Final ACTION Contract Report

Using Nursing Practices and Health IT To Reduce Fall-Related Injuries

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Final Report

Using Nursing Practices and Health IT to Reduce Fall-Related Injuries

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Executive Summary

Background

Advances in health information technology and the use of clinical decision support (CDS) systems in the electronic health record (EHR), hold great promise for enhancing the safety, quality, effectiveness, and efficiency of patient care, but are relatively untested for nurses. Many nurses continue to develop, implement, and document their care plans on paper, with little automation, limited access to CDS, and manual abstraction for quality reporting. Research is needed on how, when, and where CDS can be used to increase the quality and safety of patient care. Previous researchers have recommended that CDS research be focused on developing tools to address a specific patient care issue (vs. more general approaches) in order to show that the CDS can improve nursing performance and patient outcomes. Researchers have further recommended the use of quantitative and qualitative (mixed) methods to gather information at baseline (context) and to design tools with content and "fit" placement within the workflow to address identified needs.

Project Aim

The goal of the project was to design, build, and implement CDS tools that were populated with data extracted from the EHR and to evaluate if the CDS tools could support nurses to improve care planning and quality improvement activities related to fall prevention in acute care. The project was funded by Agency for Healthcare Research and Quality, carried out as a task order (Contract No. HHSA290200600162) under the Accelerating Change and Transformation in Organizations and Networks (ACTION) program between June 2009 and January 2011.

The project deliverables included:

- Qualitative and quantitative measures used to describe baseline and inform tool design (Appendixes C-J).
- Specifications for a care planning (CP) clinical decision support (CP-CDS) tool (Chapter 3; Figures 4–10).
- Specifications for a quality improvement (QI) clinical decision support (QI-CDS) tool (Chapter 3; Figures 11-12; Appendix K).
- A Patient and Family Member Fall Prevention Educational (ED) tool to identify fall risk and engage them in creating individualized plan to reduce risks (Chapter 3; Figures 13 and 14.
- Electronic metadata dictionary (Chapter 3) with link to the United States Health Information Knowledgebase (USHIK), where the dictionary resides.
- Staff nurse training presentation for the deployment of the CP-CDS tool (and the supplemental handout of the Fall Prevention Education Tool).
- Nurse leader training presentation for the deployment of the QI-CDS tool (and separate document with supplemental handout for data element definitions).
- Cost- Benefit evaluation (Chapter 4 and Appendix L).

Methods

A pre/post mixed methods design was used including data queries, observation, focus groups, surveys, and usability testing with Institutional Review Board (IRB) exempt status. The information collection used in this project was acquired as part of Aurora's ongoing employee satisfaction process and was not funded by this task order. Since the information was collected by the organization for internal use and the data made available for this research, it was not subject to Paperwork Reduction Act clearance from the Office of Management and Budget. The project was conceptually based on the Knowledge-Based Nursing Initiative (KBNI) framework and the Technology Acceptance Model. Qualitative and quantitative measures were constructed to describe current state and to identify what was needed for tool content and logistical design.

The project was carried out with nurses who worked on two medical/telemetry Magnet-recognized nursing care units in a large urban medical center in the Midwest during 2009–2010. The facility had a pre-existing EHR with nurse-sensitive fall prevention and injury management data elements, electronic care planning functionality, and CDS that identified fall and fall-related injury risks using data entered during patient care.

Baseline findings were analyzed to inform the content and logistics of tool design. Workflow processes were observed to be complex with limited real-time EHR documentation. The change of shift "report" processes involved reviewing narrative and EHR screens with manual synthesis and forecasting of care. Report took approximately 45 to 60 minutes for 4 to 10 patients depending on the shift. Nurses reported that they "did not trust" the computer information, requiring double-checking. Nurses did not always utilize the electronic care plan features as designed. Nursing assistants relied on peer report and visual risk cues in the rooms (e.g., red booties, signs, etc.) to guide them, since Nurse-Nursing Assistant report occurred 60 to 90 minutes after the start of the shift and focused on tasks with minimal fall prevention details. Patient education focused on environmental "safety" (not patient-specific risk factors even though they were available). Inaccuracies were found when the EHR and incident reporting system reports were compared. Nurse leaders accessed multiple data sources with manual analysis and delayed reporting.

The team reviewed the baseline findings and established goals for the design of each CDS tool:

- The CP-CDS needed to be accessible in nursing workflow, able to display information about all assigned patients, with a visual display (quick and easy to see without reading) of risks, risk-based interventions, and fall events.
- The QI-CDS tool needed to provide electronic access to data currently gathered manually from multiple sources, near real-time, with accurate and complete data.
- The Fall Prevention ED Tool needed to be easy to read with pictures to help nurses teach patient-specific risks and talk through picking out prevention strategies to address risks.

Tool Descriptions

The CP-CDS tool used an EHR-provider-based template that was deployed within the pre-existing EHR. The end-user accessed the tool from their main patient list. When selected, the tool populated with real time information for patients on the list and a graphic dashboard-type

display of the status of key aspects of the care plan. The dashboard featured three columns with headers labeled “Assessments,” “Interventions,” and “Falls.” Icons were used to signal the status of the care plan showing if “Assessments” were done/not done, if “Interventions” were needed or not applicable (N/A), and if an outcome (“Falls”) had occurred (with date/time) or not applicable. Hover messages and hyperlinks were provided to support the enduser with information about the meaning of the icon and to provide direct access to the patient record where the nurse could complete the assessment or update the care plan if needed.

The QI-CDS tool used the SAP BusinessObjects software with a customized report template featuring two tabs (pages) that was sourced from a data mart and refreshed daily from the EHR currently in place to support the health care system. The user specifies facility, unit, quarter (1-4), and year to run the report for a single unit and single quarter. When the query runs, the first page provides unit-specific summary data about patient days/encounters (3 items), falls/fall risks (6 items), and injuries that had occurred (7 items) with information about the status of fall prevention care planning (6 items). The second page provides details (23 items) for each fall event including time and date of the fall, circumstances surrounding the event, injury assessment information, and the narrative/progress note that was completed related to the fall.

The ED tool was developed based on current evidence with expert team, consultant, and plain language expert input. The tool was designed to help nurse to make patients/family member more aware of their personal fall and fall-related injury risk factors, the rationale for preventing falls while hospitalized, strategies to prevent accidental falls, and to engage them in creating a plan to prevent falls related to the use of medications, safe toileting and ambulation, and when the patient is forgetful. The nurses in the study had access to an EHR screen that provided them with fall and fall-related injury risk, but the nurse was still required to manually transcribe the risks to the tool and to interact with the patient to establish the interventions.

A metadata dictionary of the standardized, defined, and coded data elements used in constructing the tools was created and imported into the USHIK with the technical specifications to support interoperability and use of the tools by other organizations.

Results

The CDS tools were populated with valid and reliable near-real time EHR-based data to support CP and QI and available to clinicians and leaders. Despite providing input into design, the nurses and nurse leaders were slow to adopt the tools. The CP-CDS tool was available in the EHR with a single click but staff perceived this to be outside the workflow. Slow load time and insufficient assessment and intervention details contributed to limited CP-CDS adoption. QI-CDS tool usability testing showed that leaders could access the tool and believed the tool brought disparate data together, saving time and improving data quality, but leaders found no time to use the tool. Similarly, staff nurses provided positive feedback about the Fall Prevention ED Tool, but there was limited evidence of use during the post-implementation period. Sociotechnical issues such as competing EHR implementations and resource reduction were observed to occur during training, go-live, and adoption periods may have influenced adoption.

Conclusion/Implications

This study demonstrated that nurse-sensitive data, embedded in the EHR can be captured and extracted from the data repository to support decisionmaking during patient care and to populate CDS tools for aggregate analysis and quality improvement. The CDS tools were not adopted as well as expected, possibly due to the presence of sociotechnical issues that are not typically captured in CDS research. Transitioning to data-driven processes may require more time, knowledge, and skills in order for nurses to effectively use tools to support decisionmaking. Despite limitations, this study sheds new light on the complexities of nursing workflow and the need for gaining a better understanding of sociotechnical context and how CDS can support nurse decisionmaking.

Chapter 1: Introduction and Literature Review

Advances in health information technology (health IT), particularly the use of clinical decision support (CDS) systems in the electronic health record (EHR), hold great promise for enhancing the safety, quality, effectiveness, and efficiency of patient care. Researchers have reported that, for certain conditions, utilizing greater EHR automation was associated with improvements in guideline adherence, disease surveillance, mortality and complication reduction; however, limited use of these advances have been reported for nurses. In fact, many nurses continue to develop, implement, and document care plans on paper,[1] with little automation, limited access to CDS systems, and use manual abstraction for quality reporting. Research on how, when, and where CDS can be used to increase quality and patient safety for acute care nurses is needed.

Implementing Health IT and Clinical Decision Support (CDS)

Health IT refers to technology that makes it possible for health care providers to better manage patient care through secure use and sharing of health information.[2] Health IT has been shown to improve patient care quality by increasing adherence to guidelines, enhancing disease surveillance, and decreasing medication errors; however the generalizability of the results are limited because the research has been focused on testing medical activities in health care organizations that have well developed clinical information systems.[3] Interoperability is a key feature of health IT and refers to "the ability of a system or a product to work with other systems or products without special effort on the part of the customer."[4]

The American Medical Informatics Association (AMIA) defined the EHR as "personal data created, developed, maintained, and/or provided by clinicians, providers, and allied health providers in direct patient care."[5] The EHR also refers to the "repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users. . . [the] primary purpose [of the EHR] is to support continuing, efficient and quality integrated healthcare."[6] The EHR is typically the foundation upon which all other applications are added (e.g., decision support systems, computerized physician order entry, electronic results reporting, etc.). EHR data can be used as a "primary" source referring to data used "by the organization or entity that produced or acquired these data in the process of providing real-time, direct care of an individual."[5] EHR data can also be used as a "secondary" source referring to nondirect care use for analysis, research, quality/safety measurement, public health, payment, certification, etc.[5]

In addition to the design and interoperability, the effectiveness of health IT is influenced by the way it is implemented. Implementation involves technical installation, organizational change processes, human factors considerations, and project management.[3,7] Dixon and Zafar[8] described strategies used for successful planning, implementing and evaluating health IT: (1) gathering qualitative input, (2) employing qualified clinically based IT staff, (3) providing training and support during go-live, (4) analyzing and redesigning the workflow, (5) allocating adequate resources and time for implementation; (6) working with health IT vendors; and (7) establishing a mechanism for clinical oversight.

The Agency for Healthcare Research and Quality (AHRQ) Patient Safety Network Glossary defines a "clinical decision support system" (CDSS) as "any system designed to improve clinical decision making related to diagnostic or therapeutic processes of care."[9] More specifically, "clinical decision support" refers to "providing clinicians, patients or individuals with knowledge and person-specific or population information, intelligently filtered or presented at appropriate time to foster better health processes, better individual patient care, and better population health."[10 A] CDS intervention delivers "one or more specific pieces of clinical knowledge or intelligently filtered data to an individual at a specific time and place to address a clinical objective."[10] CDS interventions include content (clinical knowledge) and logistics for how (computer- or paper-based interventions) and where in the workflow it is delivered to an end-user who uses it to deliver or manage health care for self or others.

In 2006, AMIA published a "Road Map"[11] with a framework and key tasks to ensure that "optimal, usable and effective CDS is widely available to providers, patients, and individuals where and when they need it to make health care decisions," with an ultimate goal of improving health care quality and health in the United States. To realize the optimal benefit, the CDS must have:

- Best knowledge available when needed (organized, accessible, and delivered in standard format into a decisionmaking process that end-users can understand, access, and apply).
- High adoption and effective use (implemented, used, and produces clinical value and operational and financial sense to end-users and purchasers).
- Continuous improvement of knowledge and CDS methods (feedback/data are aggregated, assessed, and applied to improve health management). CDS content must be gathered from key stakeholders and designed to demonstrate feasibility, scalability, and value.[11]

In their systematic review, Chaudhry and colleagues found that decision support in the EHR was effective in facilitating adherence to guidelines.[3] Most of this research, however, was conducted with physicians in primary care settings. CDS-based quality measurement was found to be less labor intensive, but concerns about the reliability of the data were reported. This concern has critical implications. Incorrect or unreliable data that are fed into decision support systems can lead to inappropriate decisionmaking and potential harm depending on the nature of the process and degree to which the process is integrated across the EHR. Thus, informaticians have emphasized the importance of close scrutiny of CDS, initially and on an ongoing basis.[12, 13]

Several resources are available to support CDS designers as they begin the process of design. Bates and colleagues proposed 10 key CDS design recommendations which included anticipating needs, making the tool fit into the workflow (with minimal stopping and no reduction in performance speed), doing usability testing to identify design issues early, keeping it simple, providing additional information only when needed, and monitoring impact in the context of all that is going on.[14] They described that "surprises" do occur where CDS features thought to be valuable actually caused problems, got very little use, or both. More recently, Berner provides an overview of CDS research to date with similar recommendations to ensure that CDS will increase, rather than decrease clinician efficiency.[15]

Karsh and colleagues described a framework for designing and testing processes used to enhance health care professional performance related to safety.[16] In this document, health care professional performance is defined as the "patterns of actions carried out to satisfy an objective according to some standard" and to avoid hazards (2009, p. i60). This is most often

accomplished when physical, cognitive, and sociobehavioral processes are iteratively used to transform inputs into outputs (e.g., process change, patient safety, improved quality). More recently, Karsh applied the model to the process for designing CDS to "fit" into the sociotechnical "context" of patient care and optimize clinical workflows.[17] The "sociotechnical context" refers factors that may impact the process and outcomes of an implementation but are not health IT-related including system functionality and usability, training, technical support, user participation, top management commitment (money, time, and resources), culture, implementation timeline, and hardware location and ergonomics.[18] "Workflow" is defined as the flow of "work" (the transformation of inputs into outputs) through space and time.[17] Ideally, CDS tools are designed to support basic physical, cognitive, and sociobehavioral processes with workflows that fit within the clinician's capacity. They should be designed to filter and present useful information at the right time in the clinician workflow to be most effective.[17]

While technology is most often implemented to enhance safety, quality, and efficiency, some authors have reported unanticipated and undesired consequences such as increasing work, changes in communication patterns, workarounds, errors, and others.[19] When CDS tools do not achieve the outcomes expected, evaluation typically starts with the technical design. However, other factors should be considered including sociotechnical context, organizational alignment, culture, implementation, or incentives.[17] When evaluating for CDS fit in the workflow, several key concepts must be considered. If the work exceeds the clinician's mental or stress capacity, the clinician will work until they can no longer adapt and compensate. When the work/stress demands increase, the clinician may involuntarily consider fewer options (referred to as "cognitive tunneling")[17] or rely on only the information that is readily available information (referred to as "availability bias")[20] with increasing risk for decision errors and poor performance. Researchers who study the disorganizing effects of stress on performance also reported that increasing work or stress may decrease vigilance and increase the shedding of tasks that are not perceived to be important .[20] Thus, unintended consequences such as these should be considered during CDS evaluation.

Evaluating the Clinical Impact of Health IT and CDS for Nurses

Nurses make up the largest group of health care providers and are vital members of the health care team.[21] They have direct and indirect responsibilities for managing and coordinating patient care processes and communications to ensure safe and quality care in a complex work environment.[22]

Nursing record systems contain information about the patient's condition and evidence that the patient care was planned and/or delivered by qualified nurses and collected for clinical and legal purposes. Paper-based systems typically consist of admission assessment forms, a patient care plan, flow sheets, treatment/intervention records and progress notes.[23] These forms are designed to capture key patient and care data and support decisionmaking based on the way that data elements are organized and displayed on the page.

Health care organizations are implementing health IT to support nursing practice, but the technology development is at the early stages. In 2008, DesRoches and colleagues found that fewer than 1 in 5 R.N.s (17 percent) worked in health care settings where a minimally functional EHR was adopted.[1] These authors noted that nurses who worked in organizations using EHR

were more likely to report that their organization was engaged in activities associated with nursing excellence and quality improvement—the target audience for this project. In the wake of national efforts to promote and provide incentives to accelerate the adoption and use of health IT, more organizations are pushing to implement certified EHR and demonstrate their "meaningful use." By 2010, Jha and colleagues reported some progress, but only 11.9 percent of U.S. hospitals reported basic or comprehensive EHR adoption in 2009, with only 2 percent able to meet the Federal "meaningful use" criteria.[24] The push to achieve physician-oriented "meaningful" use criteria may advance the deployment of health IT,[25] but advances that support nursing practice are not the focus of the current initiatives.

Historically, researchers[26, 27] described that acute care nurse reported negative attitudes about the deployment of electronic nursing documentation, some persisting as long as a year after implementation, despite evidence of improved performance.[26] Smith and colleagues found that negative attitudes were often related to technical problems and perceptions that computerization did not reduce time needed for care planning.[27] Similarly, Kossman reported that the EHR enhanced nursing work with increased information access, improved organization and efficiency, and alerts, but the nurses reported increased documentation time, decreased interdisciplinary communication, impaired critical thinking, and decreased quality.[28] More recently, Urquhart and colleagues completed a systematic review of nine published studies that assessed the effects of record systems on nursing practice and patient outcomes.[29] They found limited evidence that record systems (paper or electronic) had an effect on practice. However, they noted that researchers had the most success in understanding the successes and failures of nursing documentation when their studies evaluated discreet, focused problems as foundational steps toward studying the impact of care planning systems on the EHR as a whole. They concluded that more research, especially qualitative, was needed to explore the relationship between practice and information use as a precursor to designing and testing nursing information systems.

According to the American Nurses Association Scope and Standards of Practice, nurses must demonstrate the use of the nursing process, "a critical thinking model . . . comprised of the singular and concurrent actions of six components: assessment, diagnosis, outcomes identification, planning, implementation and evaluation".[30] Nurses work with patients and other key partners to develop an individualized "plan" to attain "expected outcomes." Nurses are expected to integrate evidence and research findings into their practice (Standard 9) and contribute to quality practice (Standard 10). As systems transition to electronic processes, new designs and tools must be used to support nurses to do their "work" by including the capture of nursing-sensitive data and the use of tools that support nursing judgment in carrying out activities that are independent, interdependent, and delegated in situations where patient care requirements, decisionmaking, authority, and control over performance vary.[31]

Although nurses would like to use evidence in their practice, nurses often report that they do not have the time or the skills to retrieve, evaluate, and incorporate evidence into practice.[32, 33] Gale and Schaffer studied organizational readiness for evidence-based practice (EBP) and found that staff nurses and managers both agreed (91-100 percent) that EBP was essential for effective practice, but that decreased time, decreased staffing, and not having the right equipment were the top barriers to EBP adoption.[34] Prior and colleagues found that adoption of evidence-based clinical guidelines was often poor and that failures were most often related to how the guidelines were implemented.[35] They advised the use of multifaceted implementation strategies including interactive education, audit/feedback, and the use of electronic CDS to improve effectiveness.

Researchers have started to demonstrate that EHR-based strategies provide a vehicle for positioning evidence to providers at the point of care,[36] for capturing complete and accurate data by health care professionals,[6] to support voluntary and mandatory safety reporting,[37] and for developing practice-based knowledge and best practices for patient safety.[37] These findings provide support for automating evidence-based patient care assessment and CDS-based processes for the bedside nurse.

Anderson and Willson identified, however, that nursing science base for creating and using CDS remains in its infancy and that nursing is significantly behind the progress made by medicine.[38] These systematic reviewers identified six mixed methods research studies aimed at investigating CDS-facilitated decisionmaking by nurses, with limited use of theory. Many of the evidence-based protocols were paper-based, which made it difficult to integrate into workflow, evaluate, and link clinical processes with patient outcomes. They concluded that a knowledge gap existed related to nurses' use of CDS to enhance evidenced-based practice.

Similarly, Randell and colleagues conducted a systematic review of research examining the effects of CDS on nursing performance and patient outcomes and identified that only a small number of studies (n = 8) were published, with inconsistent results.[39] These reviewers suggested that the lack of impact was the result of issues beyond the computer-interface including varied work processes and organizational issues, information that may not be included in published research reports. They encouraged researchers to design studies to evaluate the variation in adherence to CDS recommendations and CDS use at the level of the practitioner. In a subsequent study, these researchers set out to identify barriers and facilitators to effective CDSS use by nurses.[40] In addition to previously identified barriers, they found an unanticipated interaction between nurse experience and their ability to adapt (over-ride or work-around) to make the technology to "fit" with their local clinical practice, leading to an increase in variation.

Data capture and quality outcome evaluation provides rich evidence for evaluating adherence to guidelines and improving practice. Jamtvedt and colleagues reported that audit and feedback produced small to modest effects on improving professional practice when baseline guideline adherence was low and feedback was delivered intensively.[41] More research with designs that include strategies to conceal audit processes, control bias, and capture key aspects of feedback intensity (recipient, format, source, frequency, duration, and content) is needed. The reviewers reported that audits were most often done in the context of governance when the need for practice changes was evident. It has not been determined which, if any, features of the audit and feedback process had the most impact or how long the effect would be sustained when feedback stopped. Bucknall added that feedback is more likely to have a positive effect when it is framed as a learning goal, however, it must be balanced in ways that lead professionals to accept responsibility for practice improvement when appropriate.[42]

Using Evidence and CDS to Improve Fall Outcomes

The prevention of patient falls in acute care is a nationally recognized initiative supported by several organizations including AHRQ, the National Quality Forum (NQF), the Centers for Medicare & Medicaid Services (CMS) and the Joint Commission. Patient falls and fall-related injuries are patient outcomes that are considered to be "nursing sensitive" because they improve when there is a greater quantity or quality of nursing care.[43–46] Falls account for a significant portion of injuries in hospitalized patients,[47] with an estimated cost of at least $6,437 per fall not

including the costs of long-term rehabilitation, lawsuits, and pain/suffering.[48] Because of these findings, the Joint Commission established fall prevention to be one of their National Patient Safety Goals.[49] The Centers for Medicare & Medicaid Services recently added "Falls & Trauma" (specifically fractures, dislocations, intracranial injury, crushing injury and burns) to the list of hospital-acquired "never event" conditions in which Medicare reimbursement will be reduced for incidents that suggests poor quality care.[50]

The literature on falls and fall-related injury in acute care is extensive.[51–70] Prevention efforts have focused on identifying high-risk patients and reducing risks.[49, 59, 67] The evidence remains inconclusive that any single or multifactorial fall prevention interventions can effectively prevent falls among hospitalized patients.[52, 66, 68, 71] More recently, researchers recommend moving away from a standardized list of interventions and focusing more on tailoring interventions to address the patient's most significant fall risks.[53, 59, 71, 72] Electronic mechanisms can be used to support nurses to identify risks and select appropriate risk reduction strategies offers a promising avenue for intervention.[37, 53, 59, 72, 73]

Currently, there is only one published research report that has tested electronic mechanisms to link fall risk factors with appropriate prevention activities in acute care.[74] In most cases, however, risk assessment and intervention selection continues to be a manual process. Essential patient and care data elements can be embedded into the EHR and extracted into new CDS tools. These new CDS tools could be designed to provide nurses with data to support fall prevention care planning for individual and groups of hospitalized patients.

