Published in final edited form as:

Res Gerontol Nurs. 2015 ; 8(1): 5–10. doi:10.3928/19404921-20121222-01.

The Use of Health Information Technology to Improve Care and Outcomes for Older Adults

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Introduction

Using health information technology (HIT) to improve care and outcomes for older adults is a growing program of research propelled by recent transformative policies such as the Health Information Technology for Economic and Clinical Health (HITECH) Act (Blumenthal, 2010; Institute of Medicine, 2011) and the Institute of Medicine report, "The Future of Nursing: Leading Change, Advancing Health." (Institute of Medicine, 2010). Both documents call for the implementation of electronic health records (EHR) and HIT solutions to improve the safety, quality and efficiency of care. Several nurse scientists are at the forefront of advancing this work, particularly using electronic health records, decision support and telehealth. This commentary highlights examples of recent research (2010–2014) led by nurse scientists using HIT to improve patient safety, and the quality and efficiency of patient care. We also discuss future opportunities for Gerontological nurse scientists interested in blending the care of older adults and HIT and suggest strategies to increase our capacity to engage in such innovative research.

Using the EHR to improve outcomes for older adults

Recent incentives provided by the HITECH Act have resulted in rapid growth in the development and implementation of the EHR. Nurse led studies are beginning to demonstrate that effective use of the EHR can improve outcomes of relevance to older adults such as pressure ulcers and falls. Dowding and colleagues evaluated the impact of an integrated EHR in 29 Kaiser Permanente hospitals on process and outcome indicators for patient falls and hospital acquired pressure ulcers (Dowding, Turley, & Garrido, 2012). They found that the EHR system was associated with improved documentation of both fall and pressure ulcer risk assessments and statistically significant improvements for pressure ulcer risk assessment documentation. They demonstrated that improved documentation using the EHR was associated with a 13% decrease in hospital acquired pressure ulcer rates.

The patient fall rates remained unchanged after EHR implementation. The authors reported variation in these outcomes across hospitals and care regions. They noted that in addition to EHR implementation, organizational factors such as collaboration, teamwork, and supportive leadership are needed to achieve sustained improvements in quality and safety outcomes. This highlights a role for Gerontological nurses as they can promote improvements in nursing sensitive measures such as patient falls and hospital acquired pressure ulcer rates by modeling adoption and use of the EHR and by leading quality improvement efforts that engage both senior leadership and front line nursing staff (McFadden, Stock, & Gowen, 2014; Rosen et al., 2010). Leading geriatric care improvement programs within a healthcare organization such as NICHE (Nurses Improving Care for Healthsystem Elders) is an example of how Gerontological nurses can partner with nursing leadership and frontline staff to improve the care of older adults. This type of program, coupled with an integrated EHR that captures data in a structured, coded format and provides clinical decision support can ensure that all older adults receive evidence-based, personalized care and that nursing documentation is reused to build evidence for future practice.

Gerontological nurse experts can efficiently influence important outcomes and standardize the way we assess and treat older adults by providing input into which evidence-based assessment and decision support tools are embedded into the EHR. For example, in a study in long-term care, the number of malnourished residents decreased significantly after embedding evidence-based assessment tools into the EHR that prompted nutritional and pressure ulcer risk assessments and documentation (Fossum, Alexander, Ehnfors, & Ehrenberg, 2011). Using such tools prompts the caregivers to assess these important parameters, and, over time, the data generated during standardized assessments and documentation will enable research and knowledge generation using large datasets across settings and time. The IOM called for a "learning health system" where we use EHR data to apply what is known about a patient to generate or apply knowledge resulting in evidence-based, personalized care in the form of decision support (Friedman, Wong, & Blumenthal, 2010). An integrated EHR with structured, coded data capture provides the data infrastructure for the learning healthcare system that will transform the way Gerontological nurses generate and apply knowledge. Data recorded at the individual patient level during an encounter can be used to personalize care for that patient and can be simultaneously applied to spur discovery and innovation for future care delivery for older adults (Greene et al., 2009). Gerontological nurses play an important role in guiding the development of our "learning health system."

