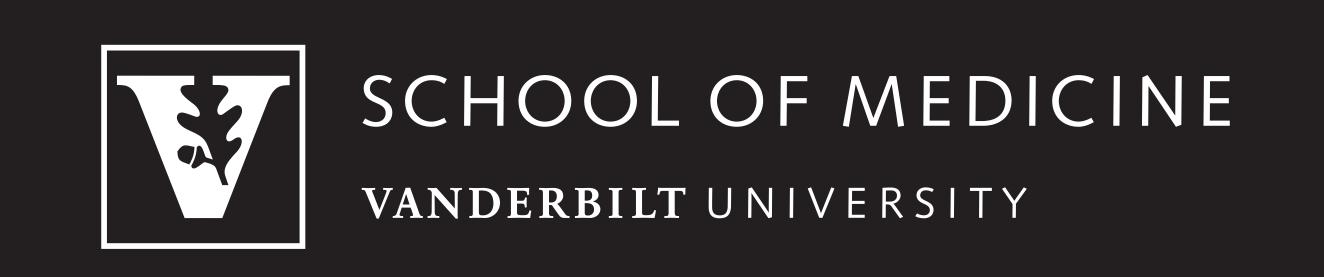


Matthew B. Weinger, MD

A Rewarding Research Career in Healthcare Human Factors

Observer-Reported



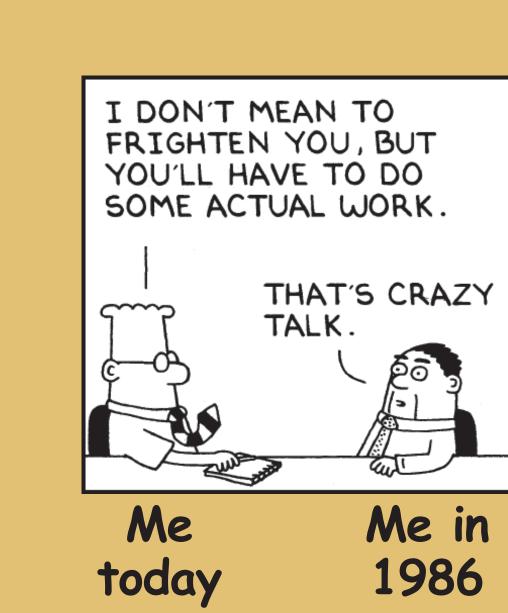
www.medschool.vanderbilt.edu

www.mc.vanderbilt.edu/criss

Goal: Have an Impact!

Dr. Weinger has taught and conducted research in anesthesia patient safety, human factors engineering, and clinical decision making for a quarter century. He has received more than \$7 million in direct research support from federal agencies and major non-profit foundations.

He has authored over 150 publications that cover topics including human factors, use error, user interface design and evaluation, measures of clinician performance, workload, alarms and vigilance, clinical expertise, automation, clinician fatigue, simulation, and clinical decision support.



Current Titles and Prior Training

Fellow, HUMAN FACTORS AND ERGONOMICS SOCIETY

Associate Editor, HEALTH AND HEALTH SYSTEMS, HUMAN FACTORS

Norman Ty Smith Chair in Patient Safety and Medical Simulation Professor of Anesthesiology, Biomedical Informatics, and Medical Education Vice Chair for Faculty Affairs, Department of Anesthesiology VANDERBILT UNIVERSITY SCHOOL OF MEDICINE

Director, Center for Research and Innovation in Systems Safety (CRISS) VANDERBILT UNIVERSITY MEDICAL CENTER

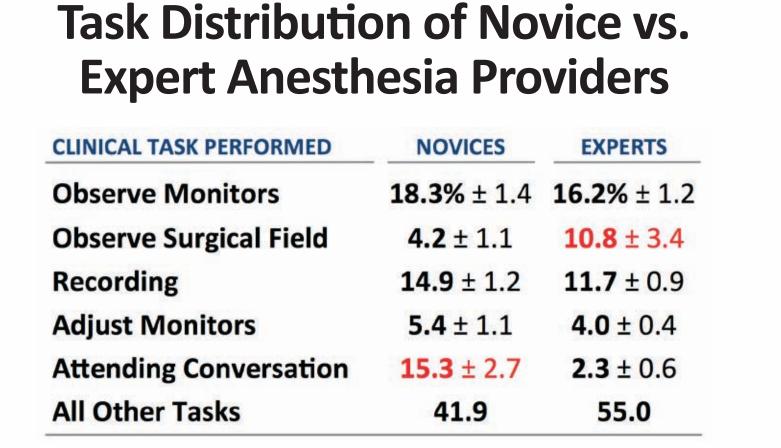
Staff Physician and Senior Scientist, Geriatric Research Education and Clinical Center (GRECC) TENNESSEE VALLEY VA HEALTHCARE SYSTEM