Engaging Patients in the Fall Prevention Plan

A high percentage of falls occur when patients are not in the presence of a caregiver[58, 61, 63, 64, 66, 75] - making patient education an important part of fall prevention programs.[55, 76] In addition to receiving education, the patient must choose, if they are able, to actively participate in the fall prevention activities that are planned.[59] Participation often involves using the call light, asking for help, and cooperating with risk-based interventions including safe mobilization and toileting. Carroll and colleagues interviewed previously hospitalized patients about their perceptions about falls.[77] Patients in their study reported urgent toileting, loss of balance, and unexpected weakness as the most common causes for falls. They also perceived that nurses were too busy to respond to calls for help. Tzeng and Yin reported that postdischarge patients perceived that fall prevention education was insufficient and that nurses were not available when needed.[78] Ideally, patients must be informed of their fall and injury risk factors and must be engaged with the nursing staff in a plan based on anticipated needs—especially when multiple demands limit nurse availability.[54, 59, 76]

Conclusions and Implications for the Project

Thus, this project was based on previous research recommendations, focusing on designing CDS to focus on fall prevention (a specific care issue) to demonstrate that CDS can improve nursing performance and patient outcomes.[29] Further quantitative and qualitative (mixed) methods were used to gather information at baseline (context) and to design tools with content and "fit" placement within the workflow to address identified needs.[17, 39, 40]

Chapter 2: Methodology

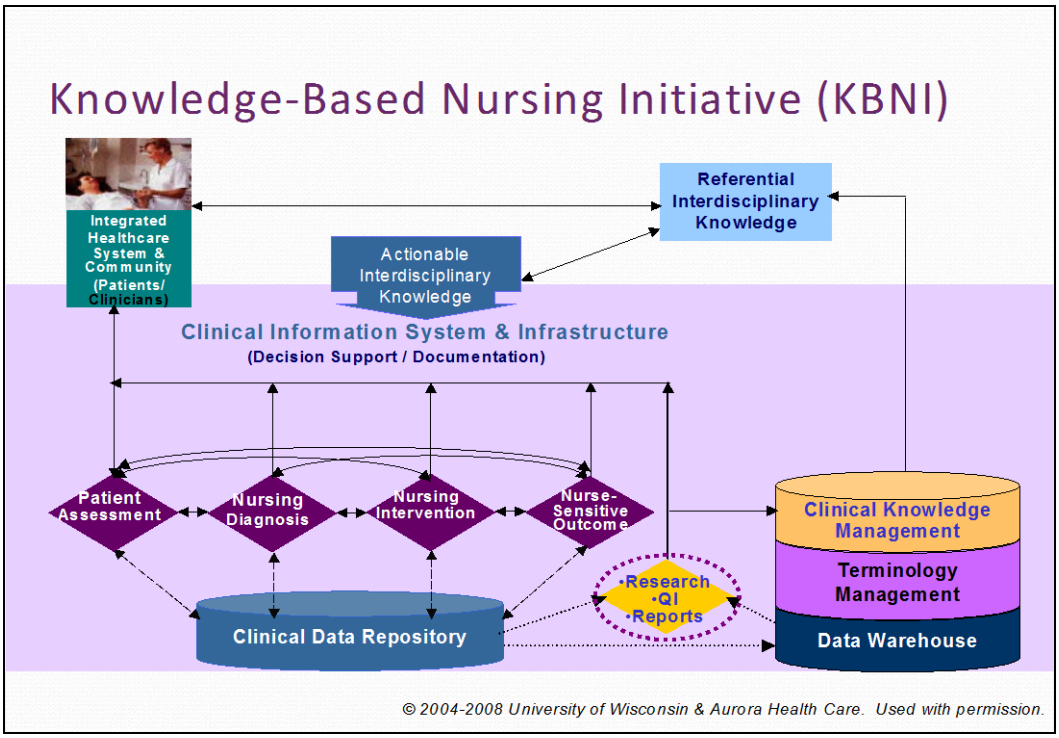
This project focused on designing CDS tools to assist nurses in their fall prevention activities, specifically related to planning care, engaging patients/family in fall prevention, and carrying out quality improvement activities. Data, captured from patient care documentation (primary use), were extracted from the clinical data repository by a tool that displays the data (secondary use) to support nurse decisionmaking. Three tools were developed: (1) a Care Planning CDS (CP-CDS) tool for use by point of care nurses; (2) a Quality Improvement CDS (QI-CDS) tool for use by nurse managers; and (3) a Patient and Family Member Education (ED) tool for use by nurses to provide information to patients. Two conceptual frameworks were used to guide this project.

Using Conceptual Frameworks to Guide the Effort

The Knowledge-based Nursing Initiative (KBNI) began as a partnership between an integrated health care delivery system, an academic college of nursing, and an EHR solution provider in 2003.[79] The partnership created a framework for using EHR technology, the nursing process and workflow, and best research-based evidence to provide real time decision support to clinicians thus enabling them to improve patient outcomes.

The conceptual framework (Figure 1) depicts the process for creating a "clinical decision support and documentation system that is able to prompt, collect, store, aggregate and report data . . . to promote the delivery of accessible, acceptable, efficient, high quality health care . . . and the attainment of the healthiest outcomes."[79]

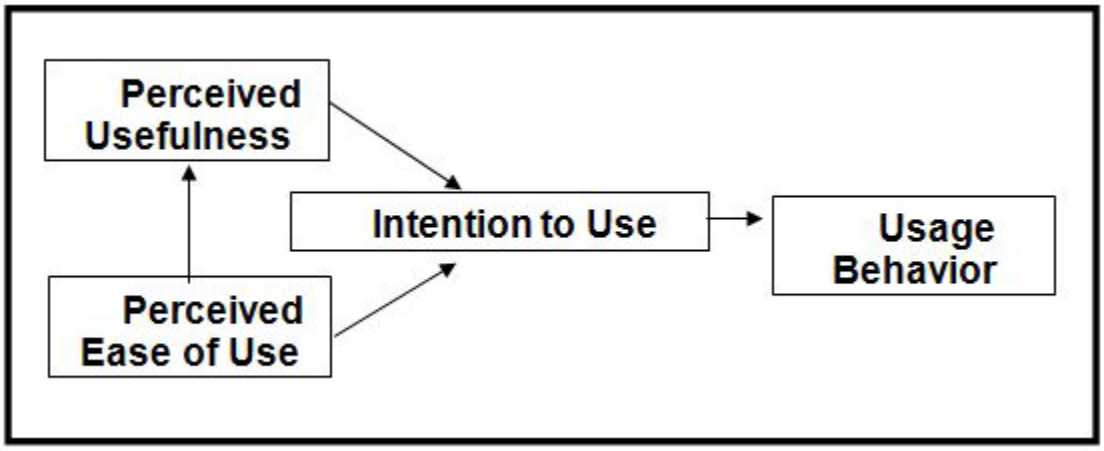
Figure 1. Knowledge-based Nursing Initiative (KBNI) conceptual framework[79]



According the framework, key evidence-based and standardized data elements and CDS tools are created and embedded into the EHR. These data elements and tools support nurses to systematically gather history and physical assessment findings and use them to drive problem identification and the selection of risk/problem-specific interventions to achieve patient outcomes. Once documented (primary use), key data elements are available in the clinical data repository for extraction and secondary use, providing nurses with feedback about individual and/or aggregated care data to support quality improvement and research.

The Technology Acceptance Model (TAM) is a theory that has been used to predict and explain health IT acceptance and use. The model posits that end-user perceptions about usefulness and ease of use impacts their intention to use and actual technology use.[80] "Perceived usefulness" refers to "the degree to which a person believes that using a system would enhance his or her job performance".[80] "Perceived ease of use" refers to "the degree to which a person believes that using a particular system would be free of effort".[80] These two determinants, which are the two most salient behavioral beliefs about using technology and known to affect intention to use and actual use of technology,[81] were the focus for this evaluation.

Figure 2. Original technology acceptance model[82] (adapted and reproduced with permission of AMIA)



Several researchers have used the original TAM-based construct[82] (Figure 2), while others have suggested adding more variables such as subjective norms,[82] experience, output quality, image, voluntariness,[82] computer self-efficacy,[83] documentation accuracy,[84] trust and compatibility.[85] The additional theoretically motivated variables have not been standardized for broad application[81] so they were not used in this study.

Procedure

A pre- and post-implementation mixed methods design was used to study existing fall prevention processes in place at one acute care hospital and to use the findings to design, build, deploy, and test the CDS tools to meet project goals. The CDS tools were designed to bring data elements extracted from an existing EHR into viewable templates that could be introduced into the workflow of the nurse to facilitate care planning and provide direction for unit-based quality improvement efforts related to fall and fall-related injury prevention. Published literature and input from expert consultants on fall prevention, informatics, and human factors/workflow provided the basis for selecting the key qualitative and quantitative measures used to evaluate nursing workflow, EHR-interaction related to care planning, staff communication patterns, and nurse perceptions about how CDS tools could improve their current fall prevention processes.

The project was reviewed by the Institutional Review Board (IRB) at Aurora Health Care and the University of Wisconsin-Milwaukee and was determined to be exempt from IRB oversight. All protocol revisions were submitted and also determined to be exempt from IRB oversight. The information collection used in this project was acquired as part of Aurora's ongoing employee satisfaction process and was not funded by this task order. Since the information was collected by the organization for internal use and the data made available for this research, it was not subject to Paperwork Reduction Act clearance from the Office of Management and Budget.

Study Setting

The CDS tools were implemented on two 36-bed acute care units in a large, urban, tertiary care medical center, a designated Magnet institution since 2001. Magnet designation means that the institution completed and maintained all the requirements of the Magnet Recognition Program®. The Magnet Program was developed by the American Nurses Credentialing Center (ANCC) to recognize health care organizations that provide nursing excellence and provide consumers with a benchmark to measure the quality of care that they can expect to receive.[86] The two acute care units (Table 1) were selected because the patient populations were similar and both had care needs sensitive to nursing practice, and stable unit-level nursing leadership.

Table 1. Characteristics of the study units

Characteristics	Unit A	Unit B
Unit Type & Specialty	Medical/Telemetry Acute Care for Elderly	Medical/Telemetry Heart Failure
Centers for Medicare & Medicaid Services (CMS) Case Mix Index	1.3632 (Admitted) 2.0829 (Transferred In)	1.5425 (Admitted) 2.0012 (Transferred In)
Patient Volume (over 6 months)	1,167 Patients 4,596 Patient Days Admissions = 76% Transfers In = 15% Observation Patients = 11%	1,412 Patients 4,899 Patient Days Admissions = 71% Transfers In = 10% Observation Patients = 17%
Patient Age	Average Age = 67 years (±19) 61% ≥ 65 yrs	Average Age = 68.5 years (±17) 60% ≥ 65 yrs
Average (Avg) Length of Stay (LOS)	Inpatients Avg LOS = 5.4 days (±6.0) Patients w/ LOS ≤5.0 days = 68% Observation Avg LOS = 1.6(±0.8)	Inpatients Avg LOS = 5.1 days (±5.0) Patients w/ LOS ≤ 5.0 days = 64% Observation Avg LOS = 1.7 (±0.8)
Discharge Disposition	Home/Self Care = 59%; Home with Home Care = 13% Skilled Nursing Facility =18.4% Inpatient Rehab = 4% Hospice = 2.1% Expired = 1.7%	Home/Self = 63% Home with Home Care = 11% Skilled Nursing Facility = 15.5% Inpatient Rehab = 3% Hospice = 2% Expired = 1.6%

The nurse leaders and staff of the study units were actively involved in the design and implementation of KBNI in the existing EHR since 2008. The KBNI fall and fall-related injury prevention and postfall care recommendations[59, 87, 88] including fall-risk screening with the Morse Fall Scale[62, 63, 64] were adopted by the organization as the basis for system-wide nursing policies and procedures for all sites within the organization. The fall prevention policy described that patients at risk for falls should be identified with risk communicated across departments, allowing each department to determine its own communication method. Most units, including Study Units A and B, choose to implement several strategies to identify patients who are at risk for falling, including red nonslip slippers, paper chart markings, and entries in the EHR-based communication tools. Study Unit B also used “falling leaf” signs posted on the room door for each patient. All staff members were expected to work to maintain the accuracy of the process.

In addition to these clinical processes, KBNI content was embedded into the EHR at the organization in July 2008. The embedding process involved the creation of new data elements and CDS triggers to prompt the nurse about the presence of key fall risk, injury risk, special conditions, and when the patient is not participating in activities to prevent falls. Once the risks were identified, the CDS trigger guided the nurse in selecting the appropriate diagnosis (Risk for Falls and/or Risk for Fall-related Injury) and provided a screen that displayed identified risks to support the nurse to select appropriate interventions to prevent falls based on identified risk(s). The design was based on nurses actively reviewing and updating their care plan to prevent falls every shift; as well as when the documentation of new risk factors triggered a plan review. If a fall occurred, a standardized postfall order set is initiated in the EHR to send tasks to the task list to prompt the nurse to complete postfall assessments to evaluate for injury and monitor for symptoms of injury in patients who have injury risk factors. When a fall occurs, nurses also complete the organization-specific risk management incident report. The risk management incident reporting system is Web-based for easy access, but requires the nurse to document data in the report, duplicating the information previously entered into the EHR.

In addition to the KBNI data elements and CDS, the not-for-profit integrated health care system had a pre-existing enterprise-wide Cerner Millennium EHR system (2007 Code; HIMSS EMR Adoption Model Stage 6) for all 14 hospitals, laboratories, rehabilitation centers, home health care, and most of the 155 medical clinics. This system had EHR-provider-based features for electronic admission/discharge/transfer processes, laboratory, radiology, and clinical documentation, and a closed-loop system for medication administration with integrated pharmacy system. It also had several feature functions that were unique to the health care organization including: policies and functionality for "Charting by Exception,"[89] the selective use of the "last charted value" (LCV), and "required fields" that required staff to complete data fields prior to signing and exiting the form.

In addition to the technical features of the EHR as described above, several other aspects of the sociotechnical context[18] for the study should be mentioned. During the study period, the integrated health care system was actively engaged in planning and implementing several important strategic projects including; the opening of two new hospital-based health care facilities, deploying new EHR functions which included electronic medication reconciliation, bar-coded medication administration, and computerized physician order entry (CPOE) at four of the largest facilities in the system. Each of these projects were supported by top management, perceived to be a strategic priority, carried urgent and aggressive timelines, and utilized some of the same expert clinical and health IT resources as needed for this study. New KBNI content was continually being developed and deployed in the EHR every 6 months, requiring staff to participate in training, skill verification, and go-live activities to take on the new skills.

Baseline Quantitative and Qualitative Measures

The project team utilized literature and consultant input to identify key measures for evaluating the current state and evaluating the impact of the CDS tools after implementation. Quantitative data were gathered from the following data sources to describe the state of falls and fall-related injury events prior to the study (January–June 2009):

1. Queries from the existing EHR for patients age 18 years and older
2. The electronic Web-based risk management incident reporting system
3. The unit-based nursing quality report using nurse-sensitive measures established by the Joint Commission based on the NQF-endorsed nursing sensitive care measures [90]
4. CMS Hospital-acquired condition (HAC) reports based on fall-related injuries reported by physicians and coded (ICD-9 e-codes).[50]

In addition to the data queries, the team used observation, focus groups, and survey methods (Table 2) to gather and explore the nurses' workflow processes and the interaction with other caregivers and the EHR. Staff members were informed about the study through established unit communication mechanisms including staff meeting announcements, flyers/postings, and email messages. An informational sheet was distributed to describe the study and to provide informed consent information for focus groups and survey participation.

Table 2. Participants and methods used to study baseline processes

Participants	Observation	Focus Groups	Online Survey
Registered Nurses (R.N., n = 67) as front line staff from all shifts including weekends. Some Staff R.N. held elected unit-based positions as staff nurse leaders in shared governance	Two Project Team members carried out structured field observations for 30 hours over 10 days, sampling all shifts for periods of 3-5 hours at a time. Target activities included "shift report', R.N.-R.N. & R.N.-NA communication and care planning. (Refer to Appendix D for Field Observation Process and Data Collection Form)	Three R.N. Focus (n = 12) Group sessions were held. Staff nurses were asked questions about care planning and patient education related to fall prevention. (Refer to Appendix E for Focus Group Moderator Guides for Registered Nurses)	R.N. Staff Nurses (n = 27/67, 40% response rate) completed an online survey (with email link) that asked questions about current fall prevention care planning and quality improvement processes to identify usefulness, ease of access, satisfaction and intention to use a new tool if available (Refer to Appendix G for R.N. Survey)
Nursing Assistants	Nonparticipant observations included target activities of the NA including NA-NA and R.N.-NA communication.	Three NA (n = 11) Focus Group sessions were held. (Refer to Appendix F for Focus Group Moderator Guides for Nursing Assistants)	Not Applicable
Manager (n = 2) One from each unit	Nonparticipant observations included weekday Outcome Facilitation Team (OFT) meetings, attended by the managers.	One Manager/CNS Focus Group sessions was held. (Refer to Appendix E for Focus Group Moderator Guide for Registered Nurses)	Not Applicable
Clinical Nurse Specialists (CNS n = 2) One from each unit	Nonparticipant observations included CNS unit-level activities including OFT meetings.	One Manager/CNS Focus Group sessions was held. (Refer to Appendix E for Focus Group Moderator Guide for Registered Nurses)	Not Applicable

Field Observation

Caregiver and workflow field observations were used to understand what nurses and nursing assistants do to prevent falls at baseline (Refer to Appendix D: Field Observation Process and Data Collection Form). Observational sessions were conducted in 3-5 hour intervals with two observers (Hook and Joosse) assigned to observe staff at each end of the unit hallway, each with the ability to observe the nurses' station and conference room. Observations were specifically focused on examining several key patient care processes including the coming on shift "report" and handoff process, the patient admission process, the outcome facilitation team (OFT) meeting process,[91] and the ongoing patient care process with documentation and care planning. The observations were conducted to capture information about how fall risk, injury risk, and risk-specific prevention strategies were communicated to other nurses, nursing assistants, and patients/family members and how the nurse interacted with the EHR for fall prevention. Field observation notes were recorded by the observers, and compared and analyzed by the project team members and consultants to identify common and less common practices.

Focus Groups

Focus group sessions were conducted by two project team members (Hook and Joosse) using a semistructured discussion format. After obtaining consent from participants, the sessions were audiotaped and transcribed without participant identifiers. Separate sessions were held for R.N. and NA staff (Refer to Appendixes E and F: Focus Group Moderator Guide for Registered Nurses and Nursing Assistants). The focus groups were designed to obtain staff perceptions about the current state and to clarify the findings from the field observations about workflow, communication, care planning, and staff interaction with the EHR. Participant responses were compared to the observation data to verify the common and less common practices and confirm observed gaps in the process that may be improved with CDS tool. The focus group findings were also used to guide the development of more precise survey questions.

Staff Nurse Survey

The final phase of baseline data gathering consisted of an online survey for the staff nurses with questions commonly used to evaluate technology acceptance.[80] The aim of the survey (Refer to Appendix G: Registered Nurse Survey—Baseline) was to gather more specific information about the ease of use, perceived usefulness, and effectiveness of current care planning processes related to fall prevention in a way that could be quantified and compared as pre- and post-implementation measures. All staff nurses received an email with a link to the online survey. Participants logged in and answered questions during times that were convenient during their work shift. The survey took approximately 10 minutes.

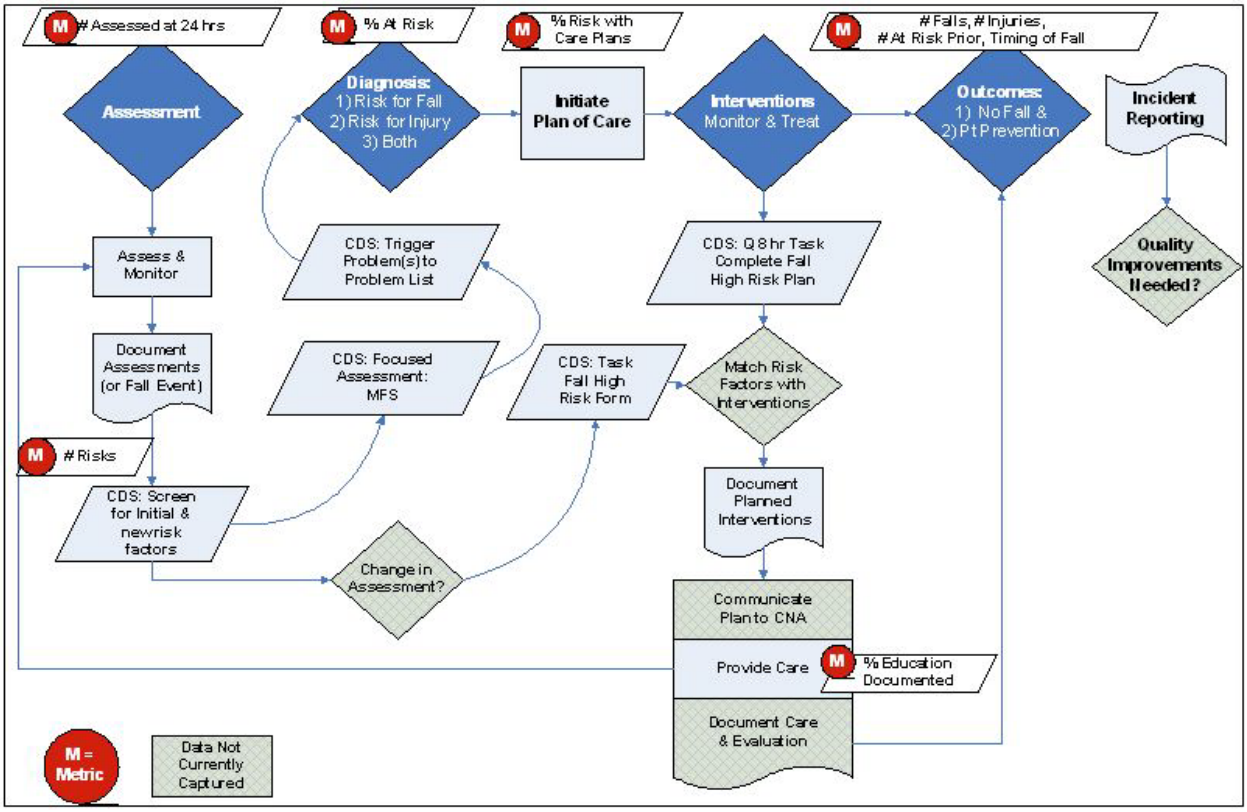
Analyzing Baseline Data to Inform CDS Tool Design

Baseline data from all sources were used to identify the common and less common practices while identifying gaps in the current proccess where the insertion of a CDS tool could improve care planning and/or quality improvement activities. Based on the baseline findings, the content and logistics for three tools were developed to support nursing in care planning (CP-CDS tool), provide a framework to teach patients about their risk factors and individualized fall prevention plan (ED Tool), and to present aggregate data for quality improvement (QI-CDS tool). This section will include information about how baseline data were analyzed to inform tool design.

Process Model of Fall Prevention at Baseline

A graphic model was created (refer to Figure 3) to depict the existing electronic care planning and quality improvement processes operating at the study sites at baseline. The red circles in the model depict the standard metrics that were being captured and used by the organization to evaluate adherence to the KBNI processes. The process model describes how the electronic care planning process is designed to work.

Figure 3. ACTION process model of fall prevention at baseline



Baseline Results

Baseline findings were summarized and used to inform the content and logistics of tool design:

- The baseline metrics indicate that almost all (98 percent for both units) patients admitted to the Study Units had fall-risk assessments documented within 24 hours. A high percentage (67 percent Unit A and 65 percent Unit B) of patients are at risk for predicted falls with a slightly higher rate (72 percent Unit A and 73 percent Unit B) of patients at risk for fall-related injury (related to special conditions and/or the use of anticoagulants). For Unit A, many patients were admitted with fall-risk factors related to immobility with 47 percent reporting the use of an assist device and 25 percent with a gait abnormality. Incontinence was reported as an ADL problem for 47 percent of patients, with 25 percent of patients with memory (25 percent) or orientation 8 percent abnormalities. Many (25 percent) had elevated coagulation (PT/PTT) studies. For Unit B, similar risk factors incidence was observed: assist device (48 percent), gait problems (34 percent), ADL-reported incontinence (21 percent), memory problems (26 percent) or orientation problems (22 percent) deficits, with elevated coagulation studies (28 percent). Care Plan initiation varied by unit. For Unit A, 92 percent of patients at risk for falls had a fall prevention care plan initiated, and 74 percent of patients at risk for fall-related injury had a care plan initiated. For Unit B, 97 percent of patients at risk for falls had a fall prevention plan and 77 percent of patients at risk for fall related injury had a care plan initiated. A lower than expected percentage (11 percent Unit A and 49 percent Unit B) of patients with documented risk-factor received patient-specific risk teaching as prescribed by the care plan.
- Workflow processes were complex with no standard workflow. Each nurse determined his or her own organizing process for gathering information and providing care.
- The coming on shift “report” process involved the R.N. sitting with a computer, reviewing the EHR screens, preprinted report sheets (per nurse preference), and hand-written notes for each patient with manual synthesis and forecasting of care. Report took about 45-60 minutes for 4-10 patients depending on the shift (day, evening, or night). The process concluded with off-going nurses providing brief informal comments to update the on-coming staff. The nurses left the conference and the computers to begin patient care.
- Nurses reported that they “did not trust” the printouts and aggregate data (overview) screens, often taking steps to review the EHR order section to make sure “things weren’t missed”.
- Nursing Assistants (NA) relied on peer report and visual fall-risk cues in the rooms (e.g., red nonskid slippers, falling leaf signs, etc.) for the first 1-2 hours of their shift. (These visual cues were often found to be inaccurate when compared to the plan of care for the patient.) When R.N.-NA report occurred, communication focused on tasks (e.g., vital signs, diet, blood sugar) with few details about the fall prevention plan. NAs reported understanding how to initiate and carry out intensive surveillance (e.g., bed/chair exit alarms, low beds, toileting, and supervision) but were not able to verbalize when and what to do when less intensive fall prevention was needed.
- Some nurses reported that they did not utilize the existing electronic CDS tools that identified specific patient risk factors, preferring to plan and care for patients based solely

on the Morse Fall Scale number and a standard set of "safety" practices (e.g., bed alarm, safety teaching).

