Information technology and childbirth education

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Technological Advances in Nursing Care Delivery

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Disclosure Statement:

Abstract

Technology is rapidly changing the way nurses deliver patient care. The HITECH Act of 2009 encourages healthcare providers to implement electronic health records for meaningful use of patient information. This has opened the door to many technologies that utilize this information to streamline patient care. This article explores current and new technologies that nurses will be working with either now or in the near future.

Key Words: Electronic Health Records, Technology in Nursing, Telehealth, mobile technology

Key Points:

1. Meaningful use incentives are encouraging healthcare organizations to implement electronic health records.
2. Electronic Health Records are leveraging and encompassing new technologies
3. Nurses will be working in a high tech environment and must utilize these resources to provide excellent patient care.
Technological Advances in Nursing Care Delivery

The nurses’ role in patient care has evolved with the use of technology to improve healthcare delivery.\textsuperscript{1} Advancements in technology will continue to progress rapidly, and be the norm in healthcare rather than the exception. Hospitals are now high tech environments, where electronic health records (EHR) have opened doors for emerging new technologies. These technologies, including EHRs, personal health records, clinical decision systems, computerized physician order entry, mobile technologies, wireless–voice-over internet phones (VOIP), radio frequency identification data tags (RFID), smart pumps, and telehealth will be examined in this article.

The Health Information Technology for Economic and Clinical Health (HITECH) Act, a component of the American Recovery and Reinvestment Act of 2009 encourages healthcare providers to become “meaningful users” of EHRs.\textsuperscript{2} Beginning in 2015, reimbursement for healthcare services will be based on the adoption and use of the EHR.\textsuperscript{2} Healthcare technology has also been identified as having a fundamental role in increased patient safety and cost-efficient care in the 2010 Institute of Medicine report title “The Future of Nursing: Leading Change, Advancing Health.”\textsuperscript{3} Nursing is at the forefront and a driving force for the transformation of health care in the US using health information technologies.\textsuperscript{1}

Information and communication technology has become vital to patient care, allowing nurses to gather and share large amounts of information, rapidly and efficiently.\textsuperscript{4} Nurses are known to be “caring” and therefore must use technology to this end towards improving quality and safety of patient care.\textsuperscript{5} Nurses have combined caring and technology to improve patient care as exemplified in an online survey, where 72\% of registered nurses believed that medication safety had improved and 30\% felt that information technology was a major contributor to those
improvements. In this ever-changing healthcare environment, caring and technology must go hand-in-hand to create a culture in nursing that embraces transformative technologies that are emerging every day.  

**Meaningful Use**

The definition of “Meaningful Use” includes the use of certified EHRs to improve quality, safety, efficiency, and reduce health disparities. The information targeted by “Meaningful Use” is patient demographics, vital signs and charge changes, medication list, allergy list, current and active diagnosis, and smoking status. Financial incentives to early adopters and the promise of future penalties for non-compliance from the Centers for Medicare & Medicaid Services to health care providers and organizations in the US have accelerated the “meaningful use” program compliance as described in the HITECH act of 2009. Healthcare organizations and providers must be certified in health information technology (IT) and meet several criteria to receive the incentives. The core objectives of the regulations involve providing patients and their primary care providers with information from the EHR, electronic ordering of prescriptions, evaluating drug interactions, tracking institutional compliance and quality improvement, and protecting the privacy and security of the EHR.

(Insert Table 1)

In a 2014 systematic review of 236 articles, looking at Health IT with a focus on meaningful use found the following summary points.  

1. Evaluation studies of health IT are increasing. 
2. Most evaluations focus on clinical decision support and computerized order entry.
3. Most studies report positive effects on quality, safety, and efficiency.  

4. Not enough information published to determine why some health IT implementation programs are successful and some are not.  

5. The most important improvement needed in health IT is increased measurement, analysis, and reporting of effects.  

**Electronic Health Records**

An electronic health record (EHR) is an electronic or digital version of the traditional patient chart. EHRs make information available instantly and securely through authorized users and are shared with other providers across various organizations. EHRs can include patient demographics, medical history, diagnosis, medication, treatment plans, immunization dates, allergies, radiology images and reports, and test results. Tools that providers can use to make clinical based decisions can be accessed from the EHR. EHRs streamline healthcare provider workflow.

