
- Feedback / Debriefing component

What is required for effective simulation-based training?

How important is fidelity to the simulation system?
- Define different types of fidelity
- Discuss different needs for different levels of learners
- Design v. Fidelity

How should training programs be evaluated?

Kirkpatrick's model
More contemporary approach

What are the factors that influence transfer?

What are the barriers to instituting effective team training programs?

What are the big future research questions and how can Emergency Medicine leverage its unique team structures to advance current team theory and practice research?

Consensus Group Leader:
Developing Procedural-Skill Expertise

Contact this group: developingskills@patientsimulation.net

Ernest Wang, MD

Dr. Ernest Wang is the Associate Residency Director for the Northwestern University Residency Program in Emergency Medicine. He has presented his work in patient simulation and resident education at the American Board of Medical Specialties, Council of Residency Directors, Society for Academic Emergency Medicine, and American College of Emergency Physicians meetings and is well-published in the field of HFS. His concentration to date has been on the creation of simulation-based exercises to evaluate the Core Competencies in Emergency Medicine. He is currently studying the role of audiovisual stimuli as adjuncts to HFS scenarios and has produced numerous published procedure videos via Academic Emergency Medicine.

Writing Team:

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Background

Developing technical expertise in medical procedures is extremely important in a specialty that is as procedurally based as emergency medicine. Unlike other specialties which often require narrow focus of expertise, the emergency physician is required to be competently trained to perform a wide array of procedures covering a broad spectrum of disciplines. Confounding factors include patient illness severity, age-related differences, and irregular frequency of performance of rare procedures.

Consensus Discussion:

Potential Research Topics

1. Which procedures in emergency medicine are most amenable to training via simulation modalities?
2. Which modalities (high-fidelity, task trainer, virtual reality, other) are best suited for individual specific procedures?
3. Does simulation training in any modality translate into clinically meaningful improvements in patient outcomes?
4. What aspects of instructional theory (ie. Deliberate practice, Blooms Taxonomy, part v. whole practice) should be incorporated or emphasized to maximize skill acquisition?
5. How much training is enough? (Overlearning concept)
6. How often do practitioners require skill review (Retention interval concept)
7. How much fidelity is enough? (Conditions of retrieval concept)
8. How do you balance emphasis on speed vs. accuracy?

Recommendations:

Future studies pertaining to simulation-based procedural instruction should adhere to the principles of accepted instructional theory. Methods should be based on maximizing psychomotor such as those described by Bloom and Dave in the educational psychology literature. Furthermore, future methods should include detailed descriptions of how the procedures are taught and be linked explicitly to principles of deliberate practice.

Investigation into part vs. whole practice. Simulation is ideal for this as individual steps can be performed on demand or to schedule. Also more learner-centered as the learning can focus on specific steps of the procedure in which they need more practice.

Evaluative work should be conducted to determine which learning tools will maximize skill acquisition and retention. This will likely be procedure specific. Task trainers may be better for certain procedures such as direct laryngoscopy while virtual reality may be as effective or better for fiberoptic laryngoscopy.

Investigation into skill retention with simulation is an area ripe for research. How much is necessary? How often? Is overtraining better than just enough? What is just enough? Mastery or minimum acceptable level of performance?

Multidisciplinary collaboration is encouraged to bring together the expertise and varied viewpoints of medical experts from different specialties who perform similar procedures in their practice. Procedural study in simulation occurs across specialties. These shared experiences will likely provide the substrate for generating innovative ideas with respect to how best to teach individual procedures to our trainees.

Future investigation should address and incorporate patient-centered outcome measures as this is the essence of what proponents of simulation argue as the inherent strength of simulation. We need to demonstrate that deliberate repetitive practice of a procedural skill lead to better, safer care.

Our specialty as a group should focus on augmenting the descriptors we use in our teaching and applying the educational principles of deliberate practice if we are to be successful in providing meaningful outcomes based data on our instructional endeavors.

Consensus Group Leader:
Developing Systems Expertise

Contact this group: developingsystems@patientsimulation.net

Leo Kobayashi, MD
Dr. Kobayashi is Assistant Professor of Emergency Medicine and Co-director of the Rhode Island Hospital Medical Simulation Center. He completed his Emergency Medicine residency at Brigham and Women's Hospital / Massachusetts General Hospital and has been an active educator in the Warren Alpert Medical School of Brown University and its postgraduate training program in Emergency Medicine. His research focuses on advancing the concepts of portable simulation for acute care systems probing and of multiple patient simulation for emergency care and disaster response.

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Consensus Discussion:
- Question 1: Is there a method with which to conceptualize, frame and organize the systems involved in Emergency Medicine clinical practice? If so, can it be used to create a guide to coordinate interventions for EM systems education and research?

- Question 2: How should simulation be applied to improve and study / probe Emergency Medicine (micro-)systems? Is there a rational way to propose and determine which types of simulation, in what setting, at what time, for whom, with what objectives and outcomes, will prove useful for EM microsystems improvement?

- Question 3: What research methodologies would be feasible + useful + cost-effective in establishing the value of simulation at the Emergency Medicine (micro-)systems level? What are the future research directions that should be taken to further study the role of simulation in Emergency Medicine microsystems education and research for improved ED clinical care?

- Question 4: How does one elicit micro-system processes in an integrated manner to unify the care of individual patients (traditional manikin) with the

simulation of entire systems or macro-systems., e.g. interfacing of manikin sims w/ pc-based modeling, i.e. are micro-system and macro-system simulations reconcilable?

- Question 5: What are limitations of using the microsystems approach with *in situ* simulations?

Alternative / Subquestions:

What constitutes a system in healthcare / how to differentiate a micro-system from a macro-system? Can micro / macro elements within the system be precisely defined?

Within emergency medicine, what micro-systems should be tested to work towards enhanced patient safety? i.e. what part of the system should be tested?

How do we achieve effective Emergency Medicine (micro-)systems education?

Do we need to test simulation-based educational interventions intended to enhance Emergency Medicine (micro-)systems and patient safety? if we do, is there a gold standard? What are the metrics to compare the interventions on?

In regards to the Table which follows:

The "Simulation Application Matrix for Emergency Medicine Systems Expertise" represents a proposed hybrid of systems thinking in Emergency Medicine with different simulation modalities + their applications as linked to representative examples of evaluative / assessment / measurement elements for development and maintenance of organizational expertise. The left third represents the proposed core EM patient care-related domains [Patient, Processes + Tasks, People + Environment, Culture / Organizational Factors, and Inter-domain linkages / interfaces], classified further into EM systems and EM system components; examples of threats to system components and threat-associated ED adverse events are given. The middle third reflects currently accessible simulation technologies [Standard Manikin-based, In situ Manikin-based, Non-manikin Physical (e.g. task trainers, SPs), Usability Testing, and Computational

(e.g. flow modeling)]. A relative utility / applicability scale has been applied to indicate the possible role of each simulation modality for individual EM care system components (from "-" for minimal / no applicability to "++++" for optimal utility unmatched by other methods). The rightmost third section highlights the evaluative, educational / interventional, and measurement aspects of system-based organizational improvement in the framework of PDSA cycles (see text).