- Outside of the admission process, nurses were rarely observed documenting in the EHR at the patient bedside (real-time). Most nurses documented in the EHR at the nurse's station after initial patient care was given.
- Patient Education documentation was focused on environmental "safety" topics. Rarely do the staff document on the teaching topics associates with patient-specific risk factors (despite the fact that the verbalization of risk factors was a required outcome in the electronic plan and that nurses documented that the plan was reviewed each shift).
- The survey indicated that staff did not feel their current process helped them to know which of their assigned patients were at risk for fall (73.9 percent) and what to do or communicate to others about fall prevention plans (78.3 percent). The current process was perceived as ineffective (refer to Table 3), but nurses could not articulate what they thought would make it better.
- The EHR and incident reporting system queries did not produce a matched set of fall events. The EHR-based queries "missed" patients (n = 8) because the nurses documented the fall event on forms that did not pull into the report. The incident reporting system queries "missed" patients (n = 11, 5 on one unit, 6 on the other) because they were not entered. The incident system fall prevention query also included patients who had an "incident" but it did not meet the criteria of a fall. Each unit had fall event rates that exceeded the established benchmark; however, based on this evaluation, the event rates were even higher than previously reported.
- One HAC related to falls and trauma (finger fracture) was reported in the baseline period.
- Nurse leaders manually accessed data from multiple sources with manual analysis and delayed reporting. The managers reported: "the current system for gathering the necessary data they needed to examine falls in the department was cumbersome and not effective."
- Established fall/injury process and outcome data elements required for external benchmark reporting were drawn from the incident reporting system. These data were frequently incomplete. These data elements were in the EHR, but currently not extracted into a report.

Table 3. Survey comments at baseline

Care Planning Comments	Quality Improvement Comments
"There is a lot of information in [the EHR] to look through, so most of what we get in shift report is from our verbal bedside report. [The EHR] is too cumbersome. " "Seems like every patient has the exact same plan." "The care planning process is more of a guide that something that prevents falls." "We are always looking for ways to keep our patients safe. Something that is easily accessible and patient specific would be great." "Almost every patient comes back as a fall risk. All these interventions which are not always pertinent can easily get overlooked because it seems like everyone should have the red booties, bed check, and low bed."	"[I] Should be hearing details about falls as they happen, not only monthly." The incident reporting system is only as good as the person filling it out, and has been very time consuming. Staff get kicked us out and it does not allow for all the variables that we need to add. We usually have to do manual investigation to get all the info." "Most effective [fall prevention strategies] is the verbal discussion at the beginning of the shift. Huddles have been helpful." "The current quality improvement process is very manual." "The [incident reporting] system is cumbersome, it doesn't ask the right questions, and it is hard to retrieve the data."

Implications for CDS Tool Design

The baseline data revealed that staff relied on multiple methods to obtain the data they needed to plan and/or improve care. They relied on visual cues and Morse Fall Scale Scores to identify patients who were at risk for falls. Limited information regarding fall risk and appropriate intervention strategies was exchanged between caregivers and between caregivers and patients/family members. Based on the baseline results, the project team developed some basic requirements for the design of each CDS tool.

The CP-CDS tool needed to contain valuable risk-specific care information prior to completing the report process so that the details could be communicated to caregivers and used to guide care. The staff wanted something that was accessible and easy to view, able to display information about all assigned patients, and provided them with information about previous falls and the risk-based interventions that were planned.

The QI-CDS tool was intended to replace the manual processes used to gather, organize, and analyze unit-specific fall events. Requirements for this tool included the need for accessing accurate, complete, and near real-time data about the falls on their unit using data documented in the EHR. This includes the ability to calculate fall and fall-related injury rates based on time-spent on the unit. The nurse leaders also wanted a way to capture data elements required by external benchmarking organizations including the following:

- Date and time of the fall
- Who was involved (assisted verses not assisted)
- Morse Fall Score (MFS)
- Date and time of last recorded MFS before the fall
- Was the patient at risk for fall before the fall?
- Was a care plan in place?
- Were the care plan interventions followed?

The staff reported that they were comfortable teaching patients about safety interventions, but they did not find it easy to teach patients about their fall/injury risk factors. A new patient education tool was needed to make it easy for nurses to teach patient-specific risks and to get them to engage the patient/family in a personal plan for fall prevention.

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Chapter 3: CDS Tool Design, Build, Testing, and Deployment

This ACTION project was aimed at creating three new CDS tools to bring information to the nurse in the form of electronic reports. The health IT staff employed by Aurora and Cerner created design descriptions, data requirements, nomenclature feeds, and output specifications. The design addressed how the new tools would be integrated within the existing infrastructure and the processes by which the tools would be delivered and/or accessed by the end user. Once designed, the tools were built into the existing system and tested against the system specification to verify that they delivered the required features. Formal testing included technical and clinical validation prior to releasing the tools for use on the study units.

Care Planning CDS (CP-CDS) Tool Specifications

Purpose

The CP-CDS tool was designed to—

- Facilitate the care and treatment of patients by assisting in the identification of patients who are at risk for a fall or fall-related injury and providing details to help nurses plan and communicate risk-specific interventions;
- Increase communication between caregivers and patients/family; and
- Help the nurse to identify when a patient's risk did not match the current intervention plan.

Audience

The tool was designed to provide front line nurses with real-time feedback regarding the status of the fall prevention care plans for their assigned patients. This tool could also be used by unit-based leaders (managers, clinical specialists, shared governance leaders, and superusers) as well as the operational leads for clinical and health information technology implementation.

Tool Specifications

The project team agreed to use an EHR-provider-based prototype tool for this project without customization. The tool was designed to function like a dashboard with multiple care plan sections, allowing users to view the status of each care plan for the patients selected for the aggregate report. The prototype tool design was created with only one care plan section for Falls, with a plan to add additional care plans to the report in the future.

The CP-CDS tool, created using JavaScript and HTML, was made available to users based on self-initiated access using a tab within the existing EHR. The report is sourced directly from

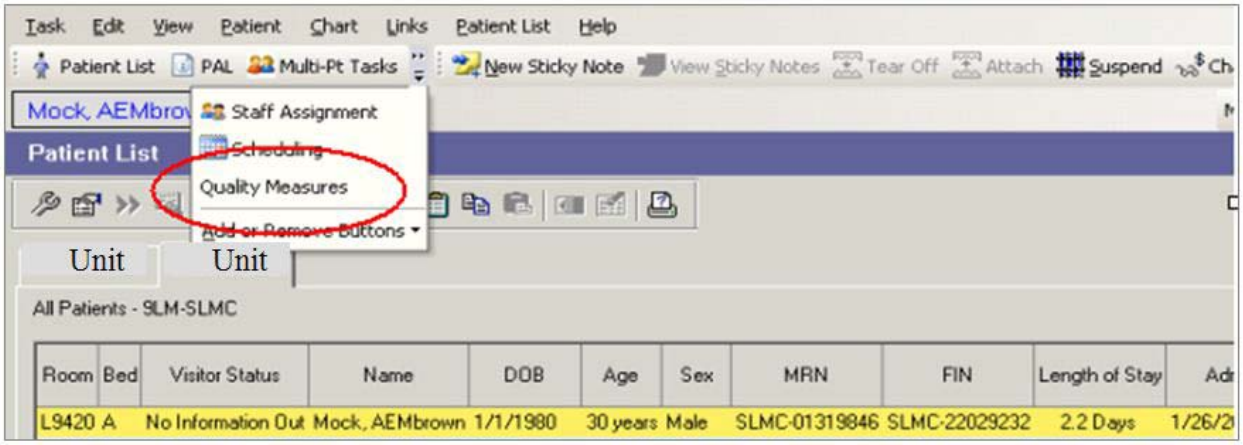
the production EHR database. The default view for the report is based on a unit-level patient list. Users were instructed on how to set up their personal patient list prior to accessing report so that the aggregate report would only display their assigned patients for efficient loading and viewing.

Specific Requirements

- Patients meeting the following general qualifications shall display in the CP-CDS:
    - Patients 18 years of age and older at the time of admission (the age restriction was imposed because the Fall Prevention plan is designed for adult populations).
    - Patients in the facility or facilities specified.
    - Patient types designated as inpatients, observation patients or outpatients in a bed without a discharge date.

- The CP-CDS tool was embedded within the EHR and accessed by navigating to a separate "Quality Measures" tab (Figure 4) visible from the main patient list screen. When the nurse accessed the tab, the tool query was activated and loaded the tool for the entire unit (default) or a selected patient list based on the nurse assignment feature in the EHR.

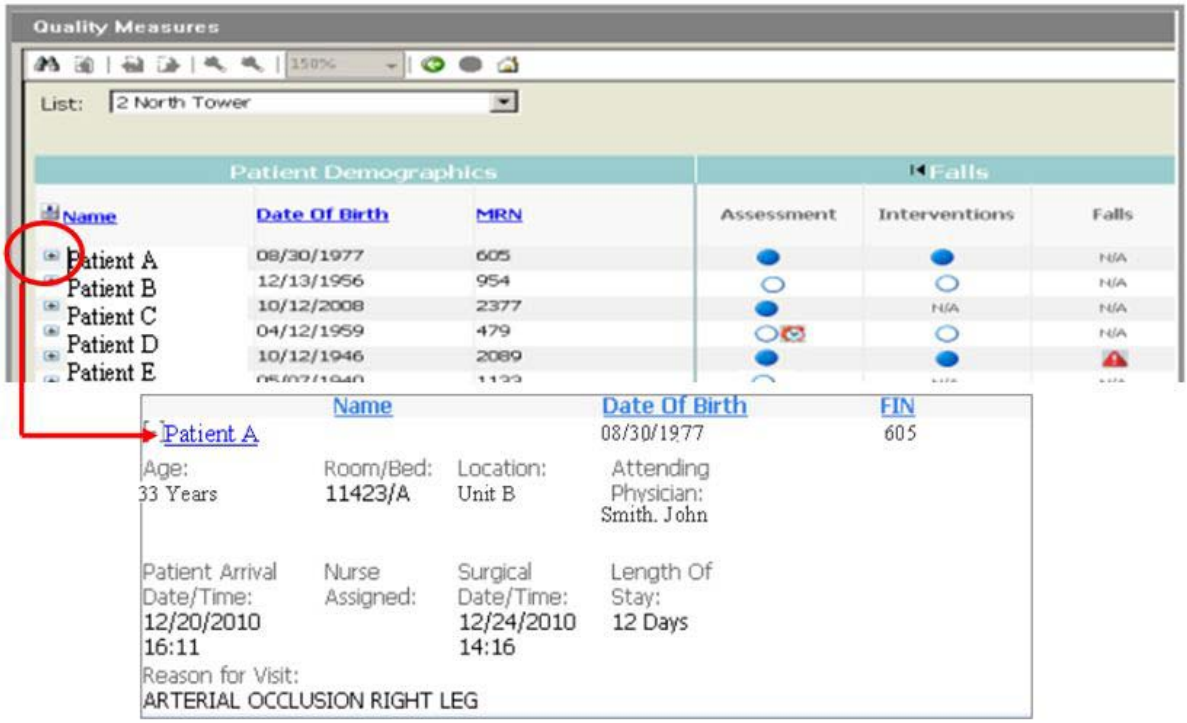
Figure 4. Screen shot of the process for accessing the CP-CDS tool



- The default view for the report (Figure 5) opens featuring a unit-level patient list (left) with two sections: Patient Demographics (left) and the Problem Sections (right). The Patient Demographic section contains minimal identifying information including each patient's Name, Date of Birth, and medical record number (MRU). The patient name has a (+) sign to indicate that more information is available including: age, room/bed, location/(unit), attending physician, patient arrival (date/time), nurse assigned, surgical date/time, length of stay, and reason for visit (refer to example). Hyperlink functionality (designated by blue underlined font) is provided here and in other places in the tool to allow the end-user to link directly to the appropriate section in the when clicked. The

hyperlink must be set up to allow the end-user to return to the CP-CDS after exiting the patient chart.

Figure 5. Screenshot of the CP-CDS tool with patient demographics section detail



- The Problems section on the right (labeled in Figure 5 as “Falls”) provides access to the problem-specific section with icons to display the status of the care plan details for each patient on the list:
  - Assessment
  - Interventions
  - Falls (Outcome)
- The icons in the problem section were designed to give the user a dashboard-type display of the status of each plan detail. Figure 6 shows the icons used to display the status of each of the plan details.

Figure 6. Icons used in the CP-CDS Tool Display

Icon	Meaning
	Not Done
	Item is time-sensitive
	Done
N/A	No action needed at this time
	Event Occurrence

The "Assessment" Plan Detail:

- An empty circle indicates that the risk assessment has not been documented ("Not Done") within the past 24 hours.
- An empty circle with a "clock" icon indicates that the patient has not been assessed but staff have additional time remaining in which to complete the assessment within the established standard (within 24 hours).
- A completed (blue) circle indicates that the Assessment has been documented within the first 24 hours of admission or within the past 24 hours of the patient's stay (based on completion of various risk assessment forms).

The "Interventions" Plan Detail:

- An empty circle indicates the patient was found to be at risk for falls or at risk for injury from fall and the prevention plan was not initiated ("Not Done").
- A completed (blue) circle indicates the patient is at risk for falls or at risk for injury from fall and has a fall or fall-related injury prevention plan of care initiated.
- An N/A indicates the patient has not been identified to be at risk for falls or fall-related injury.

The "Falls" Outcome Detail:

- An N/A indicates that the patient does not have a fall or injury from fall documented.
- An "!" symbol indicates the patient has a documented fall or a fall with injury.

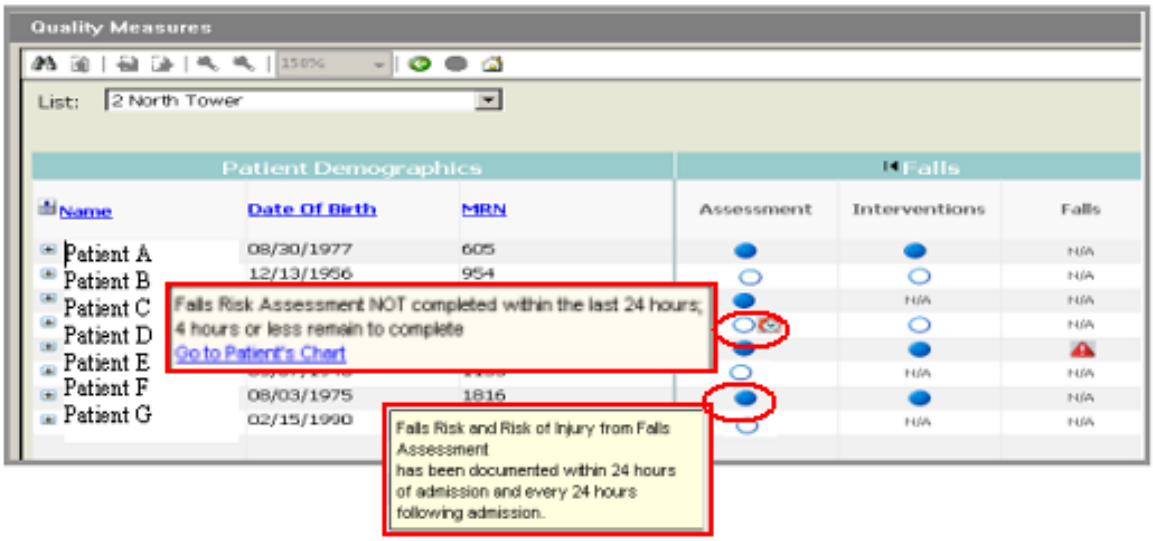
Additional Specifications

The CP-CDS tool was a very condensed screen with visual indicators of status for each patient on the patient list. Mouse "hover over" status indicators were created to display additional information as listed, with a hyperlink to the appropriate place in the patient record where the detail can be completed or reviewed.

The Assessment Detail (Figure 7)

- If the circle is not filled in (with no clock icon), the hover over status indicator will display a message: “Falls Risk and Risk for Injury from falls assessment NOT completed within the last 24 hours.” A hyperlink to the patient record was provided.
- If the circle is blank and the clock icon appears, the hover over status indicator was designed to display a message: “Falls Risk and Risk of Injury from Falls Assessment has not been documented within the last 24 hours; 4 Hours or less remain to complete.” A hyperlink to the patient record was provided.
- If the circle is filled in, the hover over status indicator was designed to display a message: “Falls Risk and Risk of Injury from Falls Assessment has been documented within 24 hours of admission and every 24 hours following admission.”

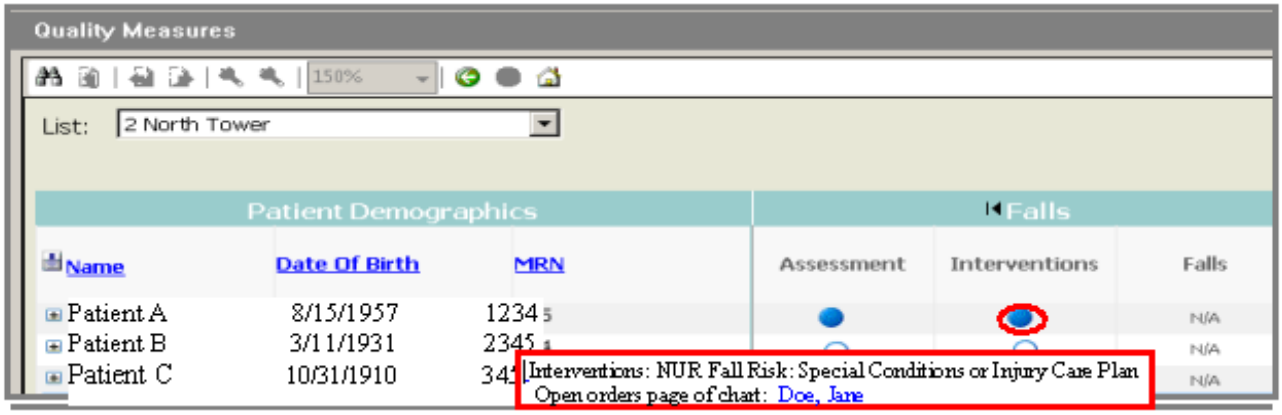
Figure 7. CP-CDS tool mouse hover messages for assessment



The “Interventions” Details

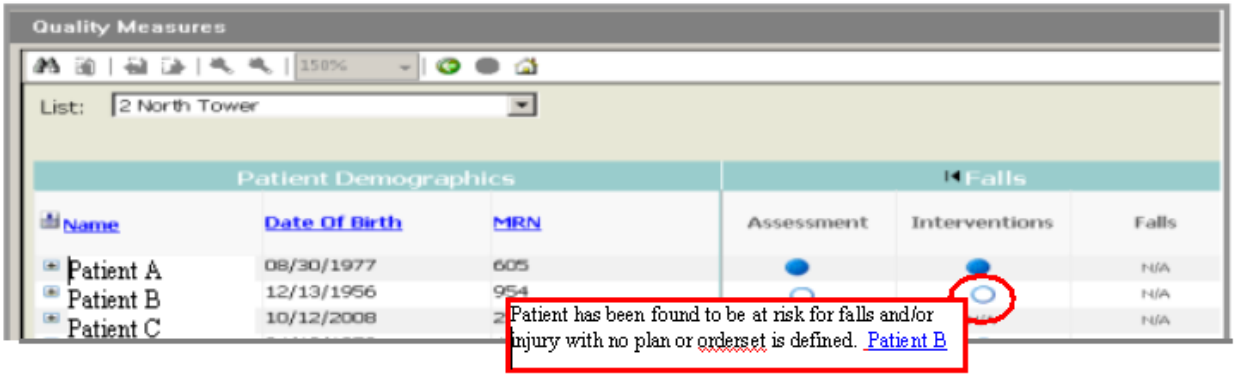
- If the patient is not at risk for falls, the “N/A” message will display with no hover message.
- If the circle is filled in, the hover over status indicator will display a message to identify the most recent plan that was initiated. The example in Figure 8 shows that the Risk for Injury Plan has been initiated, refer to hover message: “Intervention: NUR Fall Risk: Special Conditions or Injury Care Plan”. This icon should be designed to report if one or more plans are initiated. A hyperlink to the “orders” page of the chart takes the user to the care plan section of the patient record to evaluate the plan if needed.

Figure 8. CP-CDS tool mouse hover message for interventions that were "done"



- If the circle is not filled in, the hover over status indicator will display a message: "Patient has been found at risk for falls and/or at risk for injury from falls and no plan or orderset is defined" (Figure 9). The hyperlink with the patient name takes the user to the "orders" section of the patient chart to enter a care plan.

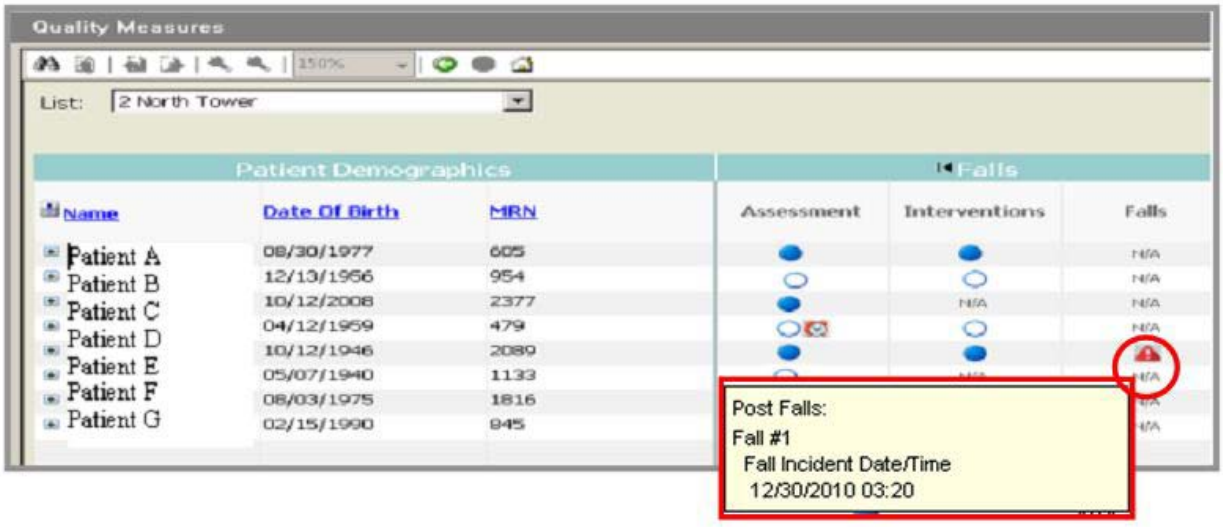
Figure 9. CP-CDS tool mouse hover over message for interventions that were "not done"



The "Falls" Details

- "N/A" status display tells user that no fall events have been documented.
- If a fall (triangle icon) appears, the hover over status indicator will display a message with the date and time of each fall or injury assessment result (Figure 10). If there is more than one fall, the falls will be labeled #1, #2, etc., showing the most recent fall first.