Providing decision support interventions

Using the EHR as a tool to achieve a learning health system affords the opportunity to build decision support within the workflow of nurses caring for older adults. Decision support can take the form of alerts, reminders, or algorithms that guide evidence-based care. Bowles and colleagues implemented the expert discharge decision support system (D2S2) within the hospital nursing admission assessment to identify older adults in need of post-acute care such as skilled home care or skilled nursing facility care. Based on how patients answer a series of questions, an algorithm generates a daily report sent to discharge planners alerting

them of patients at risk for poor discharge outcomes and therefore in need of a post-acute referral. Use of the decision support achieved a 26% relative reduction in 30 and 60-day readmissions in one study (Bowles, Hanlon, Holland, Potashnik, & Topaz, 2014) and 33%, 30-day and 37%, 60-day relative reductions in readmissions in a subsequent study (under revised review at RINAH). Study findings suggest that using decision support to early identify at risk patients and arranging appropriate follow-up care is associated with improved post-acute care outcomes.

Symptom management during cancer treatment is another complex care challenge for many older adults and their caregivers. A nurse led team created a computable algorithm that adapts research evidence for use in a clinical decision support system providing individualized symptom management recommendations to clinicians at the point of care (Cooley et al., 2013). This complex challenge required mixed methods that involved two large clinical sites, multiple panels of experts, a seven-step process, and two years to complete. These rigorously developed algorithms are available for testing.

HIT can also provide decision support for sensitive topics like advanced care planning. Hickman and colleagues created a multimedia decision support intervention that delivers education about advanced directives to patients recovering from critical illness (Hickman, Lipson, Pinto, & Pignatiello, 2013). Brought to the bedside via laptop computer, this intervention increased the intent to sign an advanced directive by 25 times compared to the commonly used advanced directive educational brochure, "Putting it in writing".

Clinical decision support in the EHR can also facilitate guideline adherence. Beeckman and colleagues evaluated whether a decision support system for pressure ulcer prevention improves guideline adherence with pressure ulcer prevention recommendations in a nursing home setting (Beeckman et al., 2013). They found that nurses who used the EHR system with the pressure ulcer prevention decision support were more likely to provide guideline-based pressure ulcer prevention interventions than nurses in the control group who received a paper copy of the practice guidelines.

The successful work of Dykes and colleagues clearly illustrates the value of integrating fall risk assessment and clinical decision support into the EHR (Dykes et al., 2010). Based on qualitative research with professional and paraprofessional providers (Dykes, Carroll, Hurley, Benoit, & Middleton, 2009), patients and family (Carroll, Dykes, & Hurley, 2010), Dykes and team learned that patient falls were a communication problem. Nurses routinely conduct fall risk assessment on hospitalized patients but the degree to which the results of that assessment and the associated plan are communicated to other care team members, the patient and family was variable. In a randomized control trial of over 10,000 patients, they found that by using HIT to integrate fall risk assessment and clinical decision support for tailored fall prevention plans into the workflow (Carroll, Dykes, & Hurley, 2012), older patients were more likely to have personalized fall prevention plans and were less likely to fall during an acute hospitalization (Dykes et al., 2010).

Remote monitoring of older adults

Telehealth, defined as the use of video and biometric devices to monitor and provide care at a distance is a rapidly growing intervention studied by nurses. The body of literature in the domain of telehealth specifically for older adults is growing in more recent years, and numerous studies highlight the leading role of nursing in designing, implementing and evaluating such systems. Published reports range from pilot feasibility studies to large multi-site randomized clinical trials. One such recent trial is by Takahashi et al examining telemonitoring in older adults with multiple chronic conditions (Tele-ERA-Elder Risk Assessment) as a tool to reduce hospitalizations and emergency department visits when compared with usual care (Takahashi et al., 2010). The telehealth device used was a commercially available one that has video monitoring allowing real-time, face-to-face interaction with the provider team. Peripheral devices were attached to measure blood pressure and pulse, oxygen saturation, glucose level, and weight. The elderly study patients found home telemonitoring to be acceptable, providing a sense of safety in their home (Pecina et al., 2011). However, home telemonitoring in older adults with multiple comorbidities did not significantly improve self-perception of mental well-being and may worsen self-perception of physical health. While a report on the effectiveness for reducing hospitalizations has not been published yet, findings from this trial have already highlighted the role of a registered nurse as overseeing all processes and assessing any changes in patient status as assessed by videoconferencing and telemonitoring.

A nurse led study examining the effectiveness of home based individual telehealth intervention for stroke caregivers was conducted in South Korea (Kim et al., 2012). This study employed a quasi-experimental design with a repeated-measures analysis to explore if caregiver burden will be lower for families that receive a telecare intervention in addition to standard care, when compared to the control group. Seventy-three patients from five hospitals participate in the study. There was a statistically significant decrease of family caregiver burden in the experimental group and the intervention was found to be cost-effective.