Prior Training

B.S. Electrical Engineering, STANFORD UNIVERSITY M.S. Biological Sciences (Neurosciences), STANFORD UNIVERSITY M.D., UNIVERSITY OF CALIFORNIA – SAN DIEGO Internal Medicine Internship, CEDARS-SINAI MEDICAL CENTER, LOS ANGELES Anesthesia Residency, UNIVERSITY OF CALIFORNIA – SAN FRANCISCO Postdoctoral Research Fellowship, UNIVERSITY OF CALIFORNIA, SAN DIEGO Fellowship in Management of Perioperative Services, STANFORD UNIVERSITY

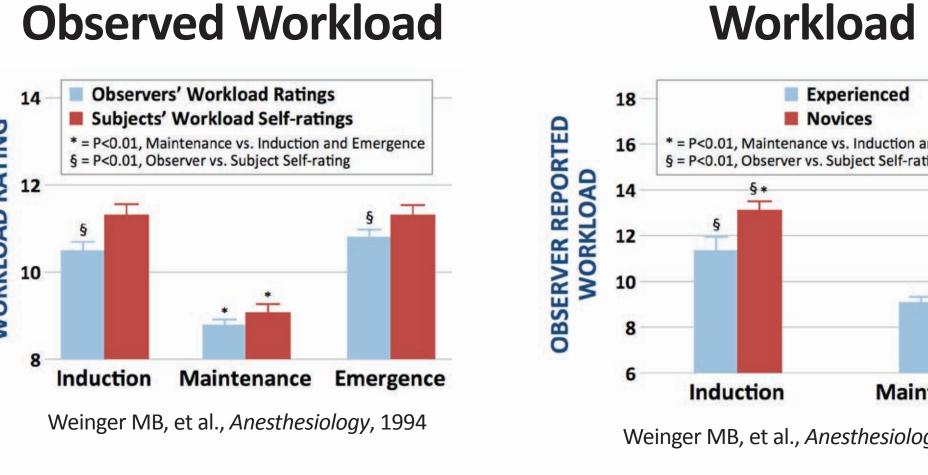
Performance Metrics: Workload & Vigilance

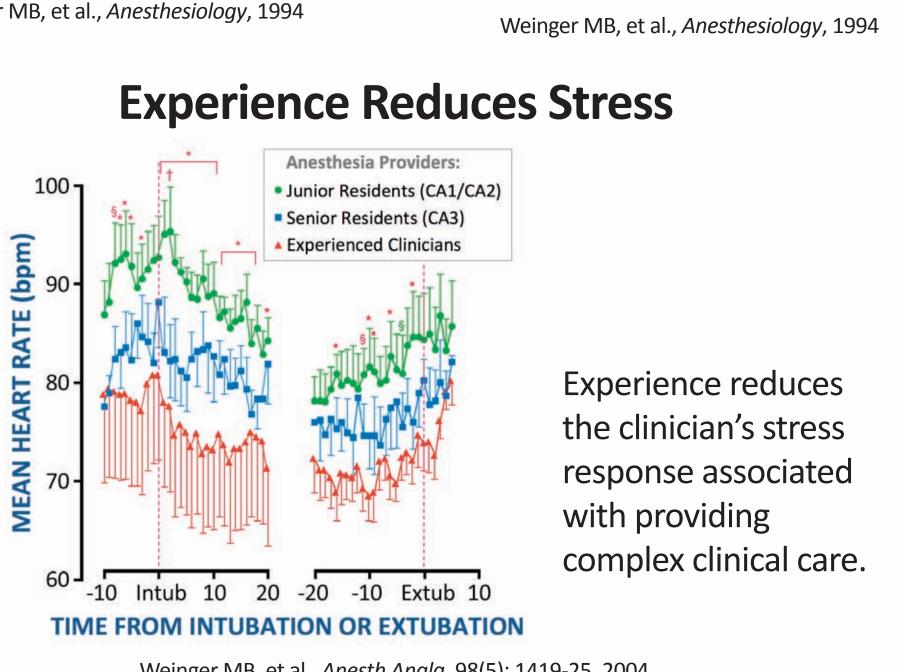
Self-Reported vs.