Figure 10. CP-CDS tool mouse hover over message for falls



Quality Improvement CDS (QI-CDS) Tool Specifications

Purpose

The QI-CDS tool was designed to:

- Gather standardized care planning and fall and fall-related injury event metrics into a single report (to replace manual data extraction); and
- Provide unit-based nursing leaders with aggregated metrics to support near-real time evaluation, feedback to staff, and data trending for quality improvement and benchmarking.

Audience

The tool was designed to be used by unit-based leaders (managers, clinical specialists, shared governance leaders, and superusers) as well as the operational leads for clinical and health IT implementation.

Tool Specifications

The QI-CDS tool was created using SAP BusinessObjects software and was made available to users using a secure Intranet site. The data mart exists on an Oracle 10g Release 2 database and utilized primarily Oracle scripts and procedures for data extraction/transformation and loading. Most reporting tools and database options, however, could be used to replicate this

report. The technical descriptions contained within this document are purposefully left generic in most cases.

The report was sourced from a data mart and refreshed daily from the EHR currently in place to support the health care system. The data mart and report contain data through the end of the previous day. When running the report, the user was asked to complete four prompts: Facility, Nursing Unit, Quarter (1-4), and Year to run the report for a single unit and single quarter.

The QI-CDS Tool Requirements

The QI-CDS tool requirements included access to accurate, complete, and near real-time data about the falls on their unit using data documented in the EHR, with the ability to calculate fall and fall-related injury rates based on time-spent on the unit. Further, the tool needed to capture data elements required by external benchmarking organizations including the following:

- Date and time of the fall.
- Who was involved (assisted verses not assisted).
- MFS.
- Date and time of last recorded MFS before the fall.
- Was the patient at risk for fall before the fall?
- Was a care plan in place?
- Were the care plan interventions followed?

The QI-CDS tool was designed as a single report with two tabs or pages that allow the user to change between a Summary view (Figure 11) and Patient Fall Details view (Figure 12). The Summary view contains unit-specific information on the total number of patients, the number of patient days, the counts of the number of falls and fall-related injuries, and the status of fall prevention care planning on the selected unit for the time frame selected.

Figure 11. Screenshot of the QI-CDS tool—summary view (tab 1)

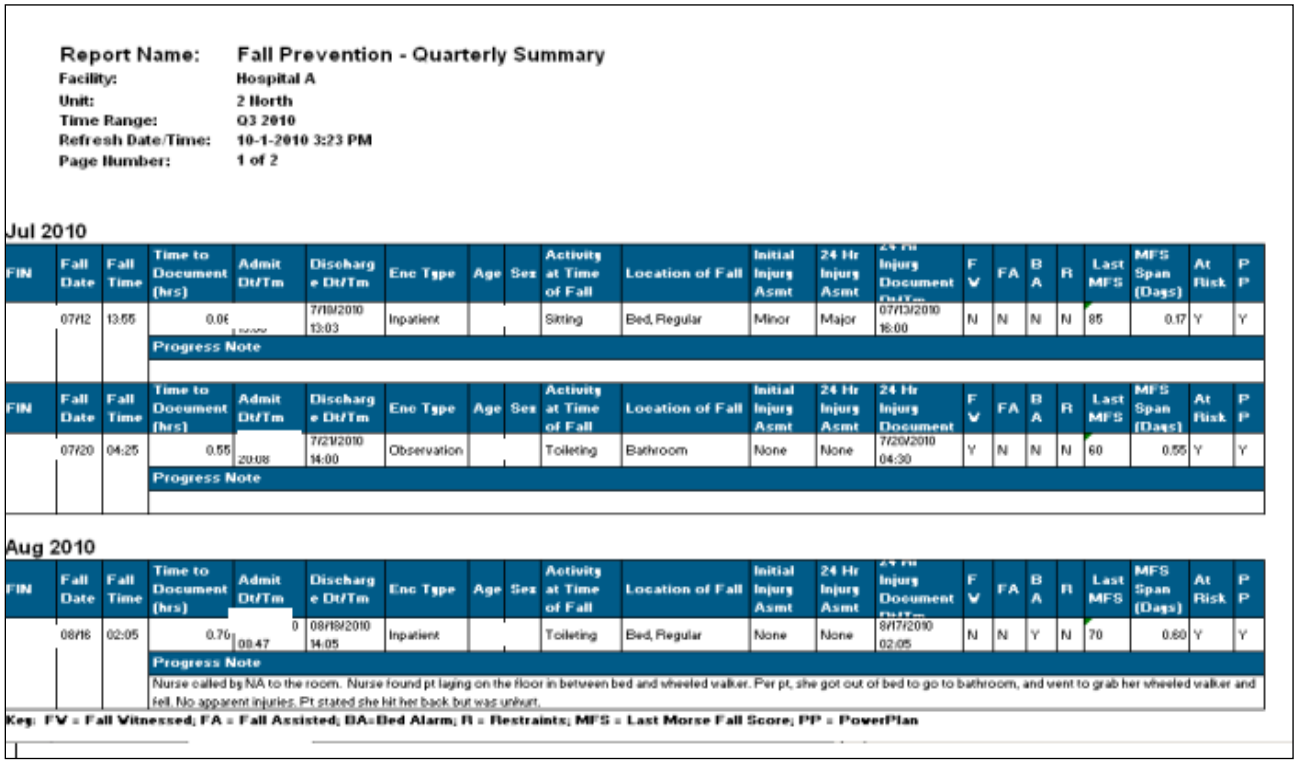
Report Name: Fall Prevention - Quarterly Summary

Facility: Hospital A
Unit: 2 North
Time Range: Q3 2010
Refresh Date/Time: 10-1-2010 3:23 PM
Page Number: 1 of 1

	Jul 2010	Aug 2010	Sep 2010	Q3 QTD
Number of Patients	150	140	145	**420**
Number of Encounters	155	145	150	**435**
Number of Patient Days	435.2	441.1	420.6	**1296.9**
Number of Patients with a Fall	1	1	2	**4**
Number of Falls	2	1	2	**5**
% of Patients with a Fall	0.7 %	0.7 %	1.4 %	**1.0** %
Number of Falls Per 1000 Patient Days	4.6	2.3	4.8	**3.9**
% At Risk Prior to Fall	100.0 %	100.0 %	50.0 %	**80.0** %
% Non-Risk Prior to Fall	0.0 %	0.0 %	50.0 %	**20.0** %
Number of Injuries From a Fall	1	0	1	**2**
Number of Injuries per 1000 Patient Days	2.3	0.0	2.4	**1.5**
Number of Minor Injury per 1000	0.0	0.0	2.4	**0.8**
Number of Moderate+ Injury per 1000	2.3	0.0	0.0	**0.8**
% of Falls Resulting in Injury	50.0 %	0.0 %	50.0 %	**40.0** %
% of Falls with Minor Injury	0.0 %	0.0 %	50.0 %	**20.0** %
% of Falls with Moderate+ Inury	50.0 %	0.0 %	0.0 %	**20.0** %
% Assessed within 24 Hrs of Admission	100.0 %	100.0 %	100.0 %	**100.0** %
% Assessed for Risk Daily	94.2 %	94.6 %	94.5 %	**94.5** %
% Identified at Risk for Falls	67.9 %	69.0 %	72.3 %	**69.3** %
% Identified at Risk for Fall Related Injury	82.5 %	80.2 %	69.8 %	**77.6** %
% At Risk with Fall Prevention Plan Initiated	91.6 %	88.5 %	85.6 %	**88.2** %
% At Risk with Education Documented	46.1 %	39.1 %	15.8 %	**35.4** %

The Patient Fall Details view provides details for each fall event, including time and date of the fall, circumstances surrounding the event and injury assessment information and the data from progress notes that were attached in the initial documentation. A key to the abbreviations on page 2 was provided at the bottom of the page for easy access. Definitions for each data element were provided (Appendix K). The report could be downloaded into an Adobe® Acrobat® (PDF) format for distribution. It could also be downloaded into Microsoft® Excel, but the format decisions (to wrap the progress note for ease of report viewing) requires the users to make adjustments to the layout before the data can be analyzed using standard Excel tools.

Figure 12. Screenshot of the QI-CDS tool—patient falls details view (tab 2)



Report Name: Fall Prevention - Quarterly Summary
Facility: Hospital A
Unit: 2 North
Time Range: Q3 2010
Refresh Date/Time: 10-1-2010 3:23 PM
Page Number: 1 of 2

Jul 2010

FIN	Fall Date	Fall Time	Time to Document (hrs)	Admit Dt/Tm	Discharge Dt/Tm	Enc Type	Age	Sex	Activity at Time of Fall	Location of Fall	Initial Injury Asmt	24 Hr Injury Asmt	24 Hr Injury Document	FV	FA	BA	R	Last MFS	MFS Span (Days)	At Risk	PP
	07/12	13:55	0.06		7/19/2010 13:03	Inpatient			Sitting	Bed, Regular	Minor	Major	07/13/2010 16:00	N	N	N	N	85	0.17	Y	Y
Progress Note																					
FIN	Fall Date	Fall Time	Time to Document (hrs)	Admit Dt/Tm	Discharge Dt/Tm	Enc Type	Age	Sex	Activity at Time of Fall	Location of Fall	Initial Injury Asmt	24 Hr Injury Asmt	24 Hr Injury Document	FV	FA	BA	R	Last MFS	MFS Span (Days)	At Risk	PP
	07/20	04:25	0.55	20:08	7/21/2010 14:00	Observation			Toileting	Bathroom	None	None	7/20/2010 04:30	Y	N	N	N	60	0.55	Y	Y
Progress Note																					

Aug 2010

FIN	Fall Date	Fall Time	Time to Document (hrs)	Admit Dt/Tm	Discharge Dt/Tm	Enc Type	Age	Sex	Activity at Time of Fall	Location of Fall	Initial Injury Asmt	24 Hr Injury Asmt	24 Hr Injury Document	FV	FA	BA	R	Last MFS	MFS Span (Days)	At Risk	PP
	08/16	02:05	0.76	08:47	08/18/2010 14:05	Inpatient			Toileting	Bed, Regular	None	None	8/17/2010 02:05	N	N	Y	N	70	0.69	Y	Y
Progress Note																					
Nurse called by NA to the room. Nurse found pt laying on the floor in between bed and wheeled walker. Per pt, she got out of bed to go to bathroom, and went to grab her wheeled walker and fell. No apparent injuries. Pt stated she hit her back but was unhurt.																					

Key: FV = Fall Witnessed; FA = Fall Assisted; BA=Bed Alarm; R = Restraints; MFS = Last Morse Fall Score; PP = PowerPlan

The Fall Prevention Education (ED) Tool

At baseline, the existing EHR functionally provided nurses with an electronic ED tool to guide them in providing evidence-based education to patients and family members. The form provided a screen that displayed identified risks to support the nurse to teach patients about their patient-specific fall and injury risk factors. The form also contained a hyperlink to help nurses to access the health care system's database for patient education materials. At baseline, the available patient education materials described general patient safety advice to prevent accidental falling, but lacked content to support the nurse in teaching patients and family members about their risks and risk-specific fall prevention care planning.

Current evidence and expert team and consultant opinion were used to develop the new ED Tool (Figures 13 and 14). The goal of this tool was to help nurses make patients aware of their personal fall and injury risk factors and work with them to create a plan to prevent falls while hospitalized. The content and graphics on the ED tool were reviewed with internal plain language and patient education experts. The tool was rated as a 3.7 on the Flesch-Kincaid Grade Level test. The tool was added to the organization's education materials database that was accessible from within the EHR. Nurses were instructed to print out the new ED Tool, review the existing fall-risk screens, and manually transcribe the identified patient risk factors onto the first page (Figure 13) and associated interventions (Figure 14) from the plan of care onto the second page to be used during the discussion with the patient. The paper form was pilot tested with four patients, and revisions were made based on patient feedback.

Figure 13. Patient and Family Member Educational (ED) Tool (p. 1 Risk Factors)

Preventing Falls and Injury While in the Hospital

You have one or more health conditions that make it likely that you may either fall or become injured if you fall. Knowing that you are more likely to fall, we want to work with you to prevent you from falling and being injured during your hospital stay.

An X marks your risk factors for falling:

- ❑ Dizziness or fainting
- ❑ Seizure disorder
- ❑ Irregular heartbeats
- ❑ Low blood pressure
- ❑ Recovering from surgery or other procedure
- ❑ History of falling
- ❑ Problems with walking or moving
- ❑ Problems with using the bathroom
- ❑ Memory loss or confusion
- ❑ Taking medications that cause you to become drowsy

An X marks your risk factors for a fall-related injury:

- ❑ Osteoporosis (brittle bones)
- ❑ Metastatic bone disease (cancer)
- ❑ Blood thinning medications
- ❑ Bleeding disorders
- ❑ Blood clotting disorders

Why are falls dangerous for me?

Falls can lead to broken bones and head injuries that can slow your recovery and keep you from returning home.

To prevent unexpected falls:

- Use your call light when you need help
- Call and please wait for help
- Get up slowly from the bed or chair to prevent a fall if you become dizzy
- Keep personal items within your reach
- Wear non-skid slippers when out of bed.
- Use your walker, cane or wheelchair to help you walk safely
- Wear your glasses while active
- Use a night light

Figure 14. Patient and Family Member Educational Tool (page 2: Interventions)

Preventing Falls and Injury While in the Hospital, Page 2

Keeping you safe

Here are some ways that you and your caregivers can keep you safe during your hospital stay:

Medications

Some medications can make you feel weak or dizzy. To prevent falls due to medications, your plan of care includes:

- ❑ Avoid sleeping pills and medicines that make your drowsy.
- ❑ Some of the medicines that you are taking can make you weak or dizzy:

  _____

• When you get out of bed, get up slowly.

Using the bathroom

To keep you safe when you use the bathroom, your plan of care includes:

- ❑ Call for assistance to the bathroom *before your need is urgent.*
- ❑ Use your cane or walker and *move slowly.*
- ❑ Use the bedside commode if you cannot walk to the bathroom safely or if you have an urgent need.
- ❑ We will offer to take you to the toilet at regular times. If you need to go before we come, please call us.
- ❑ Use grab bars in the bathroom.

Walking to stay active

Staying active helps to prevent falls. Your plan of care includes:

Wear non-skid footwear.

- ❑ Keep your strength by walking in your room *and* in the hall 1 or 2 times a day.
- ❑ Use your walker or cane, or walk with help from (1)___ or (2)___ people.
- ❑ *Focus on your walking:* Avoid doing other things at the same time.
- ❑ Use handrails when you are walking in the hall.
- ❑ PT recommendations:

  _____

  _____

Keeping you safe if you are forgetful

To prevent falls and injuries, your plan of care includes:

- ❑ A bed or chair alarm has been placed to keep you safe. It will sound if you get up without help.
- ❑ We will stay with you while you are on the toilet.
- ❑ A low bed helps prevent fall injuries.
- ❑ Your family may want to stay with you while you are in the hospital.

Creating a Data Dictionary to Support CDS Design

Information technology staff from Cerner Corporation (EHR-provider) and Aurora Health Care provided a list of data elements embedded in their respective EHR, the Cerner "Start" content system and the Aurora production system. The data elements and value sets used for this project were abstracted from data entry fields, forms, care plans, and CDS that were created or refined to support the KBNI *Risk for Falls* and *Post Fall Management* design and build that was completed in 2008.[87, 88] Many of the data elements were defined using evidence from the KBNI synthesis documents,[87, 88] medical or English dictionaries, or physical examination reference texts. The data elements were coded with unique identifiers and mapped to SNOMED CT where possible. The EHR-based data elements from Cerner and Aurora were provided to the Data Dictionary Team led by Tim Patrick, Ph.D., who combined the extracts with data previously extracted from the KBNI synthesis documents, *Risk for Falls in Adults in Acute Care*[87] and *Post-Fall Care in Adults in Acute Care.*[88] The data elements from all three sources were reviewed and refined to ensure the accuracy of the files in meetings with Aurora, Cerner, and KBNI staff from the University of Wisconsin-Milwaukee.

Based on this work, the Data Dictionary Team constructed metadata registries for each of the three data sources (Aurora, Cerner, and the KBNI syntheses). These metadata registries were based on International Standardization Organization (ISO) 11179 as implemented in AHRQ's United States Health Information Knowledgebase (USHIK), available at http://ushik.ahrq.gov. The registries contain information regarding data elements, permissible value sets, hierarchical relationships among data elements and other groupings, as well as definitions of these various entities and contextual constraints on the permissible value sets for data elements.

Initially, each of the metadata registries was implemented in a nonpublic development environment of USHIK. There, the differences among the practice recommendation, Cerner, and Aurora registries were compared as a way to understand the quality and scope of the Aurora registry. After this review, the Aurora registry was finalized and was loaded into the public USHIK facility at http://ushik.ahrq.gov.

The complete Aurora metadata registry may be found under the USHIK context *Aurora Data Dictionary (UWMR) (109478.v1).* A complete listing of the Aurora data elements included in the metadata registry is available in that context. The user may, for example, explore each data element in both its fully unconstrained form, and in its form as constrained with respect to *Falls Risk*. The registry includes 192 data elements, 30 constraints, and 187 value domains.

Technical Testing

Technical testing was conducted by technical and clinical staff for each tool and described below.

CP-CDS Tool Testing

The CP-CDS tool was an EHR provider-based product with standard features. The product was loaded using vendor specifications and mapped to elements in the production domain of the EHR. Initial technical testing revealed a problem with the data coming into the "Falls" section. A

service request was filed and the problem was corrected. It was also discovered that the "Intervention" section was designed to display care plan initiation at the phase level, meaning that the blue circle would fill in when any of the phases (Risk for Falls, Risk for Fall-related Injury, or Post Fall Care) were activated. The hover feature, however, only posted the most recent phase entered with no way for the nurse to know if more than one phase was initiated. Although potentially incomplete (especially on units with high volumes of patients with injury risk factors), this feature was working "as designed" by the EHR-provider. Staff who wanted to know if more than one phase was initiated could access the hyperlink to the care plan if needed. An enhancement request was logged, but the request was not able to be fulfilled during the study.

The Assessment icon feature was designed to display information about the completion of the assessment process. It was not designed to display specific patient risk information (as requested by the study participants). An enhancement request was logged but the request was not able to be fulfilled during the study.

During testing in the build environment the product loaded the report with individual patient lists based on the nursing care unit use of the "assignment" feature at the start of the shift. When the tool was used in the production environment, it was discovered that neither of the study units utilized the Assignment feature. In the absence of this feature, the tool loaded in the default view, including all the patients assigned to the unit. This resulted in a significant increase in load time, ranging between 2 to 4 minutes. During go-live, it was discovered that staff could create personalized patient care lists that would populate the CP-CDS with a small list, but the load times were still prolonged (1-2 minutes), delays that the staff reported to be unreasonable.

It was also discovered that some nursing staff members were not able to access the new tool. This issue was investigated and found to be related to the security constraints on their login. The Aurora Security Team was alerted and corrected the situation immediately.

The CP-CDS tool specifications from the EHR-provide did not provide any information about how to set up the tool to track utilization. A service request was filed. Information about how to set up the tool to track utilization was received and implemented, but the utilization feature only became available after the go-live support time frame had passed. Once installed, this feature provided valuable information about tool adoption. The use of this feature is highly recommended for use at the start of the implementation for future users.

QI-CDS Tool Testing

This QI-CDS tool was developed with an EHR provider-based product that used the SAP BusinessObjects software. The Aurora IT builders utilized the standard vendor packages with several customized calculations and additional fields. The "Patient Days" calculation initially available provided patient day tracking at the level of the encounter with constraints that only allowed patients to be reported in the month that they were discharged. This calculation method did not allow for fall rate calculation at the unit level. Further, fall/injury rates were often inaccurate because the patient day statistics (the denominator for the rate calculations) were inaccurate when patient encounters carried across units or months. To correct this issue, the Patient Day field was mapped to the admission/discharge/ transfer (ADT) system to reconfigure the calculation to reflect actual days spent on the unit. This required additional time and auditing to ensure that the data produced was verified by the data reported by the finance department by the organization.

The QI-CDS tool was further customized from the EHR-provider standard design with the addition of the "Patient Falls Details" tab (Figure 12). This new tab included data elements that were identified as important by study participants during the baseline study. The initial testing period also provided the clinical and technical teams to design the tool to distinguish duplicate entries (same fall event date/time) from patients who had multiple falls events (different times). Duplicate entries were displayed in the detail report (page 2) to alert nurse leaders that duplicate entries were occurring and to support them to take corrective action with the staff. The tool was set up so that duplicate entries with the same event date/time did not get counted toward the unit fall rates in the Summary tab.

The QI-CDS tool design and testing were completed, but deployment was delayed to allow for the Business Objects software upgrade to take place. After the upgrade, the QI-CDS tool required adjustment and data extract reloading to get the automated daily data mart refresh processes reconfigured to function as designed in the upgraded BusinessObjects software.

Training and Go Live Support

Prior to this study, the KBNI evidence-based Fall Prevention and Post-fall care processes were implemented in the study organization in 2008. Newly hired staff nurses were educated in the system-wide policy changes and how to use the new electronic data elements, care plans, and CDS processes in the CDS by completing online modules, competency evaluation testing, and participating in go-live and other training activities. The three new CDS tools created in the current study were based on the KBNI evidence and designed to function as additional tools to support nurses in carrying out established processes.

Training and Support for CP-CDS and Fall Prevention ED Tools

The CP-CDS tool was embedded within the EHR and accessed with one click using the "Quality Measures" tab. Once clicked, the query ran for all the patients on the unit (default) or a more selective list of assigned patients if set up. The query provided a graphic display of the status of their patient's care plans related to fall prevention assessment, intervention, and outcome. Staff nurses were advised to access the tool prior to completing their oncoming shift report to support them in evaluating the status of their fall prevention care plan and in communicating accurate care plan information to other care givers and the patient/family.

The project team prepared an online PowerPoint education module (standard tool used by the organization) to deliver important information about the purpose, content, and how to use the new CP-CDS tool. The availability of the module was communicated to nursing staff using standard communications processes (staff meeting announcements, signs on the unit and email notices). The module took approximately 10 minutes to complete.

Two members of the project team (Joosse and Hook) provided go-live support during the first 2 weeks after implementing the new tool. Go-live support was provided at the start of each shift for 10 days to support staff to access the tool during the report process as recommended in the education session. The project team members were available intermittently during the shift to answer questions and guide staff in using the new tool. Approximately 94 percent of the nursing staff participated in one-on-one or small group hands-on demonstration sessions to show staff

how to access the tool within the EHR and to offer recommendations on how the data could be used to support their care planning and patient care. The project team members were able to address the security issues (noted above), but were not able to address a key issue—slow load time.

Information about using the new ED tool for fall prevention was included in the CP-CDS training module and reviewed during go-live support. The new patient education tool was added to the online patient education materials currently available to staff nurses in the electronic Fall Prevention "Education Form". The new ED tool was designed to be printed out and individualized with the identified patient risk factors prior to the education session. The tool provided the nurses with a way to deliver individual patient risk factors information and to partner with the patient and the family to plan the interventions that they will use. While talking to the patient, the nurse would highlight and mark the specific information appropriate to the patient. The nurses were encouraged to keep the tool visible at the patient's bedside as a reminder and reference for the patient/family and other caregivers.

Training and Support for the QI-CDS Tool

The new QI-CDS tool provided the nurse leaders with a report that included aggregate patient fall/injury data and information about the current status of fall prevention care planning on their unit. The customized tool provided the nurse leaders with the fields that they communicated to the researchers that were needed to trend fall incidents at a department level. The tool was accessed using a secure portal on the Intranet. A monthly report reminder with a link to the report was sent to the nurse leaders monthly via email communication. During a time that was convenient for the leader, they could navigate to the program and view the report. In addition to viewing the report, the leaders could save, print, and email the report. These options provided the users multiple methods for archiving and distributing the report.

