

Project Title: Computer-Based Provider Order Entry (CPOE) Implementation in Intensive Care Units (ICUs)

Principal Investigator: Carayon, Pascale, Ph.D.

Organization: University of Wisconsin–Madison

Mechanism: RFA: HS-04-012: Demonstrating the Value of Health Information Technology (THQIT)

Grant Number: R01 HS 015274

Project Period: 09/04 – 08/09, Including No-Cost Extension

AHRQ Funding Amount: \$1,455,066

Summary Status as of: December 2008

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

Summary: The Computer-Based Provider Order Entry (CPOE) Implementation in Intensive Care Units (ICUs) Project is an ongoing collaborative endeavor between the researchers at the Center for Quality and Productivity Improvement (CQPI) at the University of Wisconsin–Madison and Geisinger Medical Center in Danville, Pennsylvania. This project is focused on the evaluation of the implementation of Smart Intravenous (IV) pumps and their integration with a bar code medication administration system within the ICU. This project will specifically focus on the use of a prospective approach using human factor techniques to smooth the implementation process. Although Smart IV pump technology in combination with a bar code medication administration system has the potential to decrease IV medication errors significantly, the implementation of new technology systems frequently results in failures and unforeseen errors. This project uses a human factors approach in the implementation process in order to reduce these potential negative consequences. The human factors approach with prospective error analysis will be used to evaluate the technology and technology change process, specifically using failure mode and effects analysis, work system analysis, and technology change surveys to improve implementation. Direct observations, surveys, and longitudinal assessment of the Smart IV pump event log data and error reports will provide rich data on Smart IV pump programming errors and provider job and work-life characteristics affected by the change process. This study will provide hospitals without medication administration technology opportunities to assess and change human, medication, and organizational factors related to pump programming errors. Valuable information will be gained and shared about the technology change process associated with Smart IV pump implementation and integration with a bar code medication administration system to allow other hospitals to safely and effectively implement these technologies and avert new errors.

Specific Aims

- Conduct preliminary job task analysis of nurses and physicians. **(Achieved)**
- Conduct preliminary prospective risk analysis. **(Achieved)**
- Implement timeline revision with partner organization. **(Achieved)**
- Collect data on quality of care and financial measures to determine the impact of CPOE on quality of care in ICUs and the financial value of CPOE implementation. **(Ongoing)**
- Collect and analyze employee questionnaire data to determine the impact of CPOE on end users. **(Ongoing)**
- Collect medication safety data to determine the impact of CPOE on safety in ICUs. **(Ongoing)**

- Develop and implement a publication plan to inform other hospitals about how to safely and effectively implement these technologies and avert new errors. **(Ongoing)**

2008 Activities: In 2008, post-implementation data collection for job task analysis for nurses and physicians was completed. Data on quality of care and financial measures were also collected. From January 2008–May 2008, employee questionnaires were completed and collected as part of the 3-month post-implementation end user review. Most of the 12-month post-implementation data were collected in October 2008, and all data for nurses were entered and cleaned. Data collection from residents for the 12-month post-implementation employee questionnaire continued through the end of 2008. For the medical safety data collection, the Medical Safety database was designed and used to collect post-implementation data. That data collection process is nearly complete, and the data verification and cleaning process has started. The publication plan was also evaluated and updated, and drafts have been written for several portions of that plan.

Preliminary Impact and Findings: For the job task analysis portion of the project, preliminary data analyses show interesting differences in time use across units. Also, residents, attending physicians, and physician assistants show rather different patterns of time use. Preliminary analysis of the employee questionnaire data for nurses shows that concerns about patient safety and quality of care went up after implementation but, at 1 year post-implementation, it either returned to the previous level or improved.

Selected Outputs

Hoonakker, et al. Communication in the ICU and the Relation with Quality of Care and Patient Safety from a Nurse Perspective. *Human Factors in Organizational Design and Management* 2008; 9.

Alvarado, et al. Macroeconomic Challenges in Implementation of Health Information Technology. *Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting*; New York, September 22-26, 2008.

Paris, et al. Safety of the Antibiotic Medication Use Process in the Intensive Care Unit. *Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting*; New York, September 22-26, 2008.

Li Q, Douglas S, Hundt AS, et al. A heuristic evaluation of a computerized provider order entry (CPOE) technology. In: *Proceedings of the IEA2006 Congress*; Pikaar RN, Koningsveld EAP, Settels PJM, editors. Elsevier; 2006.

Employee Questionnaire Survey: The Employee Questionnaire Survey was developed to examine CPOE/EHR implementation; the systems' usability; and the effects of implementation on communication, coordination, the quality of working life, patient, safety and quality of care. In designing the survey, researchers combined reliable and valid questions previously used to study technology implementation and the work of inpatient providers. This survey is a useful tool for researchers studying CPOE across the U.S.

Medication Safety Database: This Microsoft Access database was designed by the Medication Safety Research Team as a way for nurse data collectors to easily enter safety and quality of care data. It is an innovative tool that would be useful for any researcher gathering data on medication errors or adverse drug events because it captures the complexity of these events, their causes, and the related harm.

Grantee's Most Recent Self-Reported Quarterly Status: The project is meeting 80 to 99 percent of its milestones and is generally on time. Delays are due in part to the fact that the project was moved to Geisinger Medical Center 18 months into the project. Delays have also been caused by problems with the technology implementation at the research site. A no-cost extension has helped to remedy these issues.

Milestones: Progress is mostly on track.

Budget: Spending is roughly on target.