Emme and colleagues explored the role of home telehealth in facilitating self-efficacy in patients with chronic obstructive pulmonary disease. She conducted this study within a larger initiative called the Virtual Hospital (Emme et al., 2014). The Virtual Hospital included patients admitted to the emergency department due to chronic obstructive pulmonary disease (COPD) exacerbation. Within 24 hours after admission, participants were randomly assigned to receive standard treatment using telehealth equipment with an integrated organizational support in their own home or standard treatment in the hospital. The results of the study suggest that there may be no difference between self-efficacy in COPD patients undergoing virtual admission, compared with conventional hospital admission.

Keeping-Burke et al conducted a randomized clinical trial to determine whether coronary artery bypass graft surgery patients and their caregivers who received telehealth follow-up had greater improvements in anxiety levels from pre-surgery to three weeks after discharge, than those who received standard care (Keeping-Burke et al., 2013). No group differences

were noted in changes in patients' anxiety and depressive symptoms, but patients in the telehealth group had fewer physician contacts. Furthermore, caregivers in the telehealth group experienced a greater decrease in depressive symptoms than those in the standard care group and female caregivers in the telehealth group had greater decreases in anxiety than those in standard care.

A single-center randomized controlled clinical trial conducted by Wakefield and colleagues compared two remote telehealth monitoring intensity levels (low and high) and usual care in patients with type 2 diabetes and hypertension being treated in primary care (Wakefield et al., 2012). No significant differences were found across the groups in self-efficacy, adherence, or patient perceptions of the intervention mode. The study indicated that home telehealth can enhance detection of key clinical symptoms that occur between regular physician visits but called for further investigation of the mechanism of the effect of the telehealth intervention.

In the studies described above, patients and/or their family members have to operate specific hardware and software applications as part of the telehealth intervention. This often raises the question of feasibility for older adults who may live alone and be very frail or inexperienced with technology or are experiencing cognitive or functional limitations. As technology advances, there are opportunities to utilize systems that do not require a user to operate them but instead the systems enable passive and ongoing monitoring of older adults' well-being. An extensive program of research led by Rantz and colleagues (Rantz et al., 2012) conducted in senior housing facilities demonstrates the power of telehealth to predict adverse events and support seniors to age in place. In these studies, sensor networks were deployed that included stove temperature, bed, chair and motion sensors, and Microfoam Kinect sensors in order to assess behavioral and physiological patterns over time and identify abnormalities or emergencies. Findings so far suggest that the sensor data can serve as tools for early illness detection. There are other initiatives underway exploring this concept of a "smart home," namely a residential setting with technology embedded in the residential infrastructure to enable passive monitoring of residents with the goal to assess overall patterns of activity, quality of life and well-being. As part of the HEALTH-E (Home based Environmental and Assisted Living Technologies for Healthy Elders) initiative in the School of Nursing at the University of Washington, researchers have installed various sensor technologies in apartments of older adults who live in retirement communities in Seattle. The sensor technologies include motion sensors to detect how one moves inside the home, as well as infrastructure mediated sensing, namely an electricity sensor that can detect electricity consumption by electricity source, and a water sensor that detects water consumption by each water source. These features allow the detection of activities such as meal preparation or bathroom visit with a level of granularity that motion sensors alone cannot provide. Advanced data analysis and pattern recognition techniques allow not only the detection of activities but also potential changes over time, for example, if data indicate a more sedentary behavior over time, or an irregular pattern of activities calling for timely interventions to prevent an adverse event (Reeder, Chung et al., 2013). Findings so far indicate that older adults accept these technologies if they see a purpose and perceived usefulness does ameliorate privacy concerns (Chung et al., 2014) Case studies showcase the potential of technology to identify health related trends. However, the concept of smart

homes is still an emerging one and we are lacking large longitudinal studies and clinical trials that will examine the effectiveness of such technologies and their impact on clinical or other outcomes (Reeder, Meyer et al., 2013)

What is in the nursing research pipeline?