PowerPoint education training modules were created to introduce the leaders to the QI-CDS tool and guide them through the processes of accessing, reviewing, saving, printing, and emailing the data reports from the tool to the members of the quality improvement team. Individual training sessions were provided for all nurse leaders by a member of the project team (Joosse). During the training session, nurse leaders were guided through the process of access, view, save, print, and email the data captured in the tool. Particpants independently demonstrated that they knew how to access the tool and run the queries for their unit. Following the individual training nurse leader education sessions, additional group training sessions were conducted for the leaders and selected staff nurses who were members of the unit quality council. The group training sessions included an overview of the tool for those not part of the individual training and a discussion on how the data could be used to support their unit council in using standard conducting quality improvement tools at the unit level.

When the training sessions were complete, managers were asked to use the tool during their upcoming quality improvement activities and to contact the project team if they had any subsequent problems or questions about using the tool. During follow-up, managers reported that organizational priorities and reduced financial resources prevented them from conducting quality improvement activities, which then limited their ability to use the QI-CDS tool during the post-implementation period.

System Evaluation

The post-deployment evaluation for the CP-CDS and Fall Prevention ED Tools consisted of system use evaluation, field observations at 6 months, and an analysis of Aurora employee satisfaction survey which was performed during the early post-implementation period at one month and as scheduled at 6 months post-deployment. The post-deployment evaluation of the QI-CDS included use evaluation and usability testing with the nurse leaders. The results are reported in the next chapter.

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Chapter 4: Results

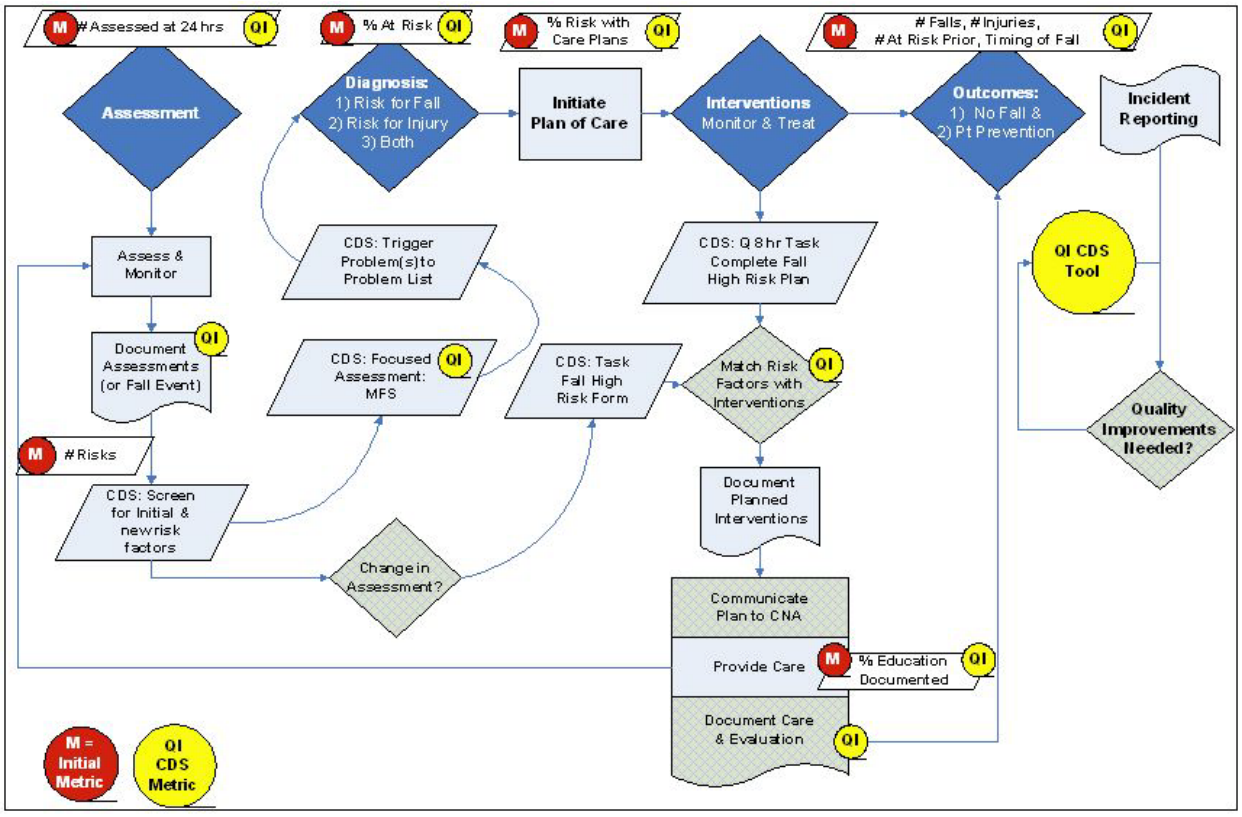
Beyond gathering data to inform tool design, this study sought to answers to questions in two broad domains: (1) Can data, entered during the processes of patient care, be extracted to create CDS to support care planning and quality improvement and (2) To what extent are the CDS tools used by bedside nurse and nurse leaders.

Post-Implementation Data Capture and Use Evaluation

Data Capture for Decision Support

Three CDS tools were created using evidence-based data elements extracted from ongoing nursing documentation in the EHR and deployed on the pilot units. The CP-CDS tool was accessible as part of the EHR, providing a graphic display of the care plan status for assessments, interventions, and outcomes based on nurse assignment. The QI-CDS tool provided near-real time access to reliable and valid EHR-based data to support nurse leaders in evaluating care planning and fall events based on new metrics (Refer to Figure 15) as requested by nurse leaders.

Figure 15. ACTION process model with new metrics provided by QI-CDS tool



This project relied on usual staff nurse documentation and fall event reporting processes to populate the EHR and non-EHR incident reporting systems. No attempts were made to verify the clinical accuracy of the fall event reporting on the unit.

The CP-CDS tool was audited during the go-live period. The tool functioned as designed with fall events consistently displayed based on nursing documentation. The Assessment icon was most often found to display the "Done" (completed blue circle) icon, indicating completion of the fall-risk assessment in the context of the documentation of patient care. The Intervention icon was accurately displaying when care plans were indicated but not initiated.

The QI-CDS tool was audited during the go-live period and monthly during the post-implementation monitoring period. Audits involved comparing the QI-CDS report data with data from incident reporting system, HAC-injury reports, and finance reports regarding patient volumes during the same time period. The QI-CDS tool populated accurately, bringing data into the template as specified in the tool design. Staff consistently used the correct forms during their patient care, so the fall events and details populated the QI-CDS tool accurately, matching and sometimes exceeding the cases reported in the incident reporting system. The QI-CDS tool reported patient and patient day volumes at levels that were within 2 percent of the finance department report figures currently in use as the source of truth for these values. Small differences between the QI-CDS tool and the finance department figures for Patient Days was related to estimation differences when calculating incremental patient stays. The QI-CDS accurately displayed data for patients who were assigned to the unit, including the fact that one fall was not included in the report because the fall occurred while the patient was off the unit for a test. Only one fall event did not populate the tool despite accurate clinical documentation. The case was missing because of an inaccurate admission time entry, causing the fall event to appear to have occurred prior to admission to the unit. There were two instances where staff documented the fall event twice, but this issue displayed the event details appropriately in the report (same fall date/time) without calculating in the fall rate statistics (Tab 1). This provided the manager with the opportunity to identify the issue and provide feedback to the staff to correct the situation in the future. Incident report system reports continued to have missing cases and missing data within the case reports during the study period.

Evaluating Use with Field Observations

Field observations were conducted by one project team member (Joosse) 6 months after tool deployment. The following represent some key summary observations.

- Workflow processes were complex with many variations in how nurses approached patient care. It remained, however, essentially unchanged from baseline despite the deployment of additional computers on wheels hardware (one in every patient room), new since baseline (unrelated to the current ACTION project).
- R.N. oncoming shift report processes were similar to baseline. Report time ranged from 40-60 minutes and included reviewing data in the EHR, written reports, and hand written data. Both informal and formal report contact occurred with off going shift. Some nurses used a walking rounds method to obtain additional information about the patient and an introduction to the patient. While others used a more informal approach to share data; for example sharing recent lab findings verbally.

- Nursing assistants (NA) continued to rely on peer-to-peer report and visual fall-risk cues. Similar to baseline findings, no consistent method for communicating patient details was identified. R.N. to NA report occurred 60-75 minutes after the NA shift start. NAs relied on peer-to-peer report to forecast care until the R.N. provided additional details. The visual fall-risk cues (e.g., falling leaf signs, red nonslip bootees) continued to be inaccurate at times.
- R.N. to NA report remained unchanged and focused on task-based care needed (i.e. tasks with times to be completed by the NA). General safety standards were communicated for some at risk patients; however no individualized fall prevention strategies were communicated.
- Unit A initiated a new procedure for communicating information about the patients who are at risk for falling to all caregivers. The unit holds a brief meeting (referred to as a "huddle") near the beginning of the shift (approximately 1 ½ hr after R.N. start time) where the nurse leaders and staff discuss important care issues for the shift. During the huddle, patients who are "at risk for falling" were identified and communicated to all staff members (with no details regarding specific fall prevention strategies that were to be used). Information from the meeting including the list of fall-risk patients is recorded in the "Communication Book" as a reference for those who did not attend.
- The use of real-time bedside documentation remained relatively unchanged on both units. Documentation occurred in the nurses' station or on computers in the hallways. Bedside computer use was observed to occur during admissions but not during routine patient care.

Evaluating Use with Post-Implementation Survey

Seventy six staff nurses had access to the CP-CDS tool during the post-implementation period. Only 16 (22 percent) had completed the education module for the tool prior to the go-live, with the majority of the education dependent on the brief hands-on demonstration sessions that occurred in the nurses' stations during go-live. The tool was accessed 113 times by study unit nurses during the 2 months after go-live. Sixty two (55 percent) views occurred during the go-live implementation period. The tool was accessed 31 more times during the month after the go-live implementation period and tapered off to 20 the following month. Access was rare the second month after go-live. Accessing the tool varied by nurse and by unit. The tool was accessed 32 times from 16 different users on unit A. In contrast, unit B had 78 views from 22 users. Views ranged by nurse and varied between 1 to 18 views per individual nurse.

Based on verbal feedback from the CP-CDS tool users during go-live, the tool showed promise for providing some benefits. It was thought to provide a quick overview of whether patient was assessed for risk of falls, if a care plan had been initiated, and whether the patient had a previous fall during the current hospitalization. Although, positive responses were received regarding the clean, visual display and the ability of the tool to link to important forms embedded in the EHR, staff reported that limited assessment and intervention detail and prolonged load time made it difficult for them to use the tool for patient care.

Early post-implementation survey results gave limited insight into the implications of the new CP-CDS tool for clinicians. Narrative comments provided reasons that bedside staff nurses

chose not to use the tool to its full potential. The following comments are derived from staff feedback on the survey tool and unsolicited comments during observations (Table 4).

Table 4. Post-implementation comments about the CP-CDS Tool

Early Post-Implementation Survey Comments: • "It is very easy read and well organized. I appreciate the link to our care Plan/orders area so that we can immediately update if necessary." • "Quicker load time needed. Put a link to it from our task list, so we are reminded about its existence. Have the actual falls risk criteria listed in a dropdown area or column for us as well, so that nursing can see what the actual risks are." • "Symbol key at top of form, how do I find the genview that tells me what the risks are?" • "I think nursing would appreciate a quick column reference check list for fall prevention strategies that are needed. A reminder of which tools/strategies are currently in use and which need to be added." • "Load time for this entire tool took too long."
Unsolicited comments during Field Observation • "We don't use the [CP-CDS] tool because it doesn't give us any different data; we already get the stuff that is on that report. Why we would we go to a separate screen to get the same data. I don't think anyone up here is using the form." • "Despite what is in KBNI—I have implemented my own protocol. I have had some bad experiences so before I get a new admit, I get info from whoever, chart, or report. If they are old, I put them in the "A" bed—close to the nurses' station. I put them in a low bed with a bed check right away. I guess I started this because I had some really bad experiences." • "I get more from the report and my peers than I got from the [CP-CDS] tool. I don't use it."

Evaluating Use of the Patient and Family Education (ED) Tool

At baseline, most of the patient education documented was about the use of environmental management strategies (e.g., call light use, use of nonslip footwear, etc.). The evidence-based training sessions in place at baseline had content that advised staff nurses to teach patients and family members about their personal risk factors and to individualize fall prevention strategies, but they did not have any education tools to help them teach this content. The new fall prevention ED tool was created and deployed using standard training methods used at the organization. Completion of the training module was limited (22 percent). Much of the staff education to support tool deployment occurred in the form of one-on-one demonstrations during go-live support. Post-implementation field observation patient education form audit findings revealed that the majority of documented patient/family education involved environmental safety strategies (e.g., call light use, etc.) with no documentation of patient-specific risk education or the use of the new tool. No staff nurses were observed printing out the tool for education. Since this study was focused on evaluation at the nurse and unit level, patient and family contact was outside the scope. Early post-implementation survey respondents indicated that the ED tool showed promise. Three of the eight (43 percent) post-implementation survey respondents reported that the ED tool helped them identify patient-specific fall-risk factors and was easy to fill out. Only two survey respondent provided comments (Table 5), both of which were positive.

Table 5. Early Post Implementation Survey Results about the ED Tool

Survey Comments related to the Fall Prevention ED Tool
• "I really like this new material. I think the X marks the box feature is easy to read for our patients and allows nursing to really customize the education using this handout to our patient's specific risks for falls and injuries related to falls. I wish more of our education tools were like this handout. It is a great handout!"
• "Like it. Helps remind me which interventions and risks to talk about."

Evaluating Usability With the QI-CDS Tool

A post-implementation focus group was the mechanism planned for evaluating the QI-CDS tool. Nurse leaders, however, reported that they were not able to use the tool for quality improvement activities because of fiscal and time limitations. The Project Consultants (refer to Appendix A) advised the project team to use formal usability testing as a suitable alternate approach for evaluating the content and design of the tool with the nurse leaders even if they had not had the opportunity to use it.

Standard usability testing[92] was conducted with the mangers, CNS, and five staff nurse leaders to examine the design and function of the QI-CDS tool. Individual sessions were conducted with consented volunteer user participants and two researchers (one facilitator and one data logger) using a semistructured testing guide. Nine nurses participated in the testing: five staff nurses with leadership responsibilities, two nurse managers, and two clinical nurse specialist, each employed on the unit for longer than 1 year. Each participant was seated in front of the computer and completed the test scenarios using the "talk out loud" methodology with prompting as needed. Each participant demonstrated how they accessed the QI-CDS tool (PDF format for staff and computer-based format for mangers/CNS), how they went about reviewing the details of the two-section report, how to save, print, and send reports (managers/CNS only), and discussing summary/exit questions. Data were collected regarding ease of access and review, what data they viewed, how they interpreted what they saw, and what they said they would do with the information. Each session lasted between 15 and 25 minutes.

Usability Test Findings

- All of the managers and CNS needed some coaching to successfully access, maneuver inside, and save/print reports inside the tool.
- Participants viewed the data elements and tried to interpret what they were seeing even though many reported that they were unfamiliar with the definitions.
- Participants had difficulty interpreting the findings when the population and denominators changed. The separation lines within the table were not enough to cue the change.
- Staff nurse participants commented that they believed that the nursing staff was doing patient/family teaching and that low teaching percentages reflected limited documentation. Two staff pointed out that percentages were low because of a high volume of patients with barriers to learning related to cognitive impairment.
- Data elements with decimal values less than one were hard to interpret.
- All participants reported that the tool brought disparate data together, helping them to review cases, validate adherence to standards, and identify gaps in care.

QI-CDS Tool Revision Recommendations

Based on the observations and comments during the usability testing the following QI-CDS tool revisions were recommended:

- Change the format for the table on Page 1, with clear markings or more words to identify when populations (fall/injury patients vs. all patients) or denominators change.
- Provide concise, accessible definitions for each data element.
- Change numeric display for the two data elements that are reported in values that are less than one (e.g., Time to Document (the time estimate between the fall date/time and the time the Initial Post-Fall Assessment form was completed) and MFS Span (the time estimate between the fall date/time and the documented time of the last Morse Fall Score risk assessment). Make them both reflect days, with a key that 0.2 days is roughly = 5 hours.

QI-CDS Tool Enhancement Recommendations

- Add a data element (Fall Summary, p. 1) to capture the number/percentage of patients with cognitive impairment (e.g., history of dementia or OMCT >7 mild cognitive impairment or >12 moderate/severe—fields that currently exist at the facility). Consider adding the selected data element to Fall Detail Section.
- Consider adding Day of the Week and Date/Time on Unit Transfer In.
- Provide a rolling 12-month data summary for fall and injury (>minor) events displayed on a run chart with confidence intervals indicated.

Assessing Costs and Financial Benefits of Electronic CDS

A cost and finacial benefit analysis measures the benefits and costs that would be associated with the proposed improvement. The Project Team reviewed the literature and worked with an external Cost/Financial Benefit consultant to develop a plan to measure and track direct and indirect costs associated with the design, conduct, and evaluation of the new CDS reports (Appendix L). In addition, the plan should include estimates for the costs that would be associated with "adopting" the CDS using the content and specifications.

The new tools were implemented in a facility with an existing EHR and a Magnet-designated professional nursing environment. The following aspects of the infrastructure currently existed:

- The pilot site had an existing EHR for nurses for over 10 years, including electronic care planning. The organization implemented electronic care planning using the standard EHR-provider functionality in 2007 with knowledge-based nursing content/functionality deployed to focus on five specific care plan topics in July of 2008.
- Study unit nurses (71 percent), CNSs (100 percent), and nurse managers (100 percent) completed a minimum of 40 minutes of computer-based education on evidence-based fall-prevention and post-fall management prior to this project.
- The two study units are located in one of the five Aurora Metro Region Magnet-recognized hospitals where infrastructure, basic knowledge, and resources exist to

support professional nurses and nurse leaders in evidence-based practice and shared governance.

The costs associated with a project of this nature were difficult to establish because the EHR was pre-existing at the site. It was difficult to separate usual operating procedure costs from those costs associated with this project. This project found two different costs associated with the development of the tools. First, the team used a standard software vendor based program to deliver the CP-CDS. This method of delivering a tool would be associated with a onetime cost for purchasing all packages required to implement and run the program within the EHR. In addition to the onetime cost, IT staff labor costs need to be considered. When using a vendor based tool site specific staff are necessary to embed and link all associated terminology that drives the data in the CDS. Vendor based specifications need to mapped to data elements within the EHR. Once populated validation processes are also necessary and require staff time.

In building the QI-CDS tool, the project team utilized a reports option software package, which provided a standard package with customization option. This method required IT staff to manually locate and map data into the program. Once automated, IT staff dedicated time to auditing ensuring data produced match data in multiple existing reporting systems. In addition to the purchase price of the software package, IT staff labor costs need to be included when examining the cost of using this method for developing and delivering a CDS.

Based on postevaluation findings, it is difficult to estimate the benefits of the use of these tools at this time. Adoption of the CP-CDS tool was limited. However, based on user feedback there were specific aspects of the tool that were thought to be beneficial. Intention to use and actual use differed, suggesting the tool may need further enhancements to achieve its full potential and benefits. Similarly, the QI-CDS tool was embraced with leadership enthusiasm. Intent to use was high; however, sociotechnical issues beyond the control of this study may have impacted use.

The findings of this study are similar to others attempting to examine the impact of CDS tools. Eichner and Das reported encountering significant challenges and barriers when implementing other CDS projects.[93] The authors highlight that “there are no easy solutions to gain clinicians’ acceptance and use of CDS interventions.” Clinicians’ suboptimal use of the CDS products makes it difficult to fully examine the benefits of the CDS.

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Chapter 5. Discussion

As stated earlier, this study sought to answers to questions in two broad domains: (1) Can data entered during the processes of patient care be extracted to create CDS to support care planning and quality improvement? and (2) To what extent are the CDS tools used by bedside nurse and nurse leaders?

The CDS tools created in this project captured nurse sensitive data and populated CDS report templates with valid and reliable near-real time EHR-based data to support care planning and quality improvement. The tools were accessible to staff nurse and nurse leaders to use when they wanted them. Despite providing input into design, the nurses and nurse leaders were slow to adopt the tools. This chapter will discuss these findings in the context of the TAM Model[80] and other information known about nurse-based decisionmaking. The concept of sociotechnical context will be also be described, with a discussion about how these factors may have influenced CDS tool adoption by the study organization.

Project Outcomes

Data Capture for Decision Support

The fall event data capture findings reported in this study are consistent with reports by other researchers. Incident reporting data typically underestimates fall events and that data capture may be increased if gathered from direct patient care documentation sources.[75, 94] Researchers have found that missing incident report system falls events were often not missing at random; systematic patterns of missingness have been reported.[94] These findings suggest that the users of the QI-CDS tool must be aware that ongoing validation with key data sources (financial and incident reports) will be required to ensure the integrity of the data. Managers must oversee the accuracy of the data sources that feed all the clinical and incident reports, and this tool makes it much easier to monitor data as it is coming (vs. when it is 3 months old). The QI-CDS tool is not likely to replace the need for some level of incident reporting, however, since incident reporting systems are administrative and used by risk managers to gather information that may not be appropriate for entry into the clinical report. Reporting systems of the future must interface the clinical and administrative sources to increase the accuracy of reporting, minimize the duplicative effort by nurses, and provide a portal for collecting care data needed for risk management and quality improvement efforts. This QI-CDS tool prototype may provide other organizations with a framework for designing their own QI-CDS tool to bring disparate data together and enhance the process for obtaining important quality improvement data.

The project team collaborated in the process of selecting functionality/software used to design and build the tools in this study. The team evaluated needs and selected two EHR-provider based tools for the project. There are significant advantages to using a template developed by a EHR provider such as ready access, reduced cost, and reduced labor, which would be significantly lower than developing a home grown tool. Despite the advantages, there were other issues that need to be considered, including work to load the tool at the institution and understanding that customization may be limited. Organizations must be aware of the tools

intended audience (i.e., nurses' vs physician) and whether testing was performed to assure validity and reliability of the tool. The QI-CDS tool that was used for the study was designed and deployed by the organizations IT staff. There are advantages in customizing a report to fit your organization's needs. However, data management and technical designs require considerable time and funding. In addition, organizations need to be aware that software upgrades may require additional resources to manually redeploy data to the tool.

Using the TAM Model to Explain Use Findings

Focus groups, surveys, and usability test questions was the method used to test the theory that ease of use and usefulness predicted intention to use and ultimately use behavior with staff nurses and nurse leaders. Findings from the study provided support for the TAM model, although many other issues were likely to have contributed to the adoption issues observed.

CP-CDS Tool Outcomes

At baseline, staff nurses reported that their fall prevention planning process could be improved. They reported that they would use a new CDS tool if it was easy to access and provided risk-specific intervention information. The CP-CDS tool provided to the staff nurses was created using a standard EHR-provider prototype design without customization. The tool was "accessible" from within the EHR with one click. Post evaluation feedback indicated staff perceived the tool to be outside their workflow. Nurses, who did not specify their patient list, experienced a significant delay (1-3 minutes) to load data for the entire unit (default view). Staff reported that the prototype design was graphic, clean, and easy to read, but did not provide specific information about patient risk and the interventions they should use (indicators of usefulness). Nurses tested the tool during go-live but did not adopt the tool for daily use. Some of the findings of this project may be explained by reexamining the TAM Model. According to the TAM model,[80] usage behavior is dependent on perceived usefulness, perceived ease of use, and intention to use. In this project, staff intended to use the new tool but was confronted with access barriers (one click away, slow load time) and icons that provided information of limited usefulness (insufficient details about assessment and interventions). This finding is consistent with the TAM construct and suggests that the CP-CDS had limited adoption for somewhat obvious reasons, but the barriers to the adoption of this tool may be broader than the tool by itself.

QI-CDS Tool Outcomes

At baseline, the nurse leaders reported that they wanted a CDS tool to provide them with reliable, valid, and timely data from a single source that could replace their manual efforts. Usability testing revealed that the QI-CDS tool was easily accessible for staff nurses (PDF format delivered by email) and for Managers and CNS (from the secure portal). The most difficult part appeared to be finding the portal and remembering the login. Once logged in, the managers and CNS accessed the tool with ease. All participants communicated that the report brought disparate data together, helping them to review cases, validate adherence to standards, and identify gaps in care, findings consistent with perceptions of usefulness. Barriers beyond technology acceptance appeared to be limiting the use of their tool by nurse leaders, warranting further exploration.