An example of a high-acuity pediatric blunt trauma patient in situ simulation is used to demonstrate potential items for exploration within the system framework; the applicability of the specific scenario for each ED system component is shown graphically (follow stippled line to vertical bars for simulation points-of-use) and categorically by patient care phase [1.Pre-arrival, 2.Triage, 3.Initial ED Resuscitation, 4.ED Diagnostic + Therapeutic Interventions, 5.Social Support and 6.Transition] (follow straight line to dark grey blocks, white and light grey text mark good and possible utility respectively for the phases)

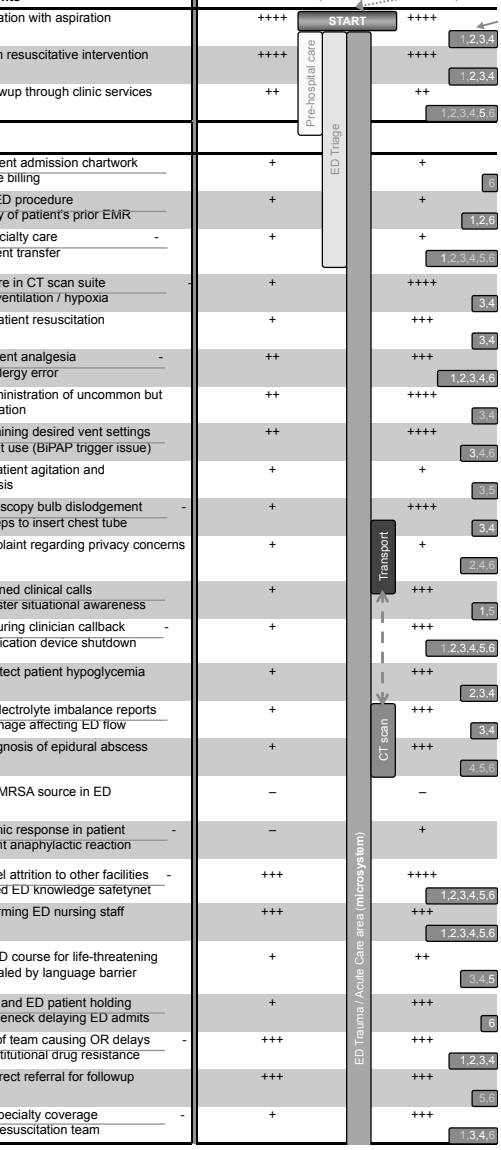
Simulation Application Matrix for Emergency Medicine Systems Expertise

simulation specific materials to the right---------->

Utility of Simulation Method for EM Syste

Indicators reflecting expert panel and conference
applicable (minimal or no utility); **+ = possible utility** (
(useful role through some simulated situations); **+++ = s**
utility (unmatched by other methods)

Domain	ED System	ED System Component	Examples of ED System Component Threat to Patient Safety	Examples of Threat-associated ED Adverse Events or Contribution to Potential for ED Adverse Events	**Standard Manikin-based Simulation** (typically in separate simulation center)	***In situ* Manikin-based Simulation** (conducted on-site in ED environment)
Patient	*Patient*	Clinical interactions with patient anatomic elements	53 year old male, severe traumatic head injury, Mallampati 4 / Cormack-Lehane 3 airway	Difficult intubation with aspiration	++++	++++ 1,2,3,4
		Clinical interactions with patient physiologic elements	83 year old female with septic shock, chronic renal failure, poor cardiac reserve	Limitations on resuscitative intervention options	++++	++++ 1,2,3,4
		Clinical interactions with patient socioeconomic elements	25 year old female, Asian immigrant with chronic systemic illness, no health insurance	Delayed followup through clinic services	++	++ 1,2,3,4,5,6
Processes + Tasks (categorized as Service Systems)	*Clerical support*	Billing + chart processing	-Missing chartwork Incorrect coding of procedure	-Delay in patient admission chartwork -Inappropriate billing	+	+ 6
		Registration	-Patient registration under incorrect name Duplicate registration of return patient	-Wrong-site ED procedure -Unavailability of patient's prior EMR	+	+ 1,2,6
		Secretarial services	-Difficulty identifying consultant contact Difficulty locating physician to accept patient transfer	-Delayed specialty care Delayed patient transfer	+	+ 1,2,3,4,5,6
	Clinical support	Biomedical engineering	-Transport monitor/defibrillator battery not working Defective disposable ventilator tubing	-Monitor failure in CT scan suite Patient hypoventilation / hypoxia	+	++++ 3,4
		Blood banking services	-Delays in blood specimen type / cross processing for semi-stable GI bleed	-Prolonged patient resuscitation	+	+++ 3,4
		Information technology / services	-CPOE slowdown during peak hours -Housestaff oversight of pre-existing condition in EMR	-Delayed patient analgesia Medication allergy error	++	+++ 1,2,3,4,6
		Pharmacy services	-ED medication carts stocked with limited, institution-preferred medications	-Delayed administration of uncommon but critical medication	++	++++ 3,4
		Respiratory therapy	-Limited technician in-servicing on new ventilator -Insufficient number of BiPAP machines in ED	-Difficulty attaining desired vent settings -Off-label vent use (BiPAP trigger issue)	++	++++ 3,4,6
		Security	-Prolonged application of physical restraints in under-sedated patient	-Persistent patient agitation and rhabdomyolysis	+	+ 3,5
		Supply	-Laryngoscope bulb loosening during sterilization Thoracentesis tray content modification	-Intra-laryngoscopy bulb dislodgement Additional steps to insert chest tube	+	++++ 3,4
		Transport	-Inadequate HIPAA and professionalism education in transport staff	-Patient complaint regarding privacy concerns	+	+ 2,4,6
	Communications	Extra-institutional (central or distributed communications center, telephone exchange)	-Insufficient incoming phone lines Non-existent disaster notification network	-Missed returned clinical calls -Loss of disaster situational awareness	+	+++ 1,5
		Intra-institutional / intra-unit (cellphone, local wireless devices, overhead/intercom)	-Discrepant internal and external phone extensions Loss of department wireless service	-Confusion during clinician callback Unit communication device shutdown	+	+++ 1,2,3,4,5,6
	Diagnostic testing	Bedside point-of-care (EKG, glucometer, misc devices (e.g. iSTAT), urine tests, U/S)	-Inconsistent quality assurance of glucometer	-Failure to detect patient hypoglycemia	+	+++ 2,3,4
		ED laboratory, ED radiology	-Chemistry analyzer malfunction unfamiliarity with CT weight restrictions	-Staff -Inaccurate electrolyte imbalance reports -CT scan damage affecting ED flow	+	+++ 3,4
		Hospital diagnostic facilities	-MRI machine over-booking	-Delayed diagnosis of epidural abscess	+	+++ 4,5,6
	Other	Environmental + janitorial services	-Improper cleaning of restroom facilities	-Undetected MRSA source in ED	–	–
		Food services	-Regular food tray order delivered to diabetic patient Undisclosed nut ingredients in third-party food	-Hyperglycemic response in patient Severe patient anaphylactic reaction	–	+
	Quality initiatives	Education / training	-Budget reductions affecting educational opportunities -Overtime limiting staff availability for education	-ED personnel attrition to other facilities Loss of shared ED knowledge safetynet	+++	++++ 1,2,3,4,5,6
		Evaluation / assessment / remediation	-Nursing shortage factoring into disciplinary options	-Under-performing ED nursing staff	+++	+++ 1,2,3,4,5,6
	Sociocultural support	Case management, chaplains, interpreters, social work, volunteers)	-Unavailability of interpreters for certain languages on overnight shifts	-Prolonged ED course for life-threatening illness concealed by language barrier	+	++ 3,4,5
	Treatment plans	Admitting services	-Inpatient unit over-occupancy by scheduled admits -Late afternoon patient discharges on weekends	-ED overflow and ED patient holding -hospital bottleneck delaying ED admits	+	+++ 6
		Algorithms / protocol-driven clinical care	-Trauma team activation protocol not followed Antibiotic prescription guidelines not followed	-Late arrival of team causing OR delays Increased institutional drug resistance	+++	+++ 1,2,3,4
		Referral networks	-Non-standardized referral systems	-Lost or incorrect referral for followup	+++	+++ 5,6
		Specialty care / consultants (e.g. cardiac cath lab, psychiatric services, stroke team)	-Consultation agreements not precisely negotiated Pre-hospital notification of critical patient lost	-Inconstant specialty coverage Unprepared resuscitation team	+	+++ 1,3,4,6