Weinger MB, et al., *Anesthesiology*, 1994

Workload Density





Non-Routine Events

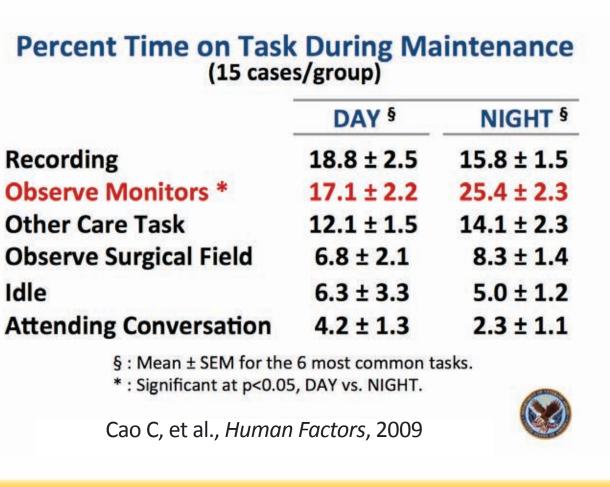
Anesthesia Non-Routine Events NRE = Any deviation from optimal care for

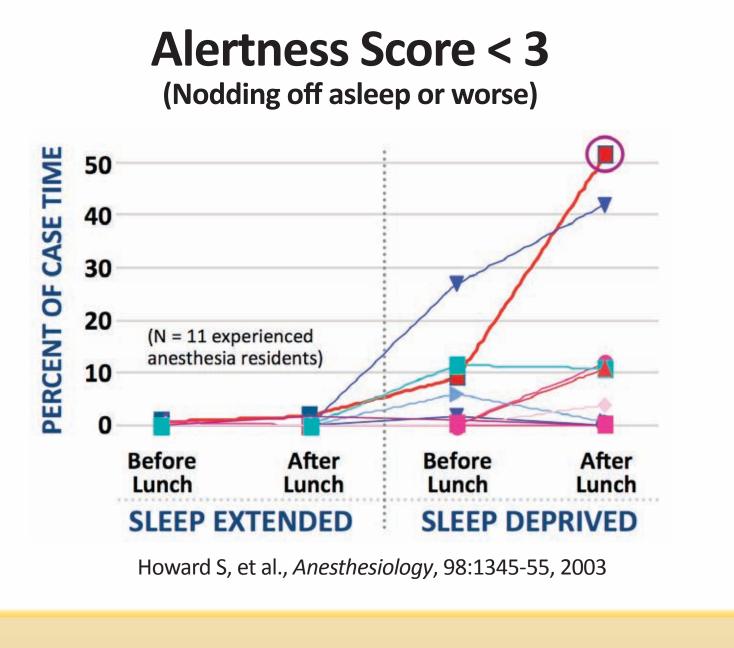
- 776 anesthesia cases videotaped.
- 349 cases (45%) with at least one non-routine event (NRE).
- 586 total NREs identified (41% of cases had more than one NRE).
- 65% of NRE had patient impact.