Evaluating the Impact of Nursing Workflow on the Use of CDS

Karsh recommended that CDS tools be designed to support basic physical/cognitive and sociobehavioral processes within workflows that fit with the clinician's capacity.[17] In addition, the CDS should filter and present useful information at the right time in the workflow in order to be most effective.

The field observations reported in this study provided rich data about the complexities that nurses face in their daily practice. Observers reported varied and inefficient report processes, limited knowledge and communication of patient-specific fall risks, and workflows that did not support the nurses to be out in the patient rooms. These issues contributed to the creation of workarounds that prevented nurses from using some of the electronic CDS processes that were thought to be in place at baseline to support individualized fall prevention care planning. The CP-CDS did not provide enough detail to increase the nurses' knowledge of individual patient risk or to improve their ability to communicate specific needs/interventions to other caregivers. Baseline processes of "standardized" fall prevention care continued.

The findings are consistent with those presented by Lopez and colleagues who used cognitive work analysis techniques to examine how nurses operationalized fall prevention strategies within their daily workflow.[95] According to their analysis, fall prevention is as a low mental, high time-based work demand process. These researchers found that the work processes and the work environment contributed to increasing the risk for patient falls (beyond patient specific risk). They observed nursing staff on a general neurological unit at an academic medical center and found certain constraint-based workarounds that may increase patients' risk for falls. For example, nurses rarely communicated about fall risk at shift change to neither nurses nor nursing assistants, unless there was a recent event/injury. Standardized "one size fits all" fall prevention measures were initiated (e.g., arm bands, etc.) including the list of all possible fall prevention interventions placed in the patient's chart. Nurses did informal patient assessments but the information was kept in their heads. Care was provided based on "schemas," described as the written or mental "chunking" strategies used to remember the tasks, subtasks, and order for completion, with limited time spent on updating the plan of care or positioned in/near the rooms where the patients are (33 percent). These observations led these researchers to conclude that workflow processes and environment considerations must be addressed at a broad level because they impact the implementation of care planned and provided to individual patients.[95]

The findings of this study highlight the complexity of the nurses' work and the presence of workflow issues and competing demands. Fitting a CDS tool into the workflow at the right time was a challenge, because of the fluidity of the nurses' work. Questions remain regarding when is the right time, how can CDS tools support physical and cognitive behavioral processes, and how do these tools fit into the context of patient care.

Evaluating the Effectiveness CDS on Nurse Decisionmaking

Randell and colleagues[39] described that currently there is much current enthusiasm for implementing complex new technologies with little or no evaluation. They suggested that the lack of impact for CDS may be the result of issues beyond the computer-interface including variation in clinician practice and varied adherence to protocols after they are automated. It is not easy to evaluate if the impact of the CDS is blunted as a result of poor protocol adherence (even on paper) or problems with the CDS/computer interface. Further, when tested these researchers

emphasized that the evaluation of how the CDS is used after deployment may vary considerably from the original intentions of the designers, since nurse have been observed to adapt the tools (over-ride or work-around) to it "fit" with their local practice, leading to increased variation.[96]

CDS tools are designed to support nurses in decisionmaking—a process that researchers are just beginning to study with nurses.[97] Thompson and colleagues have observed that the nursing profession considers intuitive reasoning as a mark of an expert, so nurses are encouraged to make decisions intuitively, often without relevant information. This is problematic because intuitive reasoning has been shown to be prone to reasoning biases, especially under time constraints. The staff nurses who were observed in this study reported many instances when they provided standardized fall prevention care to patients, even when the patient was not at risk for the factors the interventions were used for. This tendency to rely on standardized care vs. tailored care identified by a CDS tool may require additional interventions to support the nurse to begin to utilize the interventions prescribed by the CDS tool rather than the standardized interventions that may not be effective.

Using CDS to Enhance Patient Participation

Fall prevention researchers are beginning to appreciate the importance of patient-specific risk-based fall prevention plans[98] and the benefits of patient engagement in fall prevention.[59, 74, 76] Patient education is a frequently utilized nursing intervention that is often delivered to patients in the course of providing care. Researchers who reported success with this intervention also reported that the staff that delivered the education received special training[74,76] and used an adherence dashboard to ensure adherence to the intervention.[74]

Prior to the start of the current study, nurses at the study institution completed evidence-based training materials about the importance of patient education and the need to educate patients and family members about their fall and fall-related injury risk factors and in teaching patients about risk-based prevention planning. At baseline, study units had a low rate of fall prevention patient education documentation; however, tools were not available to support nurses to complete the process. The nurses reported that they taught patients about fall prevention and admitted they would forget to document. The ED tool was deployed using the standard training and go-live processes used at the facility. Although the staff provided positive comments about tool during go-live, they did not consistently use the new ED tool for fall prevention. No changes were observed in the documentation of patient education. Additional training and more formal adherence monitoring may be necessary to ensure adoption and use over time.

Using CDS to Support Nurse Leaders in Quality Improvement

The QI-CDS tool was designed to provide nurse leaders with a comprehensive battery of data about fall prevention assessments, care planning, intervention completion, and outcome achievement including the details about fall and injury events on their unit. The findings from this study indicate that, while the nurse leaders provided positive feedback about the tool, their adoption and use as a tool for quality improvement was much slower than anticipated. The managers and clinical nurse specialists involved in the study reported that other priorities limited their time and ability to continue with their quality improvement processes, and the explanation may be that simple. However, when priorities shift and they return to use the tool, the nurse

leaders are likely to need followup reinforcement and coaching to support them to interpret raw data (since they had difficulties knowing the definitions of the data elements) and effectively using the data for comparison, and drawing conclusions that can be used over time to drive quality improvement efforts.

Other researchers suggest that there are other barriers that limit nurse leaders in their ability to use best evidence and data to drive their quality improvement processes. Shever and colleagues recently conducted a study to describe nurse manager practices around fall prevention in acute care.[98] These researchers found gaps between the evidence to achieve best outcomes and the current practices of managers. The researchers highlighted that the majority of managers in their study were unsure of what evidence was used to create their fall prevention policies (67 percent). The managers reported that they were clinically and financially supporting the use of interventions (e.g., physical restraints and sitters) that had little to no evidence of effectiveness in fall prevention. The researchers pointed out that managers did not report using interventions that were known to reduce falls (e.g., staffing ratios, ambulation, etc.). These authors suggested that more work was needed to build systems that ensure evidence-based nursing interventions are consistently applied in acute care.

Thus, CDS tools with comprehensive and discreet details must be provided to nurse leaders who have other resources in place to help them to achieve the best patient outcomes. Nurse leaders must be supported with evidence-based policies (minimum) to guide them in analyzing the CDS report results and helping them to use the data to drive quality improvement over time. This statement sounds straightforward, but it contains many assumptions. It assumes that policy writers understand that "evidence" is more than citing published work. Evidence-based policies should be based on science based-research that has been evaluated for quality and conducted in a setting that is generalizable to their venue. It also assumes that nurse leaders have the skills to question policies that are not representing the best evidence and to contribute to keeping the policy updated as needed. It also assumes that nurse leaders are skilled in quality improvement strategies. Fall events are rare. Quality improvement efforts must be directed at identifying root causes, carefully selecting and testing researched based interventions that targeted key process outcomes, while examining outcomes in short-term and long-term timeframes in order to evaluate the impact.

Sociotechnical Context

As noted earlier, "sociotechnical context" refers to factors that impact the process and outcomes of an implementation but are not related to health IT. Contextual factors include the functionality and usability of the system, training, technical support, user participation, top management commitment (money, time, resources, policy), culture, implementation timeline, hardware location, and physical ergonomic considerations.[17, 18, 40]

During the study significant organizational issues impacted the resources and time allocated to this project. For example, the hospital system opened two new hospitals and deployed new feature functions (bar coded medication administration/CPOE), which pulled valuable IT and nursing resources from pilot units for system priority work. In addition, nurse leaders were unexpectedly less available due to turnover and leave of absence. The hospital unit based quality improvement model changed during the study. Finally, financial constraints resulted in a administrative decision to limit the availability of nondirect patient care time. The fiscal

constraints caused the unit nurse leaders to suspend all nondirect patient care time expenses including staff meetings, participating in continuing education offerings, and quality improvement activities not support by other funding sources. Nurse leaders were not able to schedule quality improvement meetings, limiting the time and opportunities for nurse leader to use the QI-CDS tool.

Limitations

This study highlights the complexities of studying and implementing CDS tools into existing systems. The limitations of this study were that the project was implemented in one institution, on two medical surgical units. The sample size was limited to the two units and individual participation was small. The study used observational methods with potential for observation bias. Scope of project did not include capturing patient input or other aspects of sociotechnical context that may have impacted the tool adoption (e.g., hours per patient day, staffing ratios, etc.). Despite these limitations, the study represents processes that are not typically studied during health IT deployment.

Chapter 6: Conclusions and Future Work

This study demonstrated that nurse-sensitive data elements entered into the EHR during routine patient care can be extracted to populate CDS tools and provide near real-time data. These findings also demonstrated that the patient care environment is complex and that many factors influence the adoption of CDS tools beyond the technical aspects. CDS tools are complex interventions and must be developed with the right content and delivered at the right time where it can make a difference. This study also sheds new light on how sociotechnical context issues may be influencing the adoption of CDS, particularly tools used by nurses. Although adoption was limited, this project contributes a significant amount of new information and insights that should be used to guide future EHR and CDS development and research.

Lessons Learned

Throughout the project the team learned valuable lessons that guided remedial protocol changes. Other lessons learned informed future implications for research. The following highlights the projects lessons learned.

Using the EHR to Creating Decision Support for Nurses

- Clinicians and managers want access to real-time and near real-time information about their practice and patient outcomes, but care must be taken to determine the content and logistics that would make the data useful.
- Staff nurses want data to guide their decision making about priorities of care, recognized gaps, and strategies that prevent falls, with efficient access to limited number of data sources.
- Nurse leaders want data that measures the quality of care and guides them to recognize trends or problem to focus their QI methods.

Need for Strategies to Ensure Data Integrity

Organizations that use electronic sources for data must establish processes to maintain the integrity of the data. Periodic checks against “sources of truth” and balances are needed to ensure that the data are reliable and valid as it is extracted from the EHR into CDS templates.

Risks and Benefits of Using EHR Provider-based CDS Tools

- The EHR-provider supported the effort by providing access to the use of two different CDS tools to jump-start the project with limited developmental time or resources. This benefit provides immediate access to something that was known to work in the environment.

- Despite the use of a packaged product, the deployment instructions for the CP-CDS tool were not clear and required more specialized mapping than predicted. Additional linking packages were needed, contributing barriers to ready use. Significant adjustments were needed to make it work locally.
- The project team gathered input from the nurses about the content and logistics for the CP-CDS tool that indicated the need for access to granular level data, more than the standard tool provided. Adjustments to the standard tool were not possible prior to deployment, but there was a plan to take feedback from the nurses and to better accommodate their needs during the next round of iteration.
- Negative first impressions of the CP-CDS tool resulted in limited adoption. After deployment, staff nurses contributed very little input about the product with few comments about how to improve it. No iterative changes to the CP-CDS tool were made.
- The QI-CDS tool, on the other hand, was a packaged product, but allowed for customization to accommodate the content and logistic needs specified by the nurse leaders during the baseline interviews.

Nursing Workflow Considerations

- Adoption issues occurred for many reasons.
- The CP-CDS tool did not provide the level of detail that staff needed to know about the individual plan for patient care and to communicate strategies to other caregivers.
- Despite metrics that report good adoption, staff often found ways to "fit" the technology into their workflow, but it was not always in keeping with the way that it was designed (workaround). Time and effort is needed to anticipate issues and reduce the need for workarounds and to add monitoring strategies to "hold the gain" during the post-adoption period when staff are most likely to migrate away from established practices.

Benefits of Formal Usability Testing

- Formal usability testing provided very important information and insights into the way that nurses used the technology. This testing was conducted late in the process.
- Usability testing of the CDS (prior to deployment) is recommended to aide in the identification of issues that could be improved to support adoption.

Sociotechnical Context

- Sociotechnical context issues may have had an impact on the findings of this study, particularly related to conflicting demands on staff nurses and nurse leaders, workflow, and environment. More must be done to describe these issues to support the baseline and study evaluation to support researchers to understand the results of their study and how to generalize findings to other projects.

- Health care organizations are experiencing significant demands to implement health IT and CDS products very quickly with limited capacity to evaluate the impact of the multiple demands on the staff/leaders and the overall outcomes of the work.

Recommendations Future of CDS for Nursing Research

This ACTION research contract demonstrates support for combining operations and research to create CDS tools for nurses in acute care. The exciting conclusion of the project is that indeed, essential nursing data can be built into EHR and effectively extracted for analysis and decisionmaking. As nurses document assessments, problems, interventions and outcomes, these data become part of a clinical repository. This study was able to capture selected data, aggregate the data and return it to clinicians and leaders for use in clinical decision making for individual patient care and for quality improvement programs. As part of the study, a data dictionary was developed, used as the terminology for the study, and donated to USHIK to be available to inform informatics work internationally. Content and technical specifications were also made available to support other organizations to use in customizing an EHR provider-based tool or in designing and building one from scratch. Questions remain to be answered about what levels of data are most useful to clinical nurses and to managers. Also to be answered is the extent to which the tools specifications are interoperable. And finally future research is needed to examine the complex inter-related clinical phenomena, as well as, complexity of the systems and environments in which nurses' practice.

While these are exciting breakthroughs for CDS for nurses, this is an area of research in its primitive stages. Part of the research complexity is that what is needed is the combination of clinical practice-based research as well as informatics research and health services or organizational research. These converged in the ACTION study. Further study of each of these areas and then the convergence of these areas are rich areas for further research.

This project is a microcosm that supports the conclusion of Bakken and colleagues:[99] the nursing informatics research agenda for 2008-2018 must expand user of interest to include interdisciplinary researchers; build upon the knowledge gained in nursing concept representation; guide the reengineering of nursing practice; harness new technologies to empower patients and their caregivers for collaborative knowledge development; develop user-configurable software approaches that support complex data visualization, analysis and predictive modeling; facilitate the development of middle-range nursing informatics theories, and encourage innovate evaluation methodologies that attend to human-computer interface factors and organizational context.[99]

The findings of this study support the need for future studies on the context in which a CDS study is done. Karsh and colleagues propose that the context makes a big difference in its effectiveness, safety and real costs.[100] They stress the need for interdisciplinary investigations by human factors engineers, applied psychologists, medical sociologists, and communication and cognitive scientists using such methods as cognitive field analyses, workflow and task analyses, and human-centered design evaluations. They further recommend using methodologies that have worked for increasing safety in the airline industry.

Ozbolt and Saba[101] also stressed the need for interdisciplinary research for nursing and informatics domains:

"Realizing the potential of nurses to transform and improve health care and outcomes through informatics will require fundamental changes in individuals, organizations and systems. Nurses are developing and applying informatics methods and tools to discover knowledge and improve health from the molecular to the global level and are seeking the collective wisdom of interdisciplinary and inter-organizational collaboration to effect the necessary changes" (p. 199).[101]

The recently released Institute of Medicine (IOM) report, *The Future of Nursing: Leading Change, Advancing Health* has a strong emphasis on the importance of nurses' adoption of technology in clinical practice. There is perhaps no greater opportunity to transform practice than through technology. Information technology has long been used to support billing and payments but has become increasingly important in the provision of care as an aid to documentation and decisionmaking. The IOM Report authors point out that health IT will fundamentally change the ways in which R.N.s plan, deliver, document, and review clinical care.[102] The process of obtaining and reviewing diagnostic information, making clinical decisions, communicating with patients and families, and carrying out clinical interventions will depart radically from the way these activities occur today. Moreover, the relative proportion of time R.N.s spend on various tasks is likely to change appreciably over the coming decades. While health IT arguably will have its greatest influence on how R.N.s plan and document their care, all facets of care will be mediated increasingly by digital workflow, computerized knowledge management, and decision support.

A recent article in the *New England Journal of Medicine* summarizes the meaningful use criterion as follows: "use by providers to achieve significant improvements in care."[25] Given the nature of patient data collection, nurses will be integral to proper collection of meaningful use data. For example, among the first set of criteria to be measured include patient demographics, vital signs, and lists of patient's diagnoses, allergies, and active medications. These diagnostic categories should include such patient conditions as risk for falls as targeted in this ACTION study.

In the future, virtually every facet of nursing practice in each setting where it is rendered will have a significant digital dimension around a core EHR. Thus there is great value in the continued investment in the research and development of useful health IT, EHR and CDS that affects the care given by nurses and received by patients.

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Appendix A: Project Team Members and Consultants

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  Aurora Health Care, Principal Investigator
- Norma M. Lang, Ph.D., R.N., FAAN, FRCN
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  Aurora Health Care, Senior Advisor
- Ellen Harper, R.N., M.B.A.
  Cerner Corporation, Senior Advisor
- Kevin Underwood
  Aurora Health Care, Senior Technical Advisor
- Bob Amland, Ph.D.
  Cerner Corporation, Senior Expert
- Timothy Patrick, Ph.D.
  University of Wisconsin-Milwaukee, Senior Advisor
  - Carmello Gaudiso, M.D., Ph.D. (Doctoral Student)
  - Kouresh Ravvaz, M.D. (Doctoral Student)
- Judy Murphy, BSN, R.N., FACMI, FHIMSS
  Aurora Health Care, Senior Advisor
- Patrick Falvey, Ph.D.
  Aurora Health Care, Senior Advisor

Consultants:

- Leanne Currie, DNSc, R.N., Columbia University, New York, NY and University of British Columbia; Nurse with expertise in fall and fall-related injury prevention and nursing informatics.
- Ben-Tzion Karsh, Ph.D., UW Madison Industrial Engineer with expertise in clinical decision support, workflow analysis, and technology acceptance theory, and research methodology.
- Calvin Franz, Ph.D., Eastern Research Group, Lexington, M.A., Health Economist with expertise in cost/benefit analysis.

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Appendix B: Detailed Project Timeline

Deliverables	Completion Dates
Initial meeting with COTR and other AHRQ staff	June 15, 2009
Project Timeline	June 22, 2009
Bi-Monthly Progress Report	**2009:** August 10 (Not submitted because of system error at AHRQ), Oct 12, Dec 10 **2010:** Feb 10, April 12, June 10, Aug 10, Oct 11
Draft Master Plan for the Development, Testing and Implementation and Impact Assessment an Electronic Decision Support and Care Planning Tool	Submitted July 20, 2009
Plan and Schedule Leadership Advisory Panel Meeting	July 1, 2009
Contact and Complete Consultant Contract	July 15, 2009
Draft Plan for developing a Data Dictionary and Template for Electronic and Printed Reports	Submitted July 20, 2009
Orient Consultants to the Project and Existing EHR, CDS, and Fall Prevention Care Planning Process	July 29, 2009
Complete literature search (with consultant input)	July 29, 2009
Finalize Conceptual Process Model and draft the list of quantitative metrics and the qualitative measurement tools used to design and evaluate CDS	August 14, 2009
Finalize metrics and measurement tools for Observation, Focus Groups, and Online Surveys	September 4, 2009
Prepare for Institutional Review Board Submission by contacting pilot unit leaders to seek approval for the project (ASLMC 9LM & 11LM)	September 4, 2009
Submit Institutional Review Board Application to the Aurora and UWM IRB Offices	September 18, 2009
Final Master Plan for the Development, Testing and Implementation & Impact Assessment an Electronic Decision Support & Care Planning Tool for Nurses (Task 2) including plans for qualitative and quantitative study (Tasks 6 & 7)	Resubmitted September 25, 2009
Final Plan for developing a Data Dictionary (Task 3) and Template for Electronic and Printed Reports	Included with the Revised Master Plan September 25, 2009
Draft Plan for developing Patient/Family Education (Task 4)	Included with the Revised Master Plan September 25, 2009
Draft Plan for developing Staff & Leader Education (Task 5)	Included with the Revised Master Plan September 25, 2009
Draft Plan for the Assessment of Costs & Financial Benefits of Electronic CDS for Care Planning	October 15, 2009
Final Plan for the Assessment of Costs & Financial Benefits of Electronic CDS for Quality Improvement	November 13, 2009

Project Deliverables	Completion Dates
Recruit staff for the focus groups and the survey	October 9, 2009
Gather quantitative data	Study Period September 28 - October 23, 2009
Complete observations on the Unit	October 8, 2009
Complete R.N. & NA Focus Groups	October 9, 2009
Post and complete online R.N. Surveys	Study Period October 9 - 23, 2009
Summarize baseline qualitative and quantitative findings for Core/Consultant Review	October 26, 2009
Complete data analysis of baseline findings	November 9, 2009
Complete CDS Design	December 20, 2009
Complete CDS Build	January 29, 2010
Complete Patient/Family Education Materials	December 31, 2009
Complete Staff and Leader Education Materials and post on the Aurora Learning Connection	January 29, 2010
System CDS Testing	Testing Period February 1- 8, 2010
Validation of CDS with clinical staff	Week of February 8-15, 2010
Complete staff and leader education	February 26, 2010
Care Planning CDS Go-Live with on-unit support	March 8, 2010
Care Planning Early Evaluation Survey	March 22–April 2, 2010
Quality Improvement CDS Orientation (Note: Tool Utilization was delayed to accommodate the deployment of other health IT applications at the facility)	
Quality Improvement CDS Tool Training Sessions for Manager, CNS & Staff Nurse Leaders	August/September 2010
Complete post-implementation evaluation using established quantitative and qualitative measures	July 30, 2010
Complete QI-CDS Tool Usability Testing	December 1, 2010
Final Report	January 31, 2011

Appendix C: Quantitative Measures

Data queries were conducted to abstract information from the EHR and risk management incident system to describe the state of care planning and quality improvement processes related to fall prevention at Aurora Health Care during baseline and post-implementation periods.

Sampling Criteria:

Adult patient (age ≥18 years) admitted to one of the two study pilot units and classified by their stay characteristics:

- Admitted and discharged from the same pilot unit (no transfers; full dose KBNI).
- Admitted/transferred into and/or discharged from pilot unit (partial dose KBNI; Identify patients who fell when they are not on pilot unit).
- Some time on pilot unit but discharged from another unit (unknown dose KBNI).

Data Collection Periods: Baseline: 2009 Q1 & 2 and Post: 2010 Q1 & 2

Established Knowledge-Based Nursing Initiative EHR Fall/Injury Prevention metrics:

- % Patients assessed for risk within 24 hours (Assessment/Diagnosis).
- % Patients assessed for risk daily (Assessment/Diagnosis).
- % Patients identified with Diagnosis of Risk for Falls &/or Risk for Fall-related Injury.
- Number of risk factors identified (Assessment/Diagnosis).
- % At risk with fall prevention plan initiated (Plan).
- % At risk patients with [any fall-related] education documented (Intervention).
- Number of patients with fall per 1,000 patient days.
- Median admissions between falls.
- % of Patients who fell and were at risk prior to fall event (% Morse Fall Scale Score >45 prior to time of fall).
- Number of patients injured per 1,000 patient days.
- % Patients with a fall resulting in injury.