ems Evaluation / Education

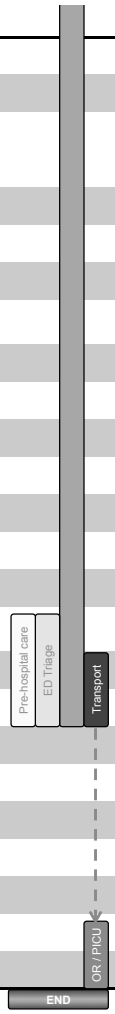
e consensus: **– = not**
potential use through limited simulated situations); **++ = good utility**
significant utility (definite role through most simulated situations); **++++ = optimal**

Sample EM Systems Simulations for an ED Microsystem

Potential evaluative elements, interventions and performance measures are presented for an example of progressive simulation using *in situ* mobile manikin scenario to assess and develop pediatric trauma EM systems expertise. Follow A.) stippled line to vertical bars spanning ED systems necessary for the care of a 12 year old schoolbus crash simulated patient with closed head trauma + intra-abdominal injuries, and B.) solid line to box descriptors indicating *in situ* SIM's applicability to ED system components with respect to specific patient care domains (text indicates good utility of simulation for component, text indicates possible utility). 1.Pre-arrival (notification by pre-hospital provider). 2.Triage (to Trauma / Acute Care area). 3.Initial ED resuscitation. 4.ED Diagnostic + therapeutic interventions. 5.Social support (arrival of family). 6.Transition (transfer to OR / PICU)

Non-manikin physical simulation (includes task trainers, standardized patients)	**Usability testing** (applied use of devices, environments and equipment)	**Computational Simulation** (e.g. mathematical modeling)	**Sample SIM Evaluation Elements in Pediatric Trauma EM System Scenario Example** (PDSA Cycle- **P**lan)	**Sample Educational / Improvement SIM Interventions for Pediatric Trauma EM System Scenario Example** (PDSA Cycle- **D**o + **A**ct)	**Potential Performance Measures during Pediatric Trauma EM System SIM Scenario Example** (PDSA Cycle- **S**tudy)
++	–	–	ED/Trauma team pediatric airway management	Pediatric advanced airway skills course	Pediatric airway management parameters
++	–	++	ED/Trauma team pediatric trauma resuscitation skills	Pediatric trauma resuscitation course	Pediatric trauma resuscitation parameters
+++ (SPs) 5	–	–	ED/Trauma team interpersonal and communications skills	Difficult discussion communications workshop	Communications + cultural sensitivity parameters
+	[see Equipment]	–	Timeliness and accuracy of chart processing and coding	Training on charting system use and coding	
+	[see Equipment]	–	Accuracy and efficiency of patient registration during resuscitation	Standardization of positive patient identification and registration processes	
+	[see Equipment]	–	Accuracy and efficiency of specialist / team activation during resuscitation	Enhanced automated paging to expedite trauma specialist / team activation	
++	+++	+	Proper functioning of critical pediatric trauma resuscitation equipment	Education on location and use of pediatric trauma resuscitation equipment	
+	+++	+	Accuracy and efficiency of blood product delivery processes	Optimization of testing, requisition, delivery and administration of blood products	
++	+++	+++	Accessibility of prior patient record (medications and allergies)	Usability-driven selection of department / institutional EMR system	
+	+++	+	Pediatric resuscitation medication supply, selection and accessibility	Usage-driven placement and supply of pediatric trauma resuscitation medications	
++	+++	–	Pediatric respiratory equipment supply, selection and accessibility	Education on location and use of pediatric respiratory equipment	
+++ (SPs) 5	+	–	Adequacy of security measures to prevent potential gang-related incident in ED	Enhancement of staff awareness of protocols to activate security measures	
++	+++	+	Logical, consistent and obvious method of equipment + supplies stocking / storage	Equipment + supplies storage optimization based on patient needs	
+	+	+	Rapidity of transit from resuscitation area to diagnostic / therapeutic suites	Promotion of safety-focused in-transit monitoring practices	
++	+++	+	Pre-hospital provider communications with ED staff for arrival notification	Development of common access point for incoming pre-hospital communications	
++	+++	+	Appropriate physician and nursing report to admitting suite / floor (e.g. SBAR)	Implementation of faxed "non-verbal" admitted patient RN report (Kosnik 2003 microsystems	
++	+++	–	Availability and utility of bedside U/S for rapid diagnosis + disposition	Review of U/S utility in pediatric trauma resuscitation	
+	+++	+	Patient identification and sidedness checks of radiographs during resuscitation	Standardization of patient identification and sidedness time-out protocols	
+	+++	+	n/a for scenario	n/a for scenario	n/a for scenario
–	+	–	n/a for scenario	n/a for scenario	n/a for scenario
++	–	–	n/a for scenario	n/a for scenario	n/a for scenario
+++	+++	++	Distributed across simulations incorporated into PDSA cycles	Distributed across simulations incorporated into PDSA cycles	
+++	+	+	Distributed across simulations incorporated into PDSA cycles	Distributed across simulations incorporated into PDSA cycles	
+++ (SPs) 5	–	–	Accessibility of social supports	Outreach efforts to publicize and familiarize ED personnel to resources	
++ (SPs)	–	+	Appropriate mobilization of resources to make high-acuity inpatient bed available	Establishment and deployment of streamlined inpatient bed control plans	
++ (SPs)	+	++	Resuscitation team compliance with pediatric trauma algorithms	Pediatric trauma resuscitation course	
++ (SPs)	+	++	n/a for scenario	n/a for scenario	n/a for scenario
++ (SPs)	–	+	Adequacy of specialty care delivery for high-acuity low-frequency events	Periodic *in situ* simulation exercises (Hunt 2006)	