Performance Shaping Factors: Fatigue

Night Work Changes the Distribution of Clinical Tasks Performed





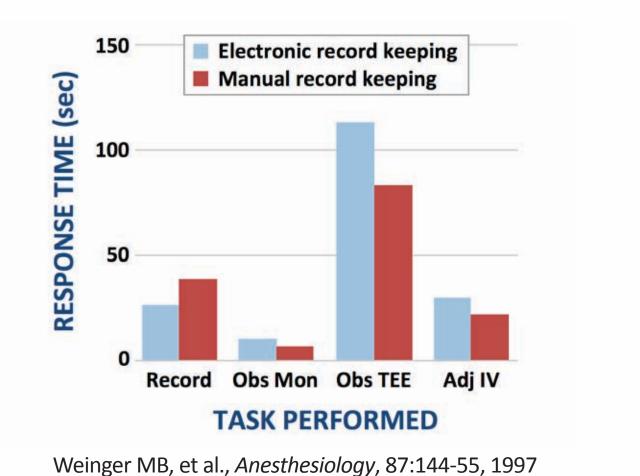
Technology & Informatics

Effects of the Introduction of an **Anesthesia EMR**

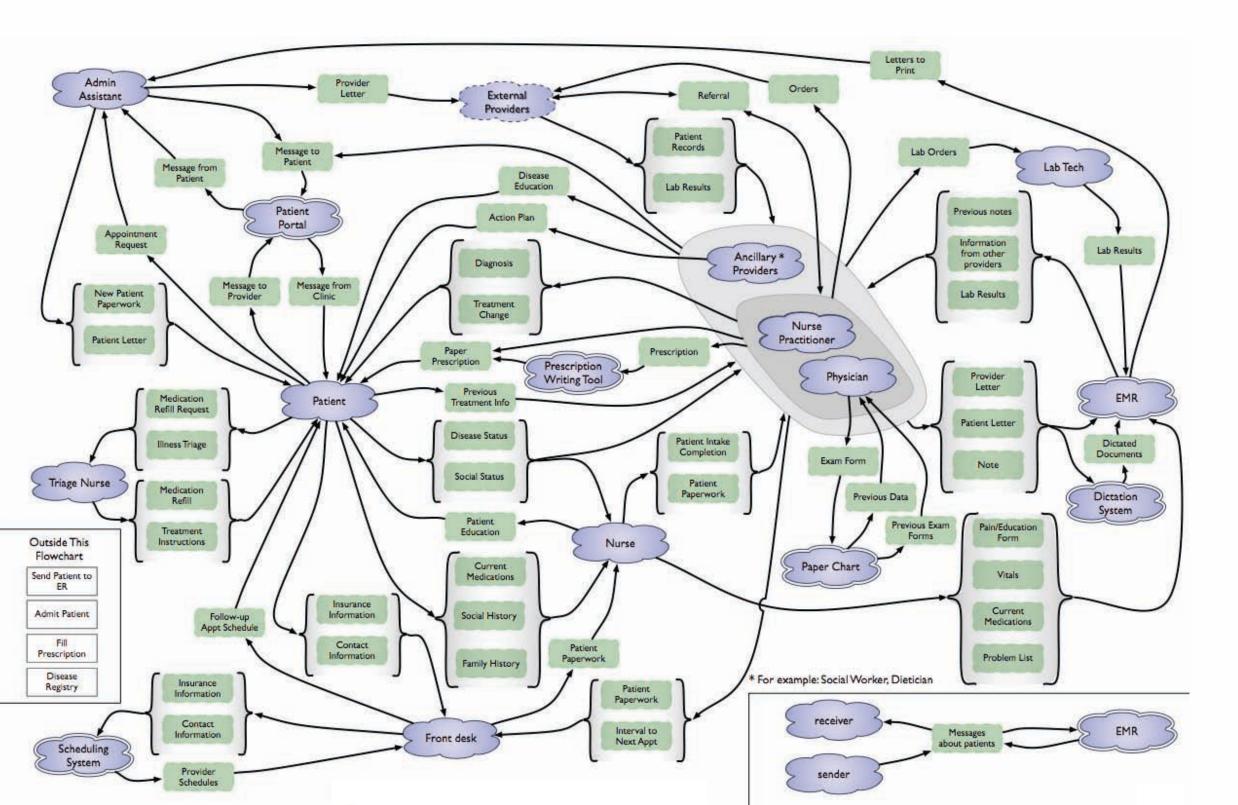
- 20 cardiac anesthesia cases (within subjects design) ... randomized to be done with or without EMR use.
- EMR group spent about 20% less total time record-keeping.
- EMR group spent more time observing the monitors and conversing.

Weinger MB, et al., Anesthesiology, 87:144-55, 1997

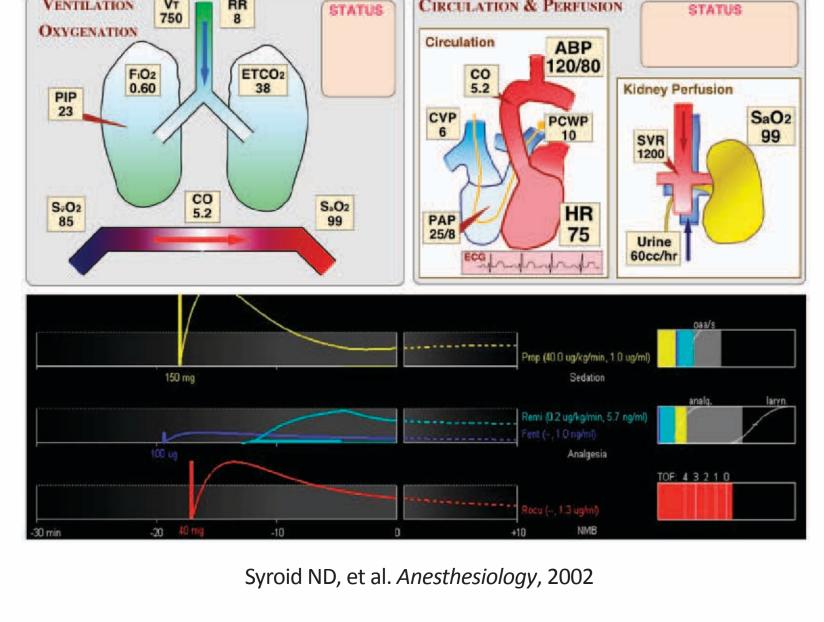
Task-dependent Response Times of 12 Senior Anesthesia Residents to a **Vigilance Light Mounted in Monitoring Array During Cardiac Surgery**