A search of the National Institute of Health REPORTER database informed us about what nurse-led HIT studies, funded by the National Institute of Nursing, are in the pipeline. We can look forward to hearing the results of several innovative studies that address the needs of and improve outcomes for Alzheimer's patients and their caregivers. At least four studies address dementia, two are RO1s, one R21 and one R15. RO1NR014737 (Williams, Principal Investigator) will test the effects of technology that connects dementia caregivers to experts for guidance in managing disruptive behaviors and supporting care at home. Experts will analyze video recordings of the triggers and precursors of the disruptive behaviors along with its features and give prevention and management advice to the caregivers. The second RO1NR011042 (Fick, Principal Investigator) proposes the use of the EHR to deliver an Early Nurse Detection of Delirium Superimposed on Dementia intervention. The EHR will provide decision support through standardized delirium assessment and management screens. The R21NR 013471 (Mahoney, Principal Investigator) will develop an innovative bureau dresser retrofitted with sensors and an IPAD that offers visual cues and verbal prompting to help persons with dementia dress. The team hopes to advance the technology from prototype proof of concept to ready it for large-scale intervention trials. Finally, the R21NR013569 (Hickman, Principal Investigator) uses gaming technology to create an interactive, avatar-based tailored electronic program that will engage and prepare family members for the role of surrogate decision maker when caring for persons with impaired judgment.

Beyond the study of dementia, the value of large dataset analysis is evident to meet the aims of RO1NR010822 (Larson, Principal Investigator). In this study, investigators are using data within a clinical data warehouse to conduct three comparative effectiveness studies about hospital-acquired infections and various contributing or preventive factors. The study will also produce policies and procedures regarding future use of these large datasets to make them more widely available for future research. An RO3NR012802 (Kim, Principal Investigator) takes advantage of EHR data documented during the longitudinal care of older adults as they transitioned across multiple care settings including their homes. The focus of the study is care coordination and the aims are to identify interventions used in care coordination, identify relationships among patients' characteristics and care coordination interventions and outcomes.

These exciting and innovative examples give us a snapshot of what new knowledge we have to look forward to and provide excellent examples of our learning health system and the use of HIT to improve care for older adults.

How Gerontological Nurses Can Get Involved

The HIT research completed to date provides a beginning foundation for evidence-based nursing care of older adults and a learning health system. Gerontological nurses can

contribute to the learning health system in several ways. First, nurses can adopt standardized, evidence-based risk assessments in practice and work with their information technology departments or vendors to make sure that these assessments, corresponding interventions and patient outcomes are represented in a structured coded fashion in the EHR. Linking evidence-based interventions to assessment data in the EHR will ensure that all patients receive evidence-based care during each encounter. In addition, submission of risk assessment and outcome data to a national nursing outcomes database such as the National Database for Nursing Quality Indicators (NDNQI), the Collaborative Alliance for Nursing Outcomes (CALNOC), the Veterans Administration Nursing Outcomes Database (VANOD), or Military Nursing Outcomes Database (MilNOD) provides a means to contribute the types of data needed for local quality benchmarking while contributing to a learning health system that will improve the care of older adults nationally.

Challenges and New Directions

As noted throughout this commentary, nurses are leading research related to the use of EHRs, clinical decision support, and telehealth. Many of these efforts have resulted in improved care and interventions for older adults. However, this work is not without challenges. One challenge of EHR research is often the inability to conduct randomized clinical trials. Most EHR studies are quasi-experimental because the EHR is delivered to all patients therefore negating the ability to have a simultaneous control group. When considering the quality of EHR research we must take note whether confounding factors were considered and adequate controls were instituted to compensate for the lack of randomization. In addition, many of these studies have multiple components. For example, in telehealth studies, the type of equipment used, the number of times a patient uses the equipment, or the quality of team communication could all affect the study outcomes making it difficult to know which component is responsible for the impact. For decision support, it is important to monitor the fidelity of the intervention to understand the amount of exposure to the advice and to monitor any other interventions occurring simultaneously that could affect the outcomes. In addition, it is important to recognize that these interventions are “decision support”. They are not one size fits all and we must never lose sight of individual patient needs and instances where the decision support is not applicable.

To advance the science of HIT research, we suggest more research to:

- understand how nurses use HIT systems in practice, the factors associated with adoption, and the effect of EHR systems on nursing practice;
- identify the organizational factors that lead to improved quality and safety outcomes after implementation of an EHR;
- determine how patient reported data can be captured and used to provide clinical decision support that is aligned with patient preferences;
- develop HIT interventions that will facilitate the engagement of older adults in their recovery plan within hospital, homecare, and long-term care settings and in maximizing self-management, wellness, and independence as they age at home

Finally, we need to expand the settings in which HIT research occurs. A recent systematic review of nursing informatics studies revealed 42.5% took place in acute care, while only 3.75% occurred in homecare or long term care respectively (Carrington & Tiase, 2013). Given the concentration of older adults served in homecare and long term care, these areas of practice are prime sources for knowledge generation through future studies.

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