Resources (People + Environment)	*Equipment*	Medical- Resuscitative (e.g. defibrillators, ventilators)	-Difficult airway cart not re-stocked after last use	-Rescue device not available for unable-to-oxygenate, unable-to-ventilate patient	+++	+++ 1,3,4,6
		Medical- Support (e.g. intercom/phone systems, supply storage spaces, stretchers)	-Poor ergonomics of medical supply storage -Malfunctioning brakes on ED stretcher	-Difficulty locating resuscitation supplies -Unstable work surface during suturing	++	+++ 1,2,3,4,6
		Medical- Information Technologies (e.g. computers, software)	-Patient tracking software instability Inflexible discharge instructions software	-Need to implement paper-based tracking Poor patient understanding of care plan	++	+++ 1,2,3,4,6
		Facilities- Electrical (e.g. power supply)	-Hospital line voltage distortion resetting ventilator(ref) Failure of hospital backup generator to activate	-Undetected change in ventilator function Loss of ED electrical functions	–	+++ 2,3,4,6
		Facilities- Environmental (e.g. HVAC, plumbing)	-ED hot water supply taken offline for maintenance	-Low ED room ambient temperatures	–	++ 2,3,4,6
		Facilities- Mechanical (e.g. pneumatic tubes)	-ED-to-OR doorway too narrow for new stretcher -Old chest compression device unfamiliar to new staff	-Unstable patient transfer to old stretcher CPR disruption by bulky,unusable device	–	+++ 2,3,4,6
		Facilities- Medical infrastructure (e.g. medical gas supply)	-Nitrous oxide tank too bulky for easy transport to patient room	-Allocation of multiple ED personnel to assist with nitrous assembly setup	–	+++ 2,3,4,6
	Human Resources	[Patient, family, and friends]	-Disruptive, intoxicated, armed family member -Malingering repeat-visit patient	-Physical harm to ED personnel Resource diversion from critical activities	+++	+++ 1,3,4,5
		[External staff- police, EMS / fire, etc.]	-Documentation practice variability by service -Inadequate EMS ongoing education	-Missed significant scene information Poor compliance with EMS protocols	++	++ 1,2,3,4,5
		Administration- institutional	-Hospital re-structuring eliminating key nursing administrative personnel	-Loss of midlevel nursing leadership affecting ED nursing staff morale	–	+++ 2,3,4,6
		Administration- ED	-Over-burdening of operations director with added responsibilities	-Backlogging of ED unit concerns that compromise patient care	–	+ 2,3,4,6
		Medical providers- physicians, midlevels providers, residents + fellows	-Annual influx, transition + efflux of trainees in July Learner hierarchy of teaching institutions	-July syndrome (disrupted clinical care) -Redundancy delaying service admission	+++	+++ 1,2,3,4,5,6
		Medical providers- nurses	-Abbreviated nurse orientations to boost staffing Limited nurse employee benefits	-Insufficient orientation for optimal function Poor retention / high attrition of staff	+++	+++ 1,2,3,4,5,6
		Medical providers- technicians (CNAs, radiology, respiratory, transport, etc.)	-Restrictive institutional policies limiting technician patient care activities	-Inefficient use of available resources	+++	+++ 2,3,4,5,6
		Trainees (nursing, medical student, etc.)	-Poor instructor:trainee ratio Instructor role assigned to over-burdened personnel	-Unsatisfactory learner experience -Inadequate trainee supervision	+++	+++ 1,2,3,4,5,6
	Workspace	Pre-hospital	-Insufficient resources for infrequent large-scale event	-Surge strain of local acute care services	++	+++ 1
		Triage area / Waiting area	-Poor preparation of transition to new triage process Absence of amenities for waiting patient comfort	-Initial over- and under-triage of patients More patients leaving without evaluation	++	+++ 1,2
		Treatment area: Critical / emergent	-Insufficient drains for therapeutic hypothermia device Excess census forces "hallway" resuscitations	-Device slows critical care room turnover Suboptimal critical patient care	+++	++++ 3,4,5,6
		Treatment area: Urgent	-Equipment and perceptual limitations resulting from designation of area as "Urgent"	-Need to transport pre-arrest patient to higher acuity area prior to resuscitation	++	+++
		Treatment area: Non-urgent	-Improper allocation of available ED resources to improve "fast track" patient flow during high census	-Improved census at expense of delayed care for sicker, non-"fast track" patients	++	+++
		Treatment area: Psychiatric / substance abuse	-Protracted ED wait for psychiatric facility bed Cursory evaluation of "just intoxicated" patients	-Prolonged deferral of psychiatric care -Overlooked medical / traumatic issues	+	++
		Observational area	-Inconstant staffing model of observation unit Over-inclusive admission criteria	-Loss of continuity of observation / care -Difficult dispositions for complicated patients	+	+++
		Holding area / overflow	-Make-shift spaces impacting patient care/recovery Unintended use of space complicates processes	-Disease transmission in open area ward -Inefficient service team rounds	+	+++
		Discharge area	-Poor signage obscures discharge area	-Lost immediate revenue and increased billing expense from "missed" discharges	+	+
		Transitive space(s) (e.g. between ED and inpatient bed)	-Discrete ED separated from main hospital complex Lack of ED-dedicated CT scanner	-Patient deterioration during long transit -Patient exposure to care interruptions	+	++++ 1,2,3,4,6
Cultural / organizational (incl. Patterns)	*Hospital administration*	n/a	-Inadequate hospital support for ED overcrowding	-Cascading delays in ED patient care		1,2,3,4,5,6
	ED administration	n.a	-Mandatory overtime demands on nursing personnel	-Increased medical error from staff fatigue		1,2,3,4,5,6
	EM culture	n/a	-Workaround mindset to overcome perceived system flaws	-Jury-rigged repairs and compensatory behaviors that fail to address underlying		1,2,3,4,5,6
		need help here re: cultural and interface sections...				
Inter-domain Linkages + Interfaces		interfaces w/ pediatric / geriatric / ob+gyn / psychiatric patient care				1,2,3,4,5,6
		capability to address/provide pediatric / geriatric / ob+gyn / psychiatric patient care				1,2,3,4,5,6
						1,2,3,4,5,6
						1,2,3,4,6



Key: BiPAP = Bilevel positive airway pressure; CPOE = computerized physician order entry; CT = computed tomography; ED = emergency department; EGDT = early goal directed therapy; EM = emergency medicine; EMR = electronic medical record; EMS = emergency medical services; GI = gastrointestinal; MRI = magnetic resonance imaging; MRSA = methicillin-resistant Staphylococcus aureus; OR = operating room; PEEP = positive end-expiratory pressure; PICU = pediatric intensive care unit; RN = registered nurse; SBAR = Situation Background Assessment Recommendation communication tool; SIM = advanced medical simulation utilizing manikin technologies (including hybrid manikin/SP simulation); SP = standardized patient; U/S = ultrasound; vent = ventilator

**representative examples from various EM clinical facilities based on common clinical experiences of consensus panelists

