Injecting Healthcare with Human Factors

Highly interdisciplinary and collaborative, CRSS conducts basic and applied research in healthcare informatics, patient safety and clinical quality, and designs and develops information technology, care processes and medical devices.

Design & Usability
CRSS investigators design and evaluate medical devices and health information technology. We have collaborated with the VA, other Vanderbilt centers and outside vendors to develop and improve the user experience.

Pre-op UI Redesign
Current - Unnecessary layout and data elements
- Difficult control of printed page
- No collaboration with other physicians
- No improvement to scan patient charts and identify status alerts

Redesigned UI
- Progression through modular queries
- Ability to audit prior rounds
- Clear, configurable view
- Improved ability to scan printouts, highlight pertinent points and alerts

Electronic Time-Out Reduces Wrong Surgeries
We helped design a presurgical time-out checklist that is displayed in a large monitor in the OR and shared through a voiceoverscooter system. The checklist is used to confirm all involved in the OR are aware of the surgical site, type and procedure. By having all participants confirm acceptance of these items, CRSS has successfully contributed to diminishing wrong-site surgeries.

Overview Displays for Hybrid Nuclear Power Plants
As part of a Department of Energy Nuclear Energy University Program (NEUP), we are creating the Multi-Modal National Laboratory in the design and evaluation of overview displays in nuclear power plant (NPP) controls. We are using our own visualization and visualization techniques to determine optimal control room layouts. Current control rooms are largely analog requiring operators to assess alarms and emergency displays (typically a wall of monitors) to report digital displays. We are developing interactive, highly immersive, synchronized overview displays (think 3D Origami) that are economically feasible and funded by the NNL to assess decision making strategies for overview displays for existing largely analog control rooms.

Teaching & Training
Faculty and student provide guidance in theories, methods and tools related to human factors theory and simulation-based training and assessment.

Simulation-Based Performance Assessment
It is important for physicians to maintain their competence through frequent analysis. This national simulation scenario assesses the performance of practicing board-certified anesthesiologists (BCAs) during simulated emergencies. Consenting BCAs, who already participated in simulation-based courses at one of 8 sites, performed a simulated emergency. BCAs were tested in 3 different environments (a high-fidelity OR, a mid-fidelity OR, and a technology laboratory) and then evaluated on their performance and self-perceived training.

Center for Experiential Learning & Assessment
Clinical residencies deviate from published guidelines for training and assessment. Despite this knowledge, adherence to consensus guidelines improves patient survival and outcomes. The Center for Experiential Learning and Assessment (CELA) offers an optimal environment for research and teaching.

Communication & Decision Making
We investigate team communication, coordination, adaptation and decision making with culture and effectiveness, and individual and group performance.

Handover Tool Development, Implementation and Evaluation
Handover transition processes can be improved by applying human factors to specific situations. This study evaluates the effects of the multi-component presurgical design and implementation of a structured at-risk OR handover checklist on the quality and frequency of transition-of-care handovers.

Work Analysis & Improvement
Using human factors engineering, cognitive psychology, biomedical engineering, and implementation science, CRSS studies performance during patient care to understand how and why care deviates from optimal.

The Epidemiology of Perioperative Non-Routine Events
Non-routine events occur frequently in the operating room, but modern patient safety efforts have often not addressed these events. The Perioperative Non-Routine Event (PNRE) is a new category of event that involves any deviation from standard operating procedures that may adversely affect a patient. We are conducting a national study of the incidence and consequences of PNREs.

Patient-Reported Non-Routine Events (NREs)
In a study funded by the Patient Centered Outcomes Research Institute (PCORI), CRSS has collected NREs from patients, family members and physicians in four hospital settings (adult ambulatory surgery, interventional cardiology, pediatric oncology, and ambulatory surgery). Patient- and clinician-reported NREs are highly congruent.

Patient Chronic Illnesses
In four separate studies, we are examining routines used by patients to manage chronic illness. In this study of diabetic patients, we explored the activities involved in self- management of diabetes. In another study, we observed how a group of patients with diabetes self-managed a diabetes home care program. In a study of patients with chronic obstructive pulmonary disease (COPD), we observed how a patient managed their disease. In another study of patients with diabetes and chronic kidney disease, we examined the strategies people use to incorporate medications into their lives.

Sources of Research Support
- Patient-Centered Outcomes Research Institute (PCORI)
- Centers for Disease Control and Prevention (CDC)
- National Institutes of Health (NIH)
- Department of Energy (DOE)
- National Cancer Institute (NCI)
- National Organizations for Hear and Balance Research (NOHAB)