New EHR metrics to evaluate care planning:

- Identify which of the (approximately 26) established fall or fall-related injury risk factors are most commonly identified during the admission process (after completing the health history and first physical assessment (prior to plan initiation within 24 hrs).
- Average # of hours between date/time of admission and date/time of plan (Risk for falls and/or Risk for falls related injury) initiation.
- Average # hours between Risk for Fall plan initiation & completion of the first "Fall High Risk Intervention" Form.
- Based on baseline risk assessment and results of the first Fall High Risk Intervention Form: (Degree of risk/intervention "matching" is based on %):
  - % of patients with identified mobility/gait risk have any selected interventions in the DTA: Interventions for Mobility/Gait.
  - % of patients with identified mental status/nonparticipation risks have any selected interventions in the DTA: Interventions for Alterations in Mental Status or Unable to Participate.
  - % of patients with identified elimination risks have any selected interventions in the DTA: Interventions for Elimination Risk.
- % of patients who have a new fall risk fired after plan initiated; how many new risks for falls were fired between plan initiation and discharge:
  - % of new fall risks were mobility/gait risk factors.
  - % of new fall risks were mental status/nonparticipation risk factors.
  - % of new fall risks were elimination risk factors.
  - % of new fall risks were other.
- % patients with a fall (new fall-risk alert):
  - Average # hours between date/time of a fall and date/time of "Fall High Risk Intervention" Form completion.
- Post-fall risk matching on the first Fall High Risk Interventions form that fired post-fall: (3 panel: risk, interventions, fall- Holy Grail):
  - % of new fall risk r/t to mobility/gait have Mobility/gait interventions.
  - % of new fall risk r/t altered mental status/nonparticipation have alterations in mental status or unable to participate interventions.
  - % of new fall risk r/t elimination have elimination interventions.
  - % of patients in each group that fell.
  - % of fall patients that had a documented change in the plan after the fall.
- Fall event summaries by unit:
  - % of patients who fell prior to prevention plan initiation (admit/during stay).
  - Date/time (by shift).
  - % of falls witnessed.
  - % of falls assisted.
  - Descriptive information re: Location, activity, special conditions, cervical collar/long board use and fall related injury interventions, etc.
- % of Risk for Falls and/or Risk for Fall-related injury who received education with a documented outcome of verbalizing personal fall injury or fall-risk factors.

Aurora Web-based Risk Management Incident System (RMIS) Reports

- Data elements currently collected in the RMIS system.
- % agreement between HER and RMIS regarding occurrence of fall incidents.
- % of time that the entry had complete and consistent data re: fields needed for quality improvement (e.g., date/time, location/activity, MFS prior to fall, plan initiation when compared with EHR.
- % agreement between EHR calculation for Falls/1,000 Patient Days and the one produced based on the RMIS data.

CMS-based coded Hospital-acquired condition (HAC) reports with e-codes

- % agreement between EHR (fall is documented with appropriate description of fall-related injury).

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Appendix D: Field Observation Process and Data Collection Form

Nonparticipant observations were conducted on the pilot units, guided by these questions:

How do nurses gather assigned patient information at start of shift?

- Estimate unit-based report time (# unit/float staff, approximate # minutes until last nurse is finished, # patients, describe patterns of interruption).
- Interaction with the computer during report.
- Use of paper report document.
- How do they organize and prioritize what to do first?

How do nurses delegate/communication to other caregivers?

- When: Approximate time first contact with CNA r/t fall prevention?
- How and what do they communicate to the nursing assistants r/t fall prevention?

How do the nurses interact with the electronic health record?

- Describe the nature of the interaction with the computer (beyond medication documentation).
- When is the first time they review care plan?
- When is the first time they chart on their patients?

How do the nurses establish fall prevention plan with newly admitted patients?

- Describe the nature of work around an admission (Total time for admission, do they use the computer at the bedside.

Is fall prevention discussed at weekday (Day Shift) Outcome Facilitation Team (OFT) meetings?

- Frequency that risk for falls/injury is discussed?
- Frequency that nursing leader(s) mentored staff re: fall prevention care planning?

What happens with a fall occurs?

- Discussions with patient/family/caregivers re: circumstances that may have led to the fall.
- Post-fall interventions (beyond established monitoring).
- Interaction with the EHR re: updating the care plan based on circumstances.

Field Observation Data Collection Form

Date:_____ Shift/Time:_____ Unit: ___LM Review: MH or LJ
R.N. Staffing: _____# patients/R.N.; NA:_____# patients/NA; Float Pool Staff:_____(#)

Activity*	Who, (R.N., CNA)	Minutes	Comments, Observation

***Activity Key**: 1=Report, 2=Collaboration with CNA, 3=In-Room Patient Care, 4=OFTs, 5=Care Planning, 6=Documentation, 7=Patient Education, 8=Admission, 9=Fall Event
Page____ of _____.

Appendix E: Focus Group Moderator Guide (Registered Nurses)

Project: "Using Evidence-based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-Related Patient Injuries in Acute Care"

Instructions for Registered Nurse Groups:

Thank you for joining us. Let me tell you what this discussion is about. As most of you know, this project is being funded by the Agency for Healthcare Research and Quality, a Federal Government Agency. The purpose of the project is to determine the best way to get valuable information to our front line care givers to improve fall and fall-related injury prevention. We are meeting with you to get your thoughts and ideas about current workflow, communication with nursing assistants and patients, and your current processes for care planning and quality improvement related to fall prevention. Your input and the other findings will be used to design and implement two new electronic reports for staff on 9LM & 11LM in January of 2010.

Before we start, we need to make a few things clear.

- Your participation offers you the benefit of having input into the design of the new electronic tools.
- Your participation today is voluntary. Your presence indicates your consent to participate. You may withdraw consent or discontinue participation at any time without penalty.
- This focus group is scheduled to last approximately one (1) hour. Unless it's critically important for you to leave your cell phones and pagers on, we'd appreciate it if you could turn them off, so that they won't interrupt our discussion.
- We would like to emphasize that there are no right or wrong answers to the questions. We want to hear your thoughts, experiences, and ideas. It doesn't matter whether you have a positive or a negative opinion about something, as long as it is your honest opinion. It is ok if you do not have or want to share your opinion/feedback about anything that we discuss.
- Everything we discuss today will remain confidential, meaning that comments will not be gathered by name. There will be no way to identify opinions by individual participant. The detailed findings will not be shared with anyone outside the research team including your manager/CNS. As far as we know, your participation will not pose any risk to you.
- This discussion is being audio taped and transcribed without participant identification so that we have something to review later on for writing up the results. We assure you that the tape will be secured in a locked cabinet and destroyed at the end of the study (11/2010). No one who is not directly involved in this research will hear the tape or have access to the transcribed report. Excerpted unidentified comments from the discussion may be used in presentations of study results.
- You may contact me, **Dr. Mary Hook** at (414) 219-5394 (mary.hook@aurora.org) or the Aurora Health Care **Human Subjects Review Board** at (414) 219-7744 or by email (irb.office@aurora.org), if any problems or concerns arise during or after the study.

Let's Begin: _____Total Participants
Participant Information:
We would like to know how well this group represents the staff on the pilot units:

- How many of you work on: ____9LM ____11LM?
- How many of you have been on the unit longer than 1 year? _____
- How many of you have completed R.N. Staging? _____
  If yes: What is your stage? ___Competent ___Accomplished ___Proficient ___Expert
- How many of you are members of your unit-based Nurse Coordinating Council? ____
- How many of your work: ___Day Shift ___PM Shift ___Night Shift ____Weekend

(Identify shift based on most hours worked.)

Note: The following questions represent an overview of the information that will be gathered. The actual questions used may be revised somewhat based on the findings from the observational portion of the study and as needed to facilitate the group discussion.

Care Planning Questions:

1. How do you currently gather information about your assigned patients?
   - Describe how you use the computer during report.
   - Describe how you use your paper document.
   - Describe how you organize and prioritize care.
2. At the end of report, what/how do you know: (try to gather differences based on shift)?
   - Which of your patients are at risk for falling/injury? (how/where do you go to get that information)
   - If any patient has had a fall prior to your shift (while hospitalized)?
   - Are there times when the report/plan does not match the patient?
3. How do you currently interact with your nursing assistant(s) at the start of the shift?
   - How (when) is fall risk communicated to nursing assistants?
   - How are planned interventions communicated?
   - How do you know if planned interventions are carried out?
4. How and when do you use the electronic health record (EHR) after you complete report? (Describe usual routine and beyond the use of the computer for medication administration)
   - Describe how/when/why do you "chart" in the EHR?
   - When/how do your review your patient's fall prevention care plan?
   - When/how do you complete the "Fall High Risk Intervention" Form?
   - How do you decide which interventions you use?
   - Do these always get done?
   - How are planned interventions evaluated?
5. How is the fall prevention plan communicated to patients?
   - How (when) is fall risk communicated to patients?
   - How are planned interventions communicated?
6. Describe fall prevention planning during the admission process.

7. Describe if/when fall prevention is discussed in Outcome Facilitation Team (OFT) meetings.
    - How often do you discuss your fall prevention plan?
    - What if any input do you receive?
8. Describe what happens when patients fall on the unit.
    - Why do patients on your unit fall?
    - How do you determine the circumstances that may have led to the fall?
    - How often do patients fall for reasons that were not identified?
    - Describe how often/when you have updated the care plan
    - How/when do you do online incident reporting?

Quality Improvement Questions (Unit-based Leaders)

1. What are the main issues related to fall prevention for your unit
2. What information do you review after a patient falls?
3. What information helps you the most in your current quality improvement work?
4. How well does your current process help you your to do quality improvement?

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Appendix F: Focus Group Moderator Guide (Nursing Assistants)

Project: "Using Evidence-based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-related Patient Injuries in Acute Care"

Instructions for Nursing Assistant Groups: (5 minutes)

Thank you for joining us. Let me tell you what this discussion is about. The purpose of the project is to determine the best way to get valuable information to our front line care givers to improve fall and fall-related injury prevention. We are meeting with you to get your thoughts and ideas about current workflow, communication with your nurses related to fall prevention. Your input and the other findings will be used to design and implement two new electronic reports for staff on 9LM & 11LM in January of 2010.

Before we start, we need to make a few things clear. (5 minutes)

- Your participation offers you the benefit of being involved in providing input that may help us to design computer-based tools to help the Registered Nurses.
- Your participation today is voluntary. Your presence indicates your consent to participate. You may withdraw consent or discontinue participation at any time without penalty.
- This focus group is scheduled to last approximately 15-20 minutes.
- We would like to emphasize that there are no right or wrong answers to the questions. We want to hear your thoughts, experiences, and ideas. It doesn't matter whether you have a positive or a negative opinion about something, as long as it is your honest opinion. It is ok if you do not have or want to share your opinion/feedback about anything that we discuss.
- Everything we discuss today will remain confidential, meaning that comments will not be gathered by name. There will be no way to identify opinions by individual participant. The detailed findings will not be shared with anyone outside the research team including your manager/CNS. As far as we know, your participation will not pose any risk to you.
- This discussion is being audio taped and transcribed without participant identification so that we have something to review later on for writing up the results. We assure you that the tape will be secured in a locked cabinet and destroyed at the end of the study (11/2010). No one who is not directly involved in this research will hear the tape or have access to the transcribed report. Excerpted unidentified comments from the discussion may be used in presentations of study results.
- You may contact me, **Dr. Mary Hook** at (414) 219-5394 (mary.hook@aurora.org) or the Aurora Health Care **Human Subjects Review Board** at (414) 219-7744 or by email (irb.office@aurora.org), if any problems or concerns arise during or after the study.

Let's Begin: _____Total Participants
Participant Questions: (2 minutes)

We would like to know how well this group represents the staff on the pilot units:

- How many of you work on: ____9LM ____11LM?
- How many of you have been on the unit longer than 1 year? _____
- How many of your work: ___Day Shift ___PM Shift ___Night Shift ____Weekend

(Identify shift based on most hours worked.)

Nursing Assistant Questions: (10-13 minutes)

1. How do you know your assigned patients are at risk for falls?
2. How do the nurses tell you about patients who are at risk for falls?
3. How do you know what to do to for each of your assigned patients to prevent falls?
4. How is information about preventing patients from falling communicated?
5. How well are the fall prevention plans carried out?
6. Based on your work with the patients, how well do patients know their risks or what to do to prevent falls?
7. Describe what happens when patients fall.
   - What do nurses say/do?
   - How often do the nurses tell you do add or do something different after the fall?

Appendix G: Survey Tool (Registered Nurses; Baseline)

Project: "Using Evidence-based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-related Patient Injuries in Acute Care." This study has been funded by the Agency for Healthcare Research and Quality (AHRQ). The findings will also be shared with the Aurora-Cerner-UWM Knowledge-Based Nursing Initiative leaders for quality improvement.

Instructions:

This survey has been designed to gather valuable information from front line caregivers to improve fall and fall-related injury prevention. You will be asked questions about your workflow, communication with nursing assistants and patients, and your current processes for care planning and quality improvement related to fall prevention. There are no right or wrong answers. You can leave blank any questions that you do not want to answer. Your responses are strictly confidential. Nobody at your hospital will see your individual responses.

Your input and the other findings will be used to design and implement two new electronic reports for staff on 9LM & 11LM in January of 2010.

Survey Questions: Care Planning (Baseline)	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the time	Very Well/ Always
1. How well does your current shift report process help you to know the specific fall or fall-related injury risk factors of your patients?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
2. How well does the current report process help you to quickly know which of your assigned patients are at risk or have had a fall?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
3. How well does your current report process help you to know what to tell your NAs about the fall prevention plan for each of your patients?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
4. Beyond the report process, how well does the current care planning process help you to know which prevention interventions to use?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
5. In actual practice, to what extent is the fall prevention care planning process is clear and understandable?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
6. In actual practice, to what extent is the fall prevention care planning process easy to do?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
7. How well does the current fall prevention care planning process work for all types of patients?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
8. How well does the current process help you to know when there are new risks that require a change in the plan of care?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
9. How well do the current electronic tools help you to talk with patients about their fall risk or prevention plan?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
10. In actual practice, to what extent does the current fall prevention care planning process helps you to prevent falls?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
11. Based on your past experience, how often do patients fall for reasons that were not identified as risk factors in the plan?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
12. Based on your past experience, how often to patient fall because planned interventions were not being carried out?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
13. If a tool was available when you finished gathering report that told you which patients were high risk and what to do for them, how likely are you to use it?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always

Survey Questions: Fall Prevention Quality Improvement (Baseline)	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
1. To what extent does your current fall incident reporting system make it easy for you to get information about falls that occur on your unit?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
2. How well does your current fall incident reporting data system help you to identify the circumstances surrounding falls on your unit?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
3. How easy is it for you to review the data reports and know what quality improvement activities are needed to prevent falls?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
4. To what extent does the current fall incident reporting system provide you with accurate and complete information about the falls on your unit?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
5. How well does your current fall incident reporting system help you to know that fall prevention care planning processes are being done on your unit?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
6. To what extent does your current incident reporting system help you to monitor the impact of the unit prevention activities?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
7. If a report was available that gave you details about the falls that occurred on your unit, as well as staff performance on key fall prevention strategies, how likely are you to view and use the report?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always

We appreciate the time you are taking to complete this survey. The information will help us to understand your workflow and how to design decision-support tools to help you prevent falls.

Thank you!

Demographics					
Nursing Unit?	9LM	11LM	Other		
Have you worked on the unit longer than 1 year?	Yes	No			
R.N. Stage	Not Staged	Competent	Accomplished	Proficient	Expert
Member of Unit-based Shared Governance?	Yes	No			
Shift you work most often?	Days	PMs	Nights	Weekend	

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Appendix H: Registered Nurse Survey (Early Post-Implementation)

Post-Implementation Fall Prevention Care Planning Tool Questionnaire

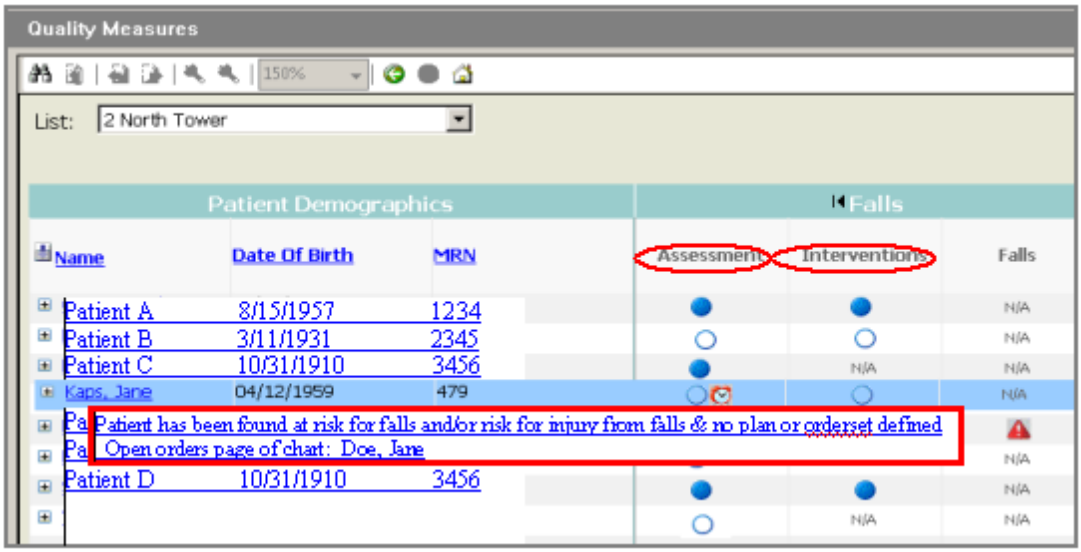
Project: "Using Evidence-based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-related Patient Injuries in Acute Care." This study has been funded by the Agency for Healthcare Research and Quality (AHRQ).

We have implemented the clinical decision support Tool for Fall Prevention Care Planning on 3/8/2010. We want your early feedback about how well the tool works. Your feedback will be used to evaluate the tool and identify if any changes are needed.

Instructions:

Please review the pictures provided and answer the questions. We encourage you to write in additional comments in the space provided. . There are no right or wrong answers. You can leave blank any questions that you do not want to answer. Your responses are strictly confidential. Nobody at your hospital will see your individual responses.

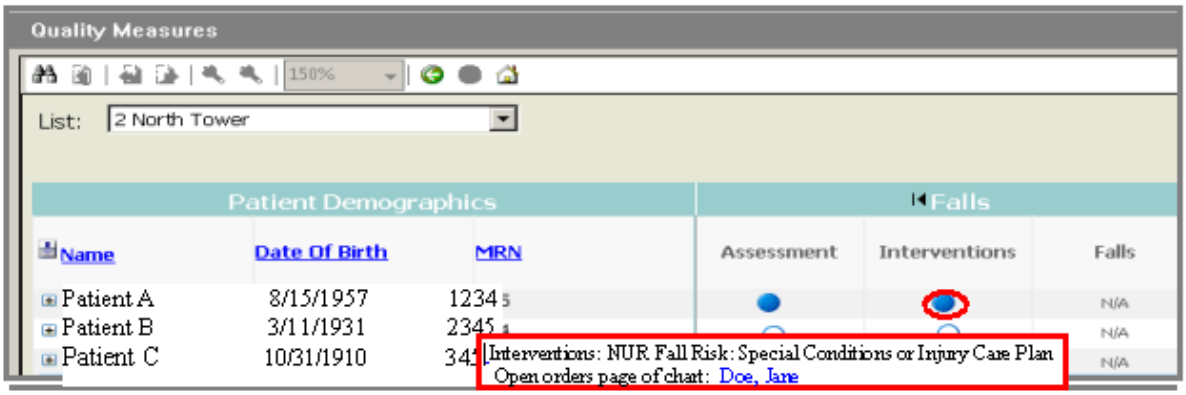
Fall Prevention Care Planning Tool



Survey Questions: Care Planning (Post)	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
1. How well does the Care Planning Tool help you to quickly know which of your assigned patients have been assessed risk for falling?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
2. How well does the Care Planning Tool help you to know the specific fall or fall-related injury risk factors of your patients?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
3. How well does the Care Planning Tool help you to quickly know which of your assigned patients have a Risk for Falls or Fall-related Injury Plan initiated?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
4. How well does the Care Planning Tool help you to quickly know which of your assigned patients have had a fall?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
Comments:				
Ideas for making the Assessment, Plan Identification (Intervention), and Fall features work better?				

2nd Page of the Survey:

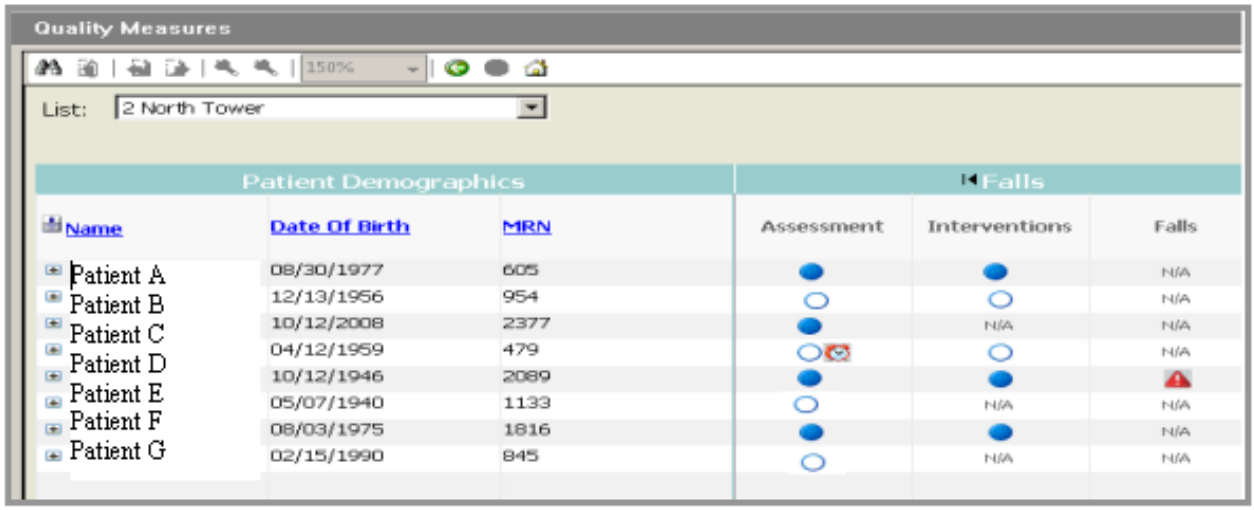
Fall Prevention Care Planning Tool



Survey Questions: Care Planning (Post)	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
1. Beyond the report process, how well does the Care Planning Tool help you to know which prevention interventions to use?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
2. How well does the Care Planning Tool help you to know what to tell your CNAs about the fall prevention plan for each of your patients?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
3. To what extent does the Tool make the fall prevention care planning process clear and understandable ?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
4. To what extent does the Tool make the fall prevention care planning process easy to do?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
Comments:				
Ideas for making the Intervention feature work better?				

3rd Page of the Survey:

Fall Prevention Care Planning Tool



Survey Questions: Care Planning (Post)	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
1. How well does the Tool help you to know when there are new risks that require a change in the plan of care?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
2. How well does the Care Planning Tool help you to know what fall risks to talk with your patient about?	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
3. How often do you use the Care Planning Tool. If you say, not very often or never, please comment	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always

What features of the Tool (e.g., ease of accessing the tool, display, content, etc.) are positive?

What features of the Tool (e.g., ease of accessing the tool, display, content, etc.) could be improved?

Please provide feedback regarding the new For Your Well Being (FYWB) on *Preventing Falls & Injury During Hospitalization:*

We appreciate the time you are taking to complete this survey.

Thank you!

4th Page of the Survey:

Demographics					
Nursing Unit?	9LM	11LM	Other		
Have you worked on the unit longer than 1 year?	Yes	No			
R.N. Stage	Not Staged	Competent	Accomplished	Proficient	Expert
Member of Unit-based NCC?	Yes	No			
Shift that you work most often?	Days	PMs	Nights	Weekend	

Appendix I: Registered Nurse Survey (Post-Implementation—6 months)

Post-Implementation (6 months) Fall Prevention Care Planning Tool Questionnaire

Project: "Using Evidence-based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-related Patient Injuries in Acute Care." This study has been funded by the Agency for Healthcare Research and Quality (AHRQ).

The Care Planning Decision Support Tool was implemented on March 8th, 2010. Nurses on 9LM & 11LM were able to access the tool using the "Quality Measures" tab in Cerner.

The purpose of this survey is to understand how the tool is working. We would like to hear both positive and negative feedback. Please tell us about the features that you liked or didn't like and if there were barriers that kept you from using the tool during patient care. We don't want you to do anything different. We just want your honest feedback.

Instructions: This survey contains general questions about the fall prevention care planning process on your unit including questions about your workflow, communication with nursing assistants and patients, and your current processes for care planning and quality improvement related to fall prevention. The next section will ask more specific questions about the tool.

There are no right or wrong answers. Your responses are strictly confidential. Nobody at your hospital will see your individual responses.

Thank you for your help!