Unfortunately, a 2012 survey reported that only 44% of hospitals used at least a basic EHR system. Also reported was that 42.2% met the Meaningful Use stage 1 criteria, with 5.1% meeting stage 2 criteria. Large urban hospitals had more EHRs in place than rural and non-teaching hospitals. Giving patients access to their own clinical data is part of stage 2 criteria and many have a portal feature that allows patients to view test results, request medication refill, and request appointments. However, there are still barriers to allowing full access to patients due to security risks. Another issue is that hospital systems are still not at the point of exchanging information between organizations and public health departments, mostly due to rural areas not having broadband internet service. In summary, the financial incentives for
ARRA/HITECH are working as intended, but more technology infrastructure is needed before smaller and rural hospitals will be able to meet stage 2 Meaningful Use criteria.\(^\text{10}\)

There are benefits to EHRs as they can leverage other technologies and incorporate other digital processes. In addition, EHRs can transform delivery of healthcare and compensation.\(^\text{11}\) Healthcare quality and convenience is improved for both the provider and patient with quick and remote access to patient records.\(^\text{11}\) A national survey of doctors reported that EHRs saved time by efficient record retrieval and enhanced data confidentiality.\(^\text{11}\) Large hospitals saved from $37 million to $59 million over 5 years, in addition to the incentive payments.\(^\text{11}\) Savings are found in being able to track patient’s use of hospital resources, such as equipment, supplies, testing, medication, and staff which were sometimes lost in paper systems.\(^\text{12}\) EHRs reduce errors, improve patient safety, and support better patient outcomes by providing alerts and reminders, analysis of information, and enabling evidence based care at point of care.\(^\text{11}\)

Of course, there are issues related to EHRs. With the many different vendors of EHRs and security risks of sharing information, it is very difficult to share information between organizations, patients, and providers.\(^\text{12}\) Cost is constraining; not only is there costs associated with the purchase of hardware and software, but implementation expenditures can be considerable for setup, maintenance, training IT support, and system updates.\(^\text{12}\) Productivity can drop for several weeks or more due to implementation.\(^\text{12}\) The biggest issue is autofill or copy and paste functions that are meant to save time but can cause documentation errors thereby putting patient safety at risk.\(^\text{12}\)

There are advantages and disadvantages to EHRs but they are here to stay. Being cognizant of the shortcomings and planning will help make purchase decisions, costs,
implementation, and maintenance less painful.\textsuperscript{12} Notably there have not been any recent studies that have found a consistent relationship between the use of EHRs and improved hospital performance.\textsuperscript{12} In one randomized control study of 325 hospitals, there was no association between EHR adoption and outcomes examined; acute myocardial infarction outcomes, risk adjusted 30-day mortality, average length of stay, and average payment per discharge.\textsuperscript{13} Clinical outcomes such as improved quality, reduced medical errors, at the patient level have been studied with positive results.\textsuperscript{14} Overall, experts agree that EHRs can benefit patients and society when widely adopted and used meaningfully.\textsuperscript{14}

**Clinical Decision Systems**

Clinical decision systems (CDS) are electronic systems that use individual patient information to generate patient specific practice guidelines. CDSs can offer the healthcare provider recommendations to consider for patient care.\textsuperscript{15} Classic CDSs include alerts, alarms, reminders, order sets, dashboards with performance feedback, drug-dose calculations, and information buttons.\textsuperscript{15} Examples of CDSs would be UpToDate, Epocrates, and MD Consult.\textsuperscript{15}

CDS tools such as physician reminders have led to increased adherence to evidence based practice (EBP) and practice guidelines.\textsuperscript{14} An example would be a physician reminder to order influenza and pneumococcal vaccinations. These types of reminders have increased adherence rates from 0\% to 35\%-50\% in hospitalized patients.\textsuperscript{14,16} In another similar study in an outpatient setting among rheumatoid patients, influenza vaccinations increased from 47\% to 65\% and pneumococcal vaccinations increased from 19\%-41\% of patients.\textsuperscript{14,17} Comparable results have been found in other studies where vaccination rates improved with computerized reminders.\textsuperscript{14,18}

In a 2012 systematic review of 160 articles, it was found that CDSs demonstrated efficacy
across diverse settings. CDSs were shown to have positive results related to prescribing treatments, facilitating preventive care services, and ordering clinical studies. More research is needed to gain a better understanding of what information is needed and should be delivered as well as a critical examination of unintended consequences of CDS.