++	+++	–		Layout, function and usability of pediatric trauma resuscitation equipment	Usability testing and in-servicing on pediatric trauma resuscitation equipment	
++	+++	–		Layout, function and usability of medical supplies for pediatric ED patients	Usability testing and in-servicing on medical supplies for pediatric ED patients	
++	++++	++		Accessibility, function and usability of information systems for pedi. ED patients	Usability testing and in-servicing on information systems for pedi. ED patients	
–	++++	–		n/a for scenario	n/a for scenario	n/a for scenario
–	++++	–		n/a for scenario	n/a for scenario	n/a for scenario
–	++++	–				
+	++++	–				
+++ (SPs) 5	–	–		ED/Trauma team interpersonal / communications skills with patient+family	Difficult discussion communications workshop	
++ (SPs)	–	–		ED/Trauma team interpersonal / communications skills with EMS providers	Inter-disciplinary progressive simulation exercises for pre-hospital trauma care	
++ (SPs)	–	–				
+ (SPs)	–	–				
++	–	++	ED Staffing modeling	Continuing inter-disciplinary trauma team performance monitoring / assessment through standard and *in situ* simulation curriculum in trauma care	Continuing inter-disciplinary trauma team education + improvement through standard and *in situ* simulation curriculum in trauma care	
++	–	++	ED Staffing modeling			
++	–	++	ED Staffing modeling			
++	–	++	ED Staffing modeling			
++	+++	++	ED Operations modeling	still in progress		
+++ (SPs) 5	++	+++	ED Operations modeling			
++ (SPs) 5	+++	+++	ED Operations modeling			
+++ (SPs)	++	+++	ED Operations modeling			
+++ (SPs)	++	+++	ED Operations modeling			
++++ (SPs)	+	+++	ED Operations modeling			
+++ (SPs)	++	+++	ED Operations modeling			
++ (SPs)	++	++++	ED Operations modeling			
++ (SPs)	++	+++	ED Operations modeling			
++ (SPs)	+++	+++	ED Operations modeling			

still in progress

Luncheon Session Speaker
Eduardo Salas, PhD

Simulation and Team Training

Join in the Consensus-building.
Contact this speaker: keynotesalas@patientsimulation.net

Eduardo Salas is University Trustee Chair and Pegasus Professor of Psychology at the University of Central Florida (UCF). He also holds an appointment as Program Director for Human Systems Integration Research Department at UCF's Institute for Simulation & Training. Previously, he was a Senior Research Psychologist and Head of the Training Technology Development Branch of NAVAIR-Orlando for 15 years. During this period, Dr. Salas served as a principal investigator for numerous R&D programs focusing on teamwork, team training, simulation-based training, decision-making under stress, learning methodologies and performance assessment.

Dr. Salas has co-authored over 300 journal articles and book chapters and has co edited 18 books. He is on/has been on the editorial boards of Journal of Applied Psychology, Personnel Psychology, Military Psychology, Interamerican Journal of Psychology, Applied Psychology: An International Journal, International Journal of Aviation Psychology, Group Dynamics, The Leadership Quarterly, Journal of Occupational and Organizational Psychology, Human Resources Development Review and Journal of Organizational Behavior and is past Editor of Human Factors journal and current Associated Editor for the Journal of Applied Psychology. In addition, he has edited three Special Issues (one focus on training, one on patient safety and one on decision making in complex environments) for the Human Factors journal. He has edited other Special Issues on team training and performance and training evaluation

(Military Psychology), shared cognition (Journal of Organizational Behavior), and simulation and training (International Journal of Aviation Psychology). Dr. Salas has held numerous positions in the Human Factors and Ergonomics Society during the past 15 years. He is the past chair of the Cognitive Engineering and Decision Making Technical Group and of the Training Technical Group, and served on the Executive Council. He is also very active with Society for Industrial and Organizational Psychology (SIOP). He is the past Series Editor for the Professional Practice Book Series and has served in numerous committees throughout the years.

His expertise includes helping organizations on how to foster teamwork, design and implement team training strategies, facilitate training effectiveness, manage decision making under stress, develop performance measurement tools, and design learning and simulation-based environments. He is currently working on designing tools, instructional strategies and techniques to minimize human errors in aviation, law enforcement and medical environments. He has consulted to a variety of manufacturing, pharmaceutical laboratories, industrial and governmental organizations. Dr. Salas is a Fellow of the American Psychological Association (SIOP and Division's 19, 21 & 49), the Human Factors and Ergonomics Society and the Association for Psychological Science. He received his Ph.D. degree (1984) in industrial and organizational psychology from Old Dominion University.

Luncheon Speaker

Robert B. Hanscom, JD

Medical Simulation from An Insurer's Perspective

Join in the Consensus-building.
Contact this speaker: keynotehanscom@patientsimulation.net

Robert Hanscom is Vice President of Loss Prevention and Patient Safety for the Risk Management Foundation (CRICO/RMF). In that capacity, he supervises a staff of approximately 20 people who are responsible for analyzing malpractice claims and providing consultative services to the Harvard Medical Teaching Institutions. He is also responsible for the operations of RMF's external division, RMF Strategies, and oversees a business unit that provides risk appraisals, comparative benchmarking data, and claims management support for healthcare systems in other regions of the country.

Prior to joining the Risk Management Foundation in 1998, he worked as an administrator at Massachusetts General Hospital in Boston (1989-1993). He then went to Lahey Clinic in Burlington, Massachusetts (1993-1998) where he was vice president of a number of clinical services, including the high-profile cardiac surgery program.

Robert Hanscom received a Bachelor of Arts degree from Pacific Union College in California, and a Juris Doctor degree from Pepperdine University Law School in 1982. He is admitted to practice law in the state of Maine, where he worked as a litigator for six years (1983-1989).

He came to RMF with a unique combination of legal expertise and a deep understanding of the issues affecting front-line healthcare. As he and his staff continue to extract "actionable themes" from malpractice claims, he uses those perspectives to build a compelling case for patient safety.

Afternoon Keynote Speaker

Join in the Consensus-building.
Contact this speaker: keynoterudolph@patientsimulation.net

Jenny W. Rudolph, PhD

Jenny W. Rudolph is Associate Director of the Institute for Medical Simulation and Lecturer in Anesthesia and Critical Care Harvard Medical School and Massachusetts General Hospital. Dr. Rudolph's research focuses on individual, group, and organizational performance in settings where the social and/or physical consequences of making mistakes are high. She is particularly interested in the role of mindfulness in enhancing patient safety and reducing medical error. Her dissertation explored error handling by anesthesiologists during OR crises, and she designed and tested a crisis management training intervention to reduce those errors. She is also interested in underlying patterns that cause organizational systems to collapse. She has used computer simulation and in-depth case studies to understand, for example, how small disruptions can precipitate large-scale disasters.

Rudolph is a graduate of Harvard College, studied System Dynamics at the Sloan School of Management as a visiting scholar, and received her Ph.D. in Management from the Carroll School of Management at Boston College. Rudolph is also the former Managing Director or BOTEC Analysis Corporation, a public policy consulting firm focusing on reducing drug abuse and crime.

Afternoon Keynote Speaker

John "Jack" R. Boulet, Ph.D.

Summative Assessment in Medicine: The Promise of Simulation for High Stakes Evaluation

Join in the Consensus-building.
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Dr. Boulet is Associate Vice President, Research and Data Resources, for the Foundation for Advancement of International Medical Education and Research (FAIMER®). He is also the Assistant Vice President, Research and Evaluation, for the Educational Commission for Foreign Medical Graduates (ECFMG®). For the past 12 years, Dr. Boulet has worked on the development of performance-based credentialing assessments in medicine. He has published extensively in the field of medical education, focusing specifically on measurement issues pertaining to performance-based assessments, including objective structured clinical examinations (OSCEs) and various mannequin-based evaluation methodologies.