Please tell us about the report process (in general):

	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the time	Very Well/ Always
How well does your current shift report process help you to know the specific fall or fall-related injury risk factors of your patients?	☐	☐	☐	☐
How well does the current report process help you to quickly know which of your assigned patients are at risk or have had a fall?	☐	☐	☐	☐
How well does your current report process help you to know what to tell your CNAs about the fall prevention plan for each of your patients?	☐	☐	☐	☐

Additional comments:

_____

Please tell us about the fall prevention care planning process:

	Not at All/ Never	Not well/ Not very often	Somewhat/ Most of the time	Very Well/ Always	Don't Know
Beyond the report process, how well does the current care planning process help you to know which prevention interventions to use?	☐	☐	☐	☐	☐
In actual practice, To what extent is the fall prevention care planning process is clear and understandable?	☐	☐	☐	☐	☐
In actual practice, To what extent is the fall prevention care planning process easy to do?	☐	☐	☐	☐	☐
How well does the current fall prevention care planning process work for all types of patients?	☐	☐	☐	☐	☐
How well does the current process help you to know when there are new risks that require a change in the plan of care?	☐	☐	☐	☐	☐
How well do the current electronic tools help you to talk with patients about their fall risk or prevention plan?	☐	☐	☐	☐	☐
In actual practice, To what extent does the current fall prevention care planning process help you to prevent falls?	☐	☐	☐	☐	☐

Additional comments:

_____

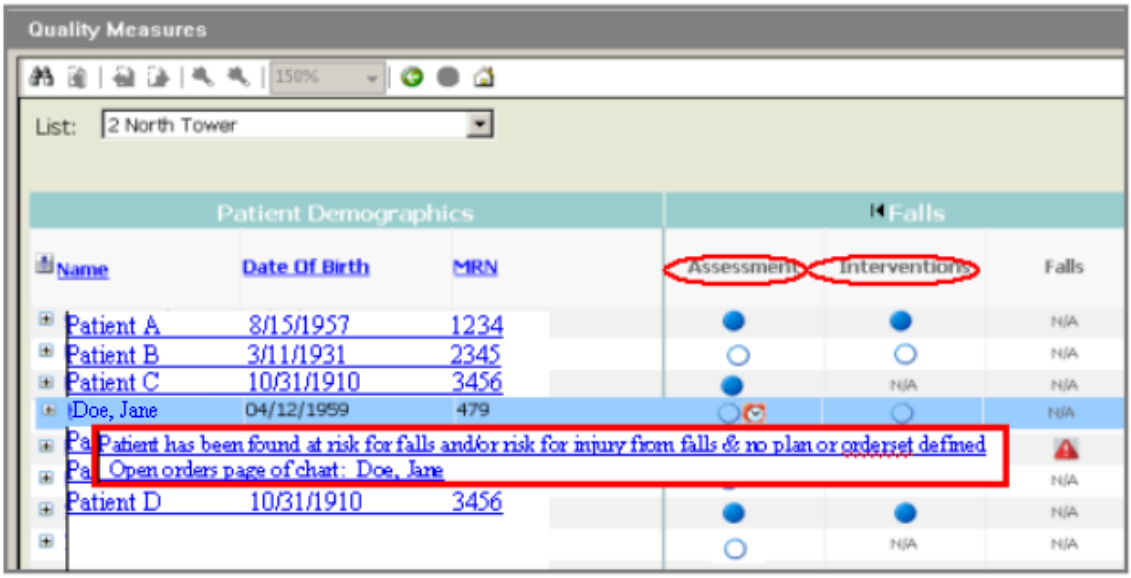
Please tell us about what happens when a patient falls:

	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the time	Very Well/ Always
How often do patients fall for reasons that were not identified as risk factors in the plan?	☐	☐	☐	☐
How often to patient fall because planned interventions were not being carried out?	☐	☐	☐	☐

Care Planning Tool Feedback

Instructions: Please review the pictures provided and answer the questions. We encourage you to write in additional comments in the space provided.

Fall Prevention Care Planning Tool



Please rate the Fall Prevention Care Planning Tool on the following:

	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the time	Very Well/ Always
How often have you used the Care Planning Tool? **If you say "not very often" or "never," please comment (below)**	☐	☐	☐	☐
How well does the Care Planning Tool help you to quickly know which of your assigned patients have been assessed for being at risk for falling?	☐	☐	☐	☐
How well does the Care Planning Tool help you to know the specific fall or fall-related injury risk factors of your patients?	☐	☐	☐	☐
How well does the Care Planning Tool help you to quickly know which of your patients need a fall prevention care plan?	☐	☐	☐	☐
How well does the Care Planning Tool help you to quickly know which of your assigned patients have had a fall?	☐	☐	☐	☐

Additional Comments:

_____

_____

_____

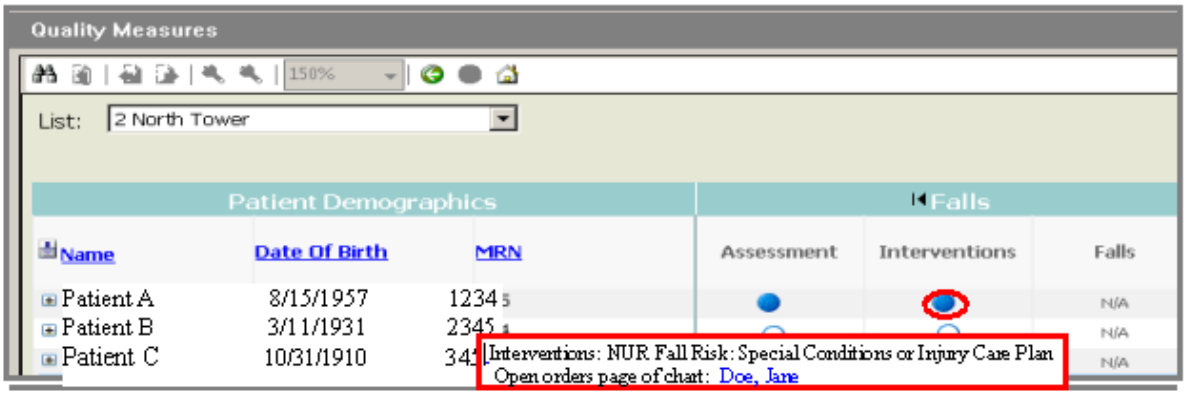
Do you have any ideas for making the Assessment and Falls features work better?

_____

_____

_____

2nd Page of the Survey



Please rate the Fall Prevention Care Planning Tool on the following:

	Not at All/ Never	Not well/ Not very Often	Somewhat/ Most of the Time	Very Well/ Always
How well does the Care Planning Tool make it easy to create or update a care plan?	☐	☐	☐	☐
How well does the Care Planning Tool help you to know which prevention interventions to use?	☐	☐	☐	☐
How well does the Care Planning Tool help you to know what to tell your CNAs about the fall prevention plan for each of your patients?	☐	☐	☐	☐
Is the Care Planning Tool clear and understandable?	☐	☐	☐	☐

Additional Comments:

_____

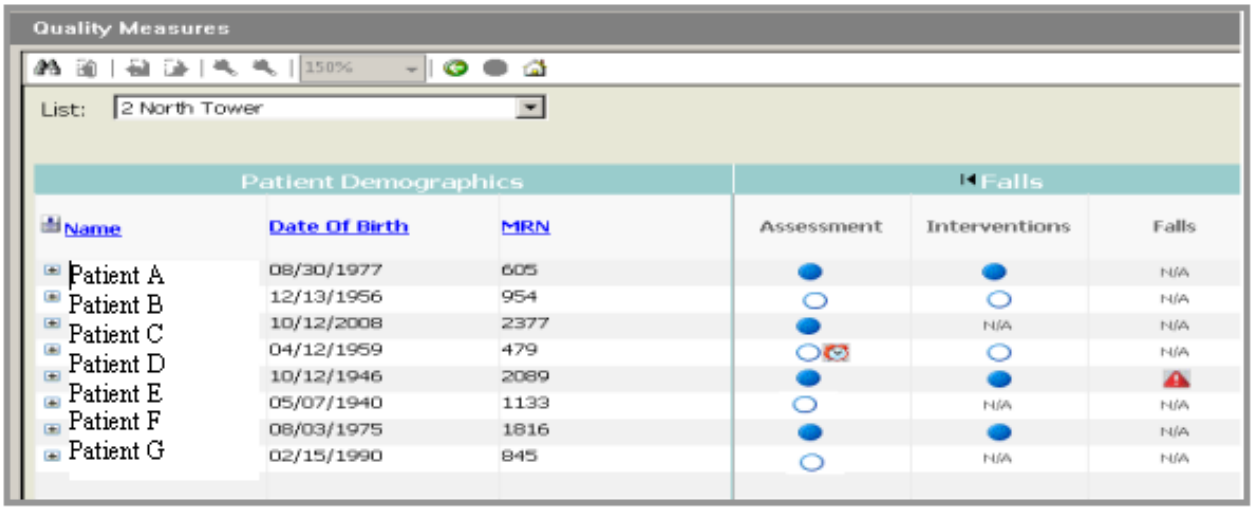
_____

_____

_____

3rd Page of the Survey:

Fall Prevention Care Planning Tool



What barriers did you encounter that prevented you from using the tool?
Tell us about the barrier and what you think could be done to support you to use the tool?

_____
_____
_____
_____

What features of the Tool (e.g., ease of accessing the tool, display, content, etc.) are positive?

_____
_____
_____
_____

What features of the Tool (e.g., ease of accessing the tool, display, content, etc.) could be improved?

_____
_____
_____

Tell us what you think about the new FYWB: Preventing Falls & Injury During Hospitalization

	Not at All / Never	Not well/ Not very often	Somewhat/ Most of the Time	Very Well/ Always
How well were you able to identify the patient-specific fall risks and complete the blanks in the new patient education sheet?	☐	☐	☐	☐
How often did you find that the new patient education tool improve your ability to do patient teaching?	☐	☐	☐	☐

How often did you find that the new patient education tool (FYWB: *Preventing Falls & Injury During Hospitalization*) improved your ability to do patient teaching?

Please provide feedback regarding the new For Your Well Being (FYWB) on *Preventing Falls & Injury During Hospitalization.*

_____
_____

Demographics					
Nursing Unit?	9LM	11LM	Other		
Have you worked on the unit longer than 1 year?	Yes	No			
R.N. Stage	Not Staged	Competent	Accomplished	Proficient	Expert
Member of Unit-based Shared Governance?	Yes	No			
Shift you work most often?	Days	PMs	Nights	Weekend	

Please use the "File" and "Print" command on your computer if you would like to print this certificate to document your participation in research for your APR. Be sure to add your name and the date that you took the survey. After you have printed your certificate, please click the "Submit Survey" button below.

We appreciate the time you are taking to complete this survey. The information will help us to understand your workflow and how to design decision-support tools to help you prevent falls.

Thank you!!

Appendix J: Quality Improvement CDS Tool Usability Testing

Project: "Using Evidence-based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-related Patient Injuries in Acute Care"

Instructions for Participants:

We are meeting with you and other members of the unit Quality Council to get feedback on the quality improvement tool. The tool was created to assist nurse leaders in performing fall prevention quality improvement initiatives at a unit level.

Before we start, we want to make sure you understand a few things:

- Your participation today is voluntary. Your presence indicates that you willingly consent to participate. You may withdraw consent or discontinue participation at any time.
- We are evaluating the new report tool. We will be asked to "walk through the tool" as you do when you review it and talk out loud. Tell us what you look at and what you are thinking as you use it. We encourage both positive and negative responses to the tool. Your feedback on the tool is completely voluntary and you have the right to not provide feedback.
- This session will last about 15-20 minutes.
- We will be taking notes and audio taping the session so that we can analyze the feedback. We assure you that your feedback is confidential. The notes and tape will be secured in a locked cabinet and destroyed at the end of the study (12/2010). No one who is not directly involved in this research will hear the tape or have access to the transcribed report. Excerpted unidentified comments from the discussion may be used in presentations of study results. As far as we know, your participation will not pose any risk to you.
- You may contact me, **Dr. Mary Hook** at (414) 219-5394 (mary.hook@aurora.org) or the Aurora Health Care **Human Subjects Review Board** at (414) 219-7744 (irb.office@aurora.org), if any problems or concerns arise during or after the study.

QI-CDS Tool Usability Testing

Scenario Part 1: Tool/Report Access

Participant instructions based on role:

Staff: "Staff members who participate in quality improvement activities where sent an email with the report in PDF format. Go to your email and find and open the report that you received."

Managers/CNS: "Go to the PowerInsight Report, log in, and demonstrate how to run a report."

Introductory Questions	Responses (selected sample)
Have you viewed the tool before?	
Just from looking at the tool, what kinds of information do you think you could get from this tool?	

Scenario Part 2: Reviewing and Interpreting the Report

Participant instructions based on role:

Staff Nurse: "Open your email featuring the ACTION report and open it. Walk through the tool and "talk out loud" about what you are viewing, how you interpret what you see, and what you will do with the information."

Manager and CNS participants: "Open your email featuring the ACTION link and go to the tool. Open the tool for this quarter. Walk through the tool and "talk out loud" about what you are viewing, how you interpret what you see, and what you will do with the information."

Scenario Part 2: What Did They Do?	**Observations/Comments (Selected)**
Potential prompt if needed: What does the information in this section tell you?	
Potential prompt: re: Fall Details Section: "If you didn't see all of what you needed, where would you go to investigate it?"	

Scenario Part 3: Creating Copies of the Report

Participant instructions if they have a role in copying or sharing the report:
"You want to create a copy of the report to send to your team? How is this done?"

Scenario Part 3: What Did They Do	Observations/Comments (Selected)

QI-CDS Tool Usability Testing

Exit questions for all participants:

Exit Questions/User Impressions	Responses
Is there anything else that you thing might be included in the tool?	
What did you like best?	
What did you like the least?	
Other Comments?	

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Appendix K: Quality Improvement CDS Tool Data Element Descriptions

Report Definitions: Falls Summary (Page 1)

Facility: The facility abbreviation for the hospital for which the report was run.

Unit: The unit name for which the report was run.

Refresh Date: The date on which the report was last refreshed.

Page Number: Page number and number of pages for Falls Summary.

Number of Patients: The number of distinct patients that stayed on the unit during the month. The QTD total will not be the sum of the individual months, as it is a total of distinct patients who stayed on the unit during the quarter. Therefore, a patient whose stay crosses two months will be counted in the metric for each of the months, but only once for the quarter.

Number of Encounters: The number of distinct patient encounters or stays that occurred sometime within the month and included a stay on the unit. An encounter does not need to be fully contained within a month in order to count for that month.

Number of Patient Days: Patient days are calculated from the patients admit time to the next day. Each patients day may start at a different time, matching their admit time on their first day. Each day is grouped into the month in which the day starts. Therefore a patient who is admitted October 31st at noon and released November 2nd at noon will have 2 patient days. The first day would count as an October day and the second day would count as a November day. Each individual day can be subdivided across multiple units and fractions of a day are included in totals.

Number of Patients with a Fall: The number of patients who fell on the unit. Each patient is counted a maximum of one time per month, regardless of the number of falls.

Number of Falls: The number of individual fall events on the unit.

% of Patients with a Fall: The number of patients with a fall divided by the number of patients who spent time on the unit.

Number of Falls per 1000 Patient Days: The number of falls divided by the number of patient days * 1000.

% At Risk Prior to Fall: The number of falls where the patient was identified as “At Risk for Falls” prior to the fall divided by the total number of falls.

% Non-Risk Prior to Fall: The number of falls where the patient was not identified as “At Risk for Falls” prior to the fall divided by the total number of falls.

Number of Injuries From a Fall: The number of falls with an injury documented on the most recent fall assessment.

Number of Injuries per 1000 Patient Days: The number of injuries from a fall divided by the total number of patient days * 1000.

Number of Minor Injury per 1000: The number of injuries documented as minor divided by the total number of patient days * 1000.

Number of Moderate+ Injury per 1000: The number of injuries documented as moderate or major divided by the total number of patient days * 1000

% of Falls Resulting in Injury: The number of Injuries from a Fall divided by the total number of falls.

% of Falls with Minor Injury: The number of falls with a minor injury documented on the most recent fall assessment divided by the total number of falls.

% of Falls with Moderate+ Injury: The number of falls with a moderate or major injury documented on the most recent fall assessment divided by the total number of falls.

% Assessed within 24 Hrs of Admission: The percentage of patients with at least a portion of their first 24 hours after admission spent on the unit with an assessment performed during that 24 hour period of time. This assessment may have occurred on another unit. In order for a person to be counted within a month, their date of admission has to be within that month.

% Assessed for Risk Daily: The percentage of patients with at least a portion of each 24 hour period after their first 24 hours after admission spent on the unit with at least one assessment performed during that period. Each patient may count multiple times in both the numerator and denominator.

% Identified at Risk for Falls: The percentage of patients that stayed on the unit and where identified as "At Risk for Falls" during their stay.

% Identified at Risk for Fall Related Injury: The percentage of patients that stayed on the unit and where identified as "At Risk for Fall Related Injury" during their stay.

% At Risk with Fall Prevention Plan Initiated: The number of patients identified as At Risk with a Fall Prevention Power Plan initiated divided by the total number of patients identified as At Risk.

% At Risk with Education Documented: The number of patients identified as At Risk with Fall related education documented divided by the total number of patients identified as At Risk.

Patient Falls (Page 2)

Facility: The facility abbreviation for the hospital for which the report was run.

Unit: The unit name for which the report was run.

Refresh Date: The date on which the report was last refreshed.

Page Number: Page number and number of pages for the Patient Fall portion of the report.

FIN: The financial (FIN) number (unique identifier) of the patient who fell.

Fall Date: The date of the patients fall.

Fall Time: The time of the patients fall.

Time to Document: The number of hours between the patient's fall (date/time) and the start of the fall documentation.

Admit Dt/Tm: The patients admit date and time.

Discharge Dt/Tm: The patient's discharge date and time, if discharged by report run time.

Enc Type: The encounter type of the patient (Inpatient, Observation, etc.)

Age: The age of the patient at the time of the fall.

Sex: The gender of the patient.

Activity at Time of Fall: The documented activity at the time of the patients fall.

Location of Fall: The documented location of the fall.

Initial Injury Asmt: The Injury Assessment at the time of the initial fall documentation.

24 Hr Injury Asmt: The Injury Assessment (if documented) for the 24-hour post fall assessment.

24 Hr Injury Document Dt/Tm: The date and time the 24-hour post fall assessment was documented.

FW: Was the fall witnessed? (Yes or No)

FA: Was the fall assisted? (Yes or No)

BA: Was a bed alarm (BA) documented for patient prior to the time and date of the fall? (Yes if present.

R: Were restraints (R) documented prior to the time and date of the fall? (Yes if present).

Last MFS: The last Morse Fall Score (MFS) documented prior to the fall. (Fall Risk Assessment tool used at the facility)

MFS Span: The number of days (including fractional days) prior to the fall that the most recent Morse Fall Score (MFS) was documented.

PP: Was a Fall Prevention Plan initiated prior to the fall? (Yes if present)

At Risk: Was the patient "At Risk for Falls" prior to the fall (based on the presence of an active problem on the problem list).

Progress Note: The progress note documented with the initial fall assessment. This free text will only be extracted in the note was created in the context of completing the Post Fall Initial Assessment form.

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Appendix L: Suggested Elements for a CDS Cost-Benefit Analysis

Initial Project Development (One Time Costs)

Measure	Source
Data Dictionary Creation	
Identify data source and data elements needed (utilize standardized terminology and definitions to the full extent possible).	Time/salary of individuals
CDS Developmental Costs	
Gather data to identify content and design requirements and sociotechnical context variables that would need to be collected to identify issues that may impact the adoption of the tool and support generalizability. Note: The clinical foundation components for fall prevention must be in place to support staff in providing care based on evidence including policy/procedure, patient education tools, and nurse sensitive data elements for patient risk assessment, fall prevention care planning, and post-fall care	Time/salary of individuals; Research consultant may be needed since some essential new variables that may need to be identified and analyzed.
Design & Build of CDS tools	Time/salary of Clinical and IT staff; Include experts in CDS EHR Report Design
Develop process to track end-user utilization	Time/salary (Prefer an electronic solution vs. manual tracking)
Carry out formal heuristic and usability testing. Identify training and other implementation strategies needed to support adoption.	Time/salary IT and selected sample of representative endusers
Make CDS tool build revisions based on user feedback	Time/salary IT developers with post-revision testing staff
CDS Installation Costs	
Technical and clinical CDS Implementation (costs vary depending on the pre-existing EHR, if tool is standard EHR-provider tool packet or new tool that was created. Note: The plan for taking on an EHR-provider tool may involve additional time and resources to install and map CDS to existing fields or to create new fields.	Time/salary
Training Costs	
Prepare course materials (includes evidence/policies to provide rationale for the change in practice as well as training to support staff to use the IT components.	Time/salary
End-User Training Time Train staff and nurse leaders to support adoption. Evaluate knowledge/skills in the use of quality improvement activities prior to deployment. Supplement training as needed to make sure that nurse leaders have the skills to effectively use the data provided with the tool.	Time/salary of Staff R.N., Managers, and CNS
Initial “just-in-time” support for Staff/Nurse Leaders The CP-CDS and Fall Prevention ED tools were designed for use during actual patient care. Consider adding staff during initial deployment to provide time for staff to practice using tools and asking questions with a lighter patient load. The QI-CDS tool provides much data. Additional support may be needed to help leaders use tool to trend data over time.	Time and hourly wages
Productivity of nurse managers learning new tool	Time and hourly wage. Estimate time to comfortable use (competence)
Productivity of R.N. staff learning new tool	Estimate time to comfortable use (competence)

Recurring Costs for Development Site

Measure	Source
MIS/IT Support	
IT support after implementation (based on established norms at facility)	
Ongoing Training Needs	
Support clinical and IT training needs Note: Staff "fit" health IT/CDS into their workflow in ways that may not be intended by the designer. This study demonstrated the need for evaluating ongoing adherence to using the tool (as designed) over time and addressing deviation as needed.	Time/wage estimates for ongoing training

CDS Adopter Facility Costs

Measure	Source
MIS/IT Support	
IT support after implementation (based on established norms at facility)	

Development costs for an adopter facility would likely be reduced by using the specifications provided by the tool/project developers. There is probably an irreducible minimum cost, plus a scale factor that would depend on the size of the adopter relative to the developer costs.

Measure	Source
Data Dictionary	
Review/revise for adopter's specific environment	Time/resources. Review and revise data dictionary available in USHIK or in CDS tool specification documents. Varies based on existing automation. Cost lower for sites with standardized language.
CDS Development	
Review/revise for adopter's specific environment	Varies based on existing automation. Adapt CDS tool specifications using AHRQ tools
CDS Install/Test	
Test/Install	Varied based on existing automation.
Training Costs	
Prepare training materials	Adapt training materials for AHRQ Tool Kit available
End-user Training time	

Recurring Costs for Adopters

Ongoing Training Needs	
Support clinical and IT training	Time/wage estimates for ongoing training

Potential Benefits (developers and adopters)

Measure	Source
Clinical Measures	
Number of averted falls and/or fall-related injury (injury cost aversion)	Extrapolated from quality improvement analysis Note: Falls are prevented directly based on the interventions initiated. CDS tools provide indirect processes for fall prevention, making it difficult to determine real measure of impact.
Number of days between falls	Falls are considered "rare" events in epidemiological terms, making time between events an appropriate method for evaluating improvement. Note: The calculation is most stable when the patient volume remains consistent without day to day variation.
Patient willingness-to-pay to avert fall	Economists often recommend measures of benefit using the concept of "willingness to pay". As patients get more engaged in fall prevention, they may be more willing to "pay" (in the form of spending time/efforts) to engage in prevention when they are more aware of the costs of not engaging.
Productivity Estimates	
Change in time spent by staff R.N.s and NAs communicating about fall-prevention or in care planning	It may be difficult to measure actual time with varied staff workflow; Consider measuring perceptions of time (survey question)
Change in time spent gathering data for fall-related quality improvement Change in time spent conducting effective quality improvement activities	Ongoing productivity impact on nurse and/or nurse leader time spent (establish mechanism to evaluate at baseline and compare initially and ongoing)