**Computerized Provider Order Entry**

Computerized Provider (Physician) Order Entry (CPOE) is a system where physicians or providers directly enter orders into a computer system, which then transmits the information to the appropriate department. Historically with handwritten orders, it was found that medication errors occurred 90% of the time during the ordering or transcribing stage of writing orders. CPOE eliminates the transcribing stage and assists the provider with ordering information, thus has the potential to reduce errors. For example, the physician enters a medication order into the CPOE system where dosage recommendations are reviewed, the order is then transmitted to the pharmacy where a patient medication administration record (MAR) is produced. The MAR guides the pharmacist to provide the correct medication for the patient and the nurse on what medication to deliver to the patient. Many times CPOEs and paired with CDS systems as they complement each other.

CPOE has been associated with a 55% reduction in serious medication errors. Another study found that in outpatient setting CPOE resulted in a reduction of errors from 18.2% down to 8.2%. On the other hand there have been studies that found an increase in medication errors associated with CPOE due to poorly designed systems, lack of training, dense pull down menus or lack of integration. In a 2014 systematic review of 19 studies that addressed CPOE and medication errors, CPOE was associated with a more that 50% decline in
the rate of injuries to patients due to medication errors in hospital settings. CPOE has the potential to benefit public health.

**Barcode Medication Administration**

When a healthcare provider uses an IT system to administer medication, it will interface with an EHR and usually a CPOE. By scanning the bar-code on the medication and the patient wrist band, the medication administration will be automatically documented into the MAR and can improve patient safety by verifying the correct medication is given in the right dose, at the right time, and to the correct patient. There have been some problems with implementation with nurse work-arounds, such as bypassing the scanning technology. A quasi-experimental study was conducted of observing medication administrations over 9 months before and after implementing a bar-code MAR system. In the study, 14,041 medication administrations were observed and between the two groups there was a 41.4% reduction in timing errors. This study supports the use of bar-code technology as it improves safety by reducing medication and transcribing errors.

**Personal Health Record or Patient Portals**

A patient health record is also known as a patient portal, and is defined as a secure online website that gives patients convenient 24-hour access to personal health information from anywhere with an internet connection. Using a secure username and password patients can view health information such as recent doctor visits, discharge summaries, medications, allergies, immunizations, and lab results. Patient portal can also be used to schedule office visits, request medication refills, email to ask questions, make payments, and view educational materials.
The features of the patient portal benefit both the patient and health care team. Portals are user friendly and are designed to alleviate the tension and frustration caused when a patient is unable to speak with their clinician. The portal allows for communication with patients without having to interrupt a busy clinic day to take phone calls. Patient portals are vehicles for meeting meaningful use criteria by enabling secure messaging with health care providers and giving patient’s access to their personal health records. Access to the portal is available 24 hours a day 7 days a week thru a secured HIPAA-compliant website. Secure messaging with clinicians is one of the major highlights of patient portals. Clinicians have found great success in secure messaging and report an increase in efficiency, productivity, and a decrease in phone calls and mailing costs.

Advocates of patient portals cite potential benefits with patient satisfaction, operational efficiency, and even clinical outcomes. However, there is limited evidence to support these claims and therefore more research is needed. One study looked at type 2 diabetic patients and the use of patient portals. The conclusion was that secure messaging through the patient portal facilitated access to care, enhance the quality of office visits, and increased patient satisfaction and clinical outcomes for diabetic patients. As mentioned previously, there are still barriers to allowing full access to patient portals due to security risks. Another issue is that hospital systems and patient accessibility are not at the point of easy access due to rural areas not having broadband internet service.