Consensus Group Leader:
Defining Individual/Cognitive Expertise

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Linda Spillane, MD
Linda Spillane, MD is an Associate Professor of Emergency Medicine at the University of Rochester. She is the Medical Director for the Emergency Medicine Center for Education and Patient Safety Research and has been the Emergency Medicine Program Director for the past 14 years. Dr. Spillane was recently appointed Assistant Dean for Medical Simulation at the University of Rochester Medical Center. Her major interest is in the use of simulation as a milieu in which to assess individual cognitive skills and teamwork skills.

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Consensus Discussion:
In this session we will discuss key issues related to the assessment of individual cognitive expertise. This topic has been divided into several important segments or questions in order to facilitate a focused discussion and develop a clearly defined research agenda.

Background
Describe the current use of Standardized Patient, Oral Board Exams and Mannequin assisted simulation for low stakes and high stakes assessment of individual skills. How are these types of simulations different in terms of the evaluation tools used to assess performance? What concepts regarding test development and evaluation can we use when designing an emergency medicine skills assessment?

What (Beeson, Spillane)
What skills/competencies important to the practice of emergency medicine are not currently or accurately being assessed via other means that would best be assessed using high fidelity mannequin assisted simulation?

How (Adler, Boulet)
What evaluation tools currently exist and how have they been validated? What scoring mechanisms make the most sense? (Mannequin response/physiologic

outcome? timing of actions? order of interventions? critical action checklist? global rating?) How can we assure that the scenarios we develop are appropriate to elicit the behaviors we wish to assess?

Threats (Fernandez, Hayden)

What are the potential threats to the validity (fairness) of the evaluation tools we use? (Unreliable Mannequin Response, Test Environment, Type/extent of orientation to the equipment, Prior exposure to simulation, The actors – standardized nurse, voice /affect of patient, Visual cues/props, Other?)

The Big Question (Spillane, Beeson)
What proof do we have that performance on simulated patients accurately reflects the quality of care provided to actual patients? Do better outcomes in the simulated environment predict better outcomes for real patients? How can this be evaluated?

Can aggregate data of individual resident performance be used to evaluate program performance? Ultimately, can program performance be linked to better patient care?

Consensus Group Leader:
Defining Group-Team Expertise

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Marc J. Shapiro, MD
Marc J. Shapiro, MD, founder of the Rhode Island Hospital Medical Simulation Center, graduated from Tufts University School of Medicine in 1989 and completed his Emergency Medicine residency at the University of Cincinnati Medical Center in 1993. He is an Associate Professor of Emergency Medicine at the Warren Alpert Medical School of Brown University. His areas of research have included emergency department utilization, geriatric trauma, patient safety and simulator-based teamwork training. As an investigator in the MedTeams™ project, he advanced the use of simulator-based training in Emergency Medicine to improve patient safety and team performance. As the director of a regional simulation center he has subsequently initiated training and conducted simulation-based teamwork research with many medical specialties.

Writing Team:

Roxanne Gardner , MD, MPH is a board-certified Obstetrician-Gynecologist and Assistant Professor of Obstetrics, Gynecology and Reproductive Biology at Harvard Medical School. She has been a faculty member of the Department of Obstetrics and Gynecology at Brigham and Women's Hospital since 1999, and prior to that she was a full time faculty member of Boston's Beth Israel Deaconess Medical Center's Department of Obstetrics and Gynecology. She has been a faculty member of the Center for Medical Simulation since 2002, where she teaches a human simulation-based team training program for labor and delivery personnel. She also assists the Harvard's Controlled Risk Insurance Company/Risk Management Foundation (CRICO/RMF) in obstetrical loss prevention and patient safety endeavors. Patient safety and simulation in healthcare are the focus of her research.

Steven (Andy) Godwin M.D., graduated medical school from the Medical University of South Carolina in 1993. He completed his residency in Emergency Medicine at the University of Florida HSC-Jacksonville following his chief residency year in June 1997. Dr. Godwin remained on faculty as the assistant residency director and then May 2000 he accepted the role of the Residency Program Director. Dr. Godwin has focused his interest in the areas of difficult airway management, clinical policy develop and simulation education. He is published in and lectures nationally on the topics of airway management and procedural sedation. Dr. Godwin has chaired or been a member of numerous

American College of Emergency Medicine clinical policies. In November 2007, Dr. Godwin became the Assistant Dean for Simulation Education for the University of Florida COM-Jacksonville. He is also the Associate Chair and Chief of Service for the Department of Emergency Medicine.

Gregory Jay, MD, PhD, is an Associate Professor of Emergency Medicine and Engineering at Brown University and a faculty member in the Center for Bioengineering. He is also the Associate Chair for Research in the Department of Emergency Medicine, Warren Alpert School of Medicine, Brown University. He is an attending physician in the Anderson Emergency Medicine Center at Rhode Island Hospital. Dr. Jay has published widely (> 80 publications) on topics in biomedical engineering and was a co-principal investigator of the MedTeams Project which led to the creation of the Rhode Island Hospital Medical Simulation Center in 2002. He has also performed NIH sponsored work on mammalian joint lubrication and musculoskeletal trauma, and served on NIH bioengineering study sections. Dr. Jay was formerly a flight surgeon in the Air National Guard where he learned crew resource management techniques.

David G. Lindquist, MD, the lead teamwork instructor at the Rhode Island Hospital Medical Simulation Center, graduated from the University of Vermont School of Medicine in 1999 and finished his Emergency Medicine residency at Brown University in 2003. He is an Assistant Professor in the Department of Emergency Medicine at the Warren Alpert School of Medicine at Brown University. Previously the director of the simulation curriculum for the emergency medicine residents and also the assistant residency director, Dr. Lindquist now heads simulation-based MedTeams® training programs for regional hospital departments, including emergency medicine, labor and delivery, neurosurgery, and internal medicine code teams.

Eduardo Salas is University Trustee Chair and Pegasus Professor of Psychology at the University of Central Florida (UCF). He also holds an appointment as Program Director for Human Systems Integration Research Department at UCF's Institute for Simulation & Training. Previously, he was a Senior Research Psychologist and Head of the Training Technology Development Branch of NAVAIR-Orlando for 15 years. During this period, Dr. Salas served as a principal investigator for numerous R&D programs focusing on teamwork, team training, simulation-based training, decision-making under stress, learning methodologies and performance assessment.

Mary Salisbury RN, MSN A graduate of North Eastern University, Ms. Salisbury, founder and owner of The Cedar Institute, Inc. enters her 4th decade of continuous career service. With a 12 year research focus in error reduction in healthcare, Ms. Salisbury works to translate research into the practical tools and strategies critical to the safe delivery of care with a focus on performance

consultation, training and coaching. From her background in emergency and critical care medicine, Ms. Salisbury brings to the client experience, the knowledge and skill set necessary to investigate and address the complex issues found in today's healthcare environment.