Modeling Information Flow in Chronic Disease Care



Prototype Anesthesia Care Monitoring Display



advanced physiological displays have been developed and evaluated. These figures show prototypes of anesthesia care monitoring displays for pulmonary (upper left), cardiovascular (upper middle), volume status (upper right) and drug pharmacodynamics (lower).

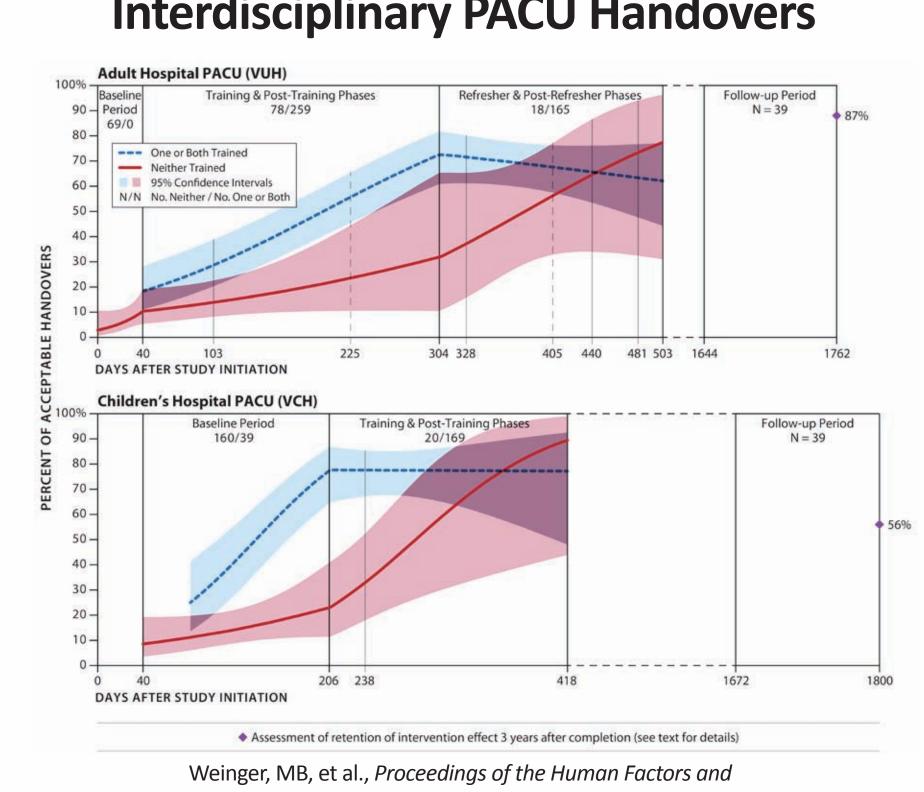
Prototype Lab Results Display



CRISS is continually involved in the design and evaluation of next-generation clinical informatics tools. Pictured is a display prototype that provides the current status and results of laboratory and radiology tests ordered on one physician's panel

Teamwork & Communication

Multimodal Intervention Significantly Improved **Interdisciplinary PACU Handovers**



Critical Elements for Success

- Mentorship
- Training & 'Deliberate Practice'
- Expertise in narrow focused areas
- Seizing interesting opportunities
- Networking & collaboration