**Mobile Technology**

Nurses are mobile, they care for patients running from patient to patient, therefore mobile technology is especially important for nurses. The need for mobile tools can reduce errors and
redundancy allowing the nurse to be at the patient’s side more, instead of having to run to the nurses station to gather information or communicate. Mobile charting makes it easier to perform electronic charting and can save time and increase efficiency. As we use more and more point-of-care technologies, the need for mobile devices that can provide easy access to information is paramount. Some of the tools being utilized are electronic handoffs, task alerts, documentation of hourly rounding with the use of wireless tracking, the use of electronic medication records with built in safety alerts, and wireless synchronized vital sign collection are just a few examples. A point-of-care technology scenario would look like this: a wireless glucometer synchronizes with a wireless network; the technician enters the blood sugar level to a point-of-care glucometer that automatically sends it to the patient’s EHR, and if the results are abnormal, the nurse receives an alert immediately on a mobile device.

The use of electronic health records (EHR) requires that nurses have easy access to computers. Due to limited computer access and stationary computers located at nursing stations, nurses have tended to batch chart; saving charting responsibilities until they had a stopping point to catch up on charting. The use of roving computers and other mobile charting devices allows the nurse to chart in “real time” and to gather current information about the patient. In a 2013 survey of 1000 nurses from across the US who were asked about the reality of how technology at the bedside has improved patient care. The results showed that 56.1% still have computers at the nurses’ station, 53.5% have roving computers, and 31% have computers in each room. A newer technology such as a tablet is rarely (9.6%) used for charting even though 46% of the nurses own a personal tablet.

In 2012 motion study of hospital nurses it was found that, nurses spent about the same amount of time charting with or without EHRs or computerized nursing notes. Despite this, in
a 2014 survey of hospital nurses, nurses reported that they felt that electronic charting took more time than paper charting. Some of the reasons cited in the 2014 nurse study as disadvantages of mobile charting included too few devices, lack of comfort, competence, or confidence in electronic documentation, and ineffective documentation. Some advantages cited included timesaving, increased time at bedside, improved interdisciplinary communication, and increased accuracy. The information found illustrates how there is a need to increase the number of easily accessible mobile charting devices and point-of-care technologies.

**Mobile Wireless Voice-Over-IP Phones**

Traditional nurse call systems provide the patient with a call button located at the bedside to push for help. The button signals a light at the nurses’ station and someone at the nurse’s station responds to the patient initiating the call. That same person then pages the nurse over an intercom or to a pocket pager. This prolongs the nurse response to the patient needs, when nurses need to be easily reachable and responsive. Nurses can be more accessible with the use of mobile wireless voice-over-internet protocol (VOIP) phone systems. These systems can notify the nurse of the room number, call priority, and the patient name as well as allowing the nurse to respond. Many of the phone systems have software that can be set to alert the nurse when preset physiological parameters are breached; for example, in monitored vital signs or EKG rhythms. Some systems can track the nurse’s location. Nurses have complained that the calls disrupt patient care while they are caring for other patients, but some systems will allow the call to roll over to another nurse based on their location to the patient. According to the Cleveland Clinic, their VOIP system improves efficiency in communication between staff and patients and decreases noise.

**Radio Frequency Identification**
Traditionally bar-code patient management systems identify patients using wristbands and can identify equipment and supplies using tags. Bar-code readers have worked nicely for medication administration. The nurse scans the patient’s wristband with a bar code reader linked to an EHR and then scans the medication. The EHR medication administration software will confirm if this is the correct medication for this patient. Barcodes are fine when you have a line of sight needed to scan the barcode but does not help if items or people are lost. Another technology used more recently in hospitals is radio frequency identification (RFID) tags. RFID tags use an electromagnetic or electrostatic connection in the radio frequency portion of the electromagnetic spectrum to distinctively identify an article, animal, or person. There are three components needed for an RFID system to work; tags, readers, and antenna. The RFID tags can be passive which means they only communicate with the reader when they are sitting in range of the reader. Passive RFID tags are mainly used for patient identification and medication administration. The second category is battery assisted-passive RFID tags where the tag is powered by a battery but not used for communication purposes only to record sensor readings when not in use. RFID tags can also be active, which means they can power integrated circuits and broadcast a signal to a reader which can be wired or wireless networks. Active RFID tags are used for tracking purposes.

These tags track at risk patients, such as newborns in the nursery and wandering Alzheimer patients. They are also used to track nurses’ movement and time, in order to study traffic flow and time spent in patient care by shift, day of week, and month. They also work in conjunction with wireless