Consensus Discussion:

Introduction
(Marc Shapiro)

Reasons to Assess Team Behavior

Diagnose team and individual weaknesses and strength
To determine future training needs
To determine effectiveness of training and improvements in team performance
To determine improvements in actual care delivery process and outcomes.

Session objectives:

To review existing teamwork metrics from non-medical industries, previous EM research, and other medical specialties.

To seek consensus on what existing measurement tools would be most applicable to Emergency Medicine simulation-based training and assessment.

To determine high priority non-technical skills which should be the priority of teamwork training and assessment

To propose research agenda for EM simulation for measuring non-technical teamwork skills

Framework for Teamwork
(Brief Summary of morning session on development)

Should we adopt/adapt the Big 5 of Teamwork for Emergency Medicine?

What Knowledge Skills and Behaviors (KSA) related to Teamwork should be emphasized in EM simulations?
What constructs of teamwork should be taught and measured at each level of medical education?
Do we agree on Temporal Taxonomy proposed by Marks to be used in future research?

Early Teamwork Research in Emergency Medicine: Challenges in Measurements (Greg Jay, Mary Salisury and Shapiro)

MedTeams™ measurements revisited: Discussion of strengths weaknesses and recommendations
Evolution of Teamwork Training: TeamStepps
Simulation-Based Teamwork Training in EM

Lessons From Other Industries and Human Performance Research (Eduardo Salas)

Theory and Summary of human performance measurement and adopting best practices for healthcare and simulation

Description of Simulation Module For Assessment of Resident Targeted Event Response (SMARTER) and its use in Emergency Medicine. Is this proposed methodology how we should proceed?

Brief review of existing measurement approaches in Medicine (Gardner and Salisbury)

What elements of existing measurement techniques inside and outside of EM should we continue to use and what needs to be developed and validated?

Discussion of need for multiple different measurement techniques as outlines in Kendall and Salas 2004 and multiple simulation scenarios (with increasing difficulty) to have a valid measurement of individual and team performance

Individual v. team measurements

Challenges of assessing teamwork in simulator

Standardizing raters, real time v. video review or both?
Need for multiple patient simulations to work overload the team?

What new measures do we need to develop?

Shared mental model

Process measures to include sequencing of events ie prioritization

Team members self and other member assessment

Simulation Technology for Training and Assessment (All)

Can we expand the use of SP already used in Medical School to incorporate teamwork scenarios?

Can we use multi user networked computer based ACLS simulations as a low cost way to augment basic teamwork training

Is full mission simulation will likely be the preferred technique for the majority of teamwork training?

Should be do “in situ” simulations to increase verisimilitude or is the sim center adequate

What level of simulation fidelity is necessary for assessing teamwork?

Advanced Teamwork Applications in Simulator:Measurement of Team Leadership (Dave and Andy)

Does leadership Training in particular need more emphasis in intermediate and advanced training?

While leadership is certainly imbedded in teamwork it is crucial to our most challenging resuscitation cases. Highlight and discuss this as a priority focus area for simulation training and assessment.

Future Research Directions (All)

Continued theory building?

What factors of teamwork (possibly leadership, shared mental model, behavior monitoring and backup actions etc) are most directly relevant to team performance in EM?

Multi-center study to test reliability and validity of consensus measurement suite? (Similar to ANTS methodology)

How many scenarios and what types are needed to accurately assess non-technical skills.

What minimum instructor training is necessary to provide reliable teamwork assessments?

Consensus Group Leader:
Defining Procedural-Skill Expertise

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Richard Lammers, MD

Dr. Lammers is Professor of Emergency Medicine and Co-Director of the Simulation Center at Michigan State University/Kalamazoo Center for Medical Studies. He has published research on the subject of wound care in Emergency Medicine and the use of simulation for resident physician training and assessment. He has led teams that created simulation models, designed simulations, produced procedural training films on management of wounds and posterior epistaxis, transvenous pacemaker insertion, and use of the slit lamp, and developed computer-based instructional programs on cervical spine radiograph interpretation and tachycardia diagnosis.

Dr. Lammers has received several teaching awards, including the 2003 Emergency Medicine Residents' Association of Michigan Teacher of the Year. He has been a Senior Examiner and Item Writer for the American Board of Emergency Medicine, and he is currently a Decision Editor for *Academic Emergency Medicine.*

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Consensus Discussion:
Statement of Research Question #1:

What are the best methods for measuring technical performance?

> What research methodology and study designs are most appropriate for investigations of procedural training and technical skill acquisition?

What are the best assessment instruments for measuring procedural skills?
Can technical competence only be assessed while the procedure is being performed on a patient?
How frequently should pre- and post-training assessments occur?
What are the potential pitfalls in educational research design involving simulation?
Can procedural simulators be used in "high-stakes" exams?

Statement of Research Question #2:
How should performance standards for procedural competencies be set?

How can the components of procedures be defined?
What other characteristics of procedures should be included in an assessment?
What standard-setting methods are appropriate for defining procedural competency?
What are the best methods of validating high-stakes assessments of procedural competence?
For which procedures should Emergency Physicians be certified and recertified?

Statement of Research Question #3:
What methods should be used to evaluate the quality of simulation-based training and assessment tools?

What methods should be used to validate simulation training?
What methods should be used to validate an assessment instrument or simulator model?

Statement of Research Question #4:
What are the optimal conditions for learning procedural skills using simulators?

What are the most effective and efficient procedural training methods?
Can a learning curve for specific procedures be measured?
How many times does a trainee need to repeat a specific procedure to achieve competence?
Can procedural simulators accelerate the learning curve for skill acquisition?
What is the optimal training schedule for acquiring technical skills?
How can the effect of feedback on technical skills training be measured?
What characteristics of procedure simulator models and training methods optimize training efficiency and effectiveness?

Statement of Research Question #5:
What factors influence skill retention?

What variables should be considered in studies of skill retention?
How should technical skill retention be measured?
What training methods are useful in preventing skill decay?

Statement of Research Question #6:
How effectively are procedural skills that are learned on a simulator transferred to the clinical environment?

At what point in training should trainees be allowed to perform a procedure under supervision on patients?

Is there existing evidence for the transfer of procedural skills from simulators to patients?

Glossary of Terms:

A "**procedure"** is defined as any maneuver or technique requiring manual dexterity that is used to accomplish a specific task during the medical management of a patient. Procedures are comprised of a series of discrete steps, tasks, or actions that are sequential, and that have a beginning and an end. In this session, the term "skill" refers to the ability to perform an entire procedure, or any component of it, as a result of training and/or practice.

The purpose of **"training"** is to create a change in the behavior of learners (including knowledge and skills) that is consistently reproduced without variation. With additional training, the behavior that is learned is performed with fewer errors, greater speed and automaticity, and under more demanding conditions. The purpose of "instruction" is to help learners to generalize beyond the specifics of what is taught. The purpose of "education" is to build general mental models and value systems by synthesizing principles, concepts, experiences, and by role modeling. (Stolovitch & Keeps, 2006) Procedural skills require consistent and well-rehearsed performances. In this session, we refer to the teaching of procedural skills as a process of "training".