Human Factors Research Methods

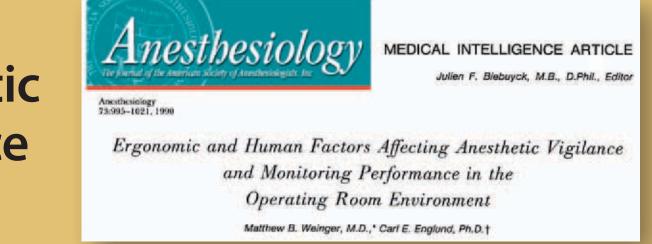
- Task analysis (behavioral & cognitive)
- Workload measurement
- Video analysis
- Surveys & active surveillance
- Event detection and analysis
- Simulation and modeling

The Path to Expertise

- Rigorous training in your field's conceptual foundations
- Learn the 'tools of the trade'
- Deliberate practice
- Continual (life-long) learning

Representative Publications

Weinger MB & Englund CE: Ergonomic and human factors affecting anesthetic vigilance and monitoring performance in the operating room environment. Anesthesiology 73: 995, 1990



Weinger MB, et al.: Objective task analysis and workload assessment of anesthesia providers. Anesthesiology 80: 77, 1994

Fraind DB, et al.: Reengineering intravenous drug and fluid administration processes in the operating room: Step one: Task analysis of existing processes. Anesthesiology 97: 139, 2002

Agutter J: Evaluation of a graphic cardiovascular display in a high fidelity simulator. Anesth Analg 97: 1403, 2003

Weinger MB: Video capture of clinical care to enhance patient safety: The nuts and bolts. Qual Safe Healthc 13: 136, 2004

Oken A, et al.: A facilitated survey instrument captures significantly more anesthesia patient safety events than does traditional event reporting. Anesthesiology 107: 909, 2007



Unertl KM, et al.: Describing and modeling workflow and information flow in chronic disease care. JAMIA 16(6): 826, 2009

Weinger MB: The pharmacology of simulation: A conceptual framework to inform progress in simulation research. Simulat *Healthc* 5(1): 8, 2010

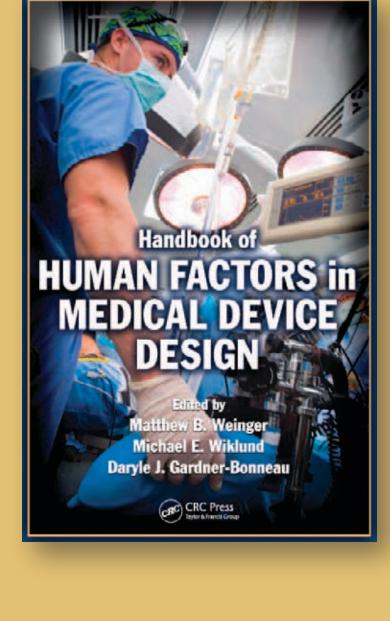
Miller A, et al.: Care coordination in Intensive Care Units: Communicating across information spaces. Human Factors 52: 147, 2010

Karsh B-T, et al.: Health Information Technology: Fallacies and sober realities. *JAMIA* 17(6): 617, 2010

Anders S, et al.: Blood product positive patient identification: Comparative simulation-based usability test of two commercial products. *Transfusion* 51(11): 2311, 2011

Weinger MB, Wiklund M, and Gardner-Bonneau D (editors): Handbook of Human Factors in Medical Device Design. Boca Raton, FL: CRC Press, 2011, 850 pp.

Anders S, et al.: Evaluation of an integrated graphical display to promote acute change detection in ICU patients. Inter J Med Inform Dec 81(12):842, 2012



Engineering Guidelines and Preferred

Practices for the

Research Support

- Agency for Healthcare Research and Quality (AHRQ)
- Patient Centered Outcomes Research Institute (PCORI)
- Veterans Affairs Health Services Research & Development
- National Institutes of Health (NIH)
- Food and Drug Administration (FDA), CDRH
- National Institutes of Standards & Technology (NIST) Center for Disease Control (CDC)
- Anesthesia Patient Safety Foundation (APSF)

National Patient Safety Foundation (NPSF)

- Attributes of Successful Researchers
- Curiosity
- Passion Focus
- Persistence
- Capable writer
 - Not easily discouraged
 - Excellent communication skills Ability to delay gratification
 - Ability to mentor the next generation

Mentees

- Shilo Anders, PhD
 - Arna Banerjee, MD
 - Caroline Cao, PhD

Dan France, PhD

- Amanda Lorinc, MD
- Anne Miller, PhD

Laurie Novak, PhD

Rich Holden, PhD

- Jason Slagle, PhD
- Kim Unertl, PhD

Emily Patterson, PhD

Alison Vredenburgh, PhD