"Medical simulation" is a method of training, instruction, education, or assessment in which learners use models, devices, or other representations that imitate patients, anatomic regions, clinical tasks, or processes in realistic situations and settings in which medical services are rendered. (Scalese, 2007) Some simulations utilize actors portraying patients, or hybrids of models and actors. (Kneebone, 2002) Simulation can be used to teach decision-making and other cognitive skills, teamwork, technical or psychomotor skills, professional skills, physiology, pharmacology, and other elements of a curriculum. (Scalese, 2007) (McLaughlin, 2002) (Bond, 2002)

A **"simulator"** is a device, model, or representation used to recreate a patient or patient care environment. These have been classified by degree of realism, components, capabilities or intended use (Patel, 2006) and include procedural simulators, partial task trainers, computer-enhanced mannequins, hybrid simulators, and immersive or virtual reality simulators. (Scalese, 2007) The term **"procedural simulator"** as used in this paper describes a tool that replicates the technical aspects of a clinical procedure. Procedural simulators range in complexity, cost, interactivity, and realism from a knot-tying board or an orange (as a skin model for intramuscular injection) to an angiography simulator (used to simulate coronary or carotid artery catheterization in an angiography suite). **"Partial task trainer"** is another term used to describe procedural simulators that represent three dimensional body parts (eg. intubation heads and peripheral intravenous access arms.) Partial task trainers are generally used to teach a portion of a procedure or other, isolated skills.

"Virtual reality" simulators are computer-driven devices that display and replicate the visual, auditory, and tactile elements of the physical world and user interactions on a computer screen or other display. (Scalese, 2007) Not all medical simulations rely on technical equipment or simulator models, but essentially all procedure simulations do.

"Fidelity" is a qualitative description of the realism of a simulation experience or simulator. High fidelity simulators closely replicate the external appearance, physiology, anatomy, behaviors, and social responses of a real patient that are relevant to the educational exercise. Low fidelity simulators are inexact approximations of these features. Newer, computer-enhanced mannequins are relatively technologically complex devices consisting of plastic, polymers, internal wiring and air hoses, and they are driven by computer software that can be programmed by an instructor. Perhaps the lowest fidelity simulations are oral examination "thought" exercises in which the learner elicits and responds to information provided verbally by the instructor. The importance of simulation fidelity is determined by the goal of the educational exercise.

An "**assessment tool"** or **"assessment instrument"** is a mechanism for recording performance and is based on a system of educationally-based metrics that identifies progress and learning for the training. (Dawson, 2006) Assessment tools range from checklists and surveys to electronically flagged video recordings. All assessment tools are accompanied by scoring protocols used to evaluate performance.

"Competence" implies a level of skill, knowledge, goal-directed strategies, or experience sufficient to accomplish a procedure successfully and safely under normal conditions or usual circumstances. (Ericsson, 2006) (Bereiter, 1993)

"Proficiency" implies further advancement in knowledge or skill plus an ability to adapt to situations as they arise. Someone who is proficient can accomplish tasks or procedures with less planning and problem-solving. (Bereiter, 1993)

"Expertise" results from a combination of a superior body of formal and informal knowledge, practice, refinement of skills, and experience in problem-solving. (Bereiter, 1993) (Ericsson & Lehmann, 1996) Knowledge itself is not expertise, and expertise can exist apart from specialization. The expert addresses new problems within their field at the upper limit of possible complexity, whereas the experienced nonexpert is more likely to rely on practiced routines. (Bereiter, 1993)

(References will be included in the published paper.)

Consensus Group Leader:
Defining Systems Expertise

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Amy Hideko Kaji, MD, PhD
Amy acts as the Medical Director for the Harbor-UCLA South Bay Disaster Resource Center and is an Assistant Clinical Professor of Medicine in the Department of Emergency Medicine at the David Geffen School of Medicine at UCLA. She is an Associate Editor for Academic Emergency Medicine. Amy received both her Master of Public Health and Doctor of Philosophy degrees in epidemiology from the UCLA School of Public Health, and the focus of her dissertation was assessing disaster preparedness and surge capacity in Los Angeles County, CA.

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Consensus Discussion:
Consensus Track 4: Systems Expertise: Effective Simulation at the Organizational level (Patient Safety/Disaster/Surge) (Amy. Kaji)

Research questions re: Patient Safety
1. Whereas the single mannequin-based simulation appears to be ideal for improving an individual's performance, what types of simulation can improve the performance of an entire system or agency? More specifically, using one mannequin in an emergency department (ED) probably will not help the ED as a whole respond to multi-casualty incidents. Other than the cost-prohibitive option of using 25 simulator mannequins at once, what are some specific examples of simulation aimed at improving the response of a system or organization? Can we break those organization level simulation techniques into a few basic categories to facilitate discussion? Potential categories would include mathematical modeling of systems (e.g., to assess the surge capacity of a region or hospital, or to assess the potential impact of a pandemic), large system drills, unit level drills, team level training, etc. What, if any is the link between the mannequin-based simulation and the broader systems-level simulation?

2. What evidence currently exists that simulator training improves clinical performance (e.g., technical skills and dexterity) and thereby patient safety? How do task trainers fit within greater system safety efforts?

3. What is the evidence that simulator training improves patient outcome? What are the barriers to demonstrating simulator use improves patient outcome? Can simulation be used to reduce the time to evidence dissemination or knowledge translation? For example, could simulation training increase adherence to protocols such as EGDT for sepsis or NSTEMI guidelines?

4. What should be the outcome measures used to demonstrate that simulator training improves patient outcome? If performance is used as a surrogate for patient outcome, what attributes of performance should be measured? What is the best method to evaluate performance? What is the best time-frame (after simulator training) to assess performance?

5. What are some risks in using simulators to train physicians? What should be measures of simulator fidelity (adequately simulates the patient encounter or clinical scenario)?

6. What are the confounding variables that must be addressed when extrapolating performance on a simulator to performance on a patient?

7. Can simulation be used as a tool for social change or cultural change in a system? Can it impact the "culture of safety"? How might we know that it was simulation that helped? What are the survey and qualitative tools used for studying complex systems that could be effectively applied here?

8. One of the barriers to simulator training is cost. How can this barrier be overcome? What is the right mix of financial, educational, research, regulatory, organizational, and cultural activities and forces to catalyze the far greater investment (in money, time, and attention) that will be needed to make health care significantly safer?

9. How can we effectively feedback information from error reporting systems into simulation training? How can this be used to improve general systems? How can this be used to improve a specific system? How can we test the system in question?

Disaster/Teamwork/Surge
Research Questions re: disaster/teamwork/surge simulation

1. How can simulation/modeling be used to identify disaster risk?

2. How can computer simulation be used to determine surge capacity?

3. What evidence exists that teamwork simulator training improves disaster response?

4. How should teamwork training be evaluated?

5. What should be the measured outcome variables that demonstrate that teamwork training improves disaster response?

6. What are the barriers to teamwork simulator training? How can these barriers be overcome?

7. How do you simulate the interface of systems (EMS and the Emergency Medicine)? The problem with both patient safety and disaster surge capacity is the underlying issue of information flow and resource flow. Perhaps one could use a mannequin IN SITU from the prehospital setting to the ED to the operating room to identify problems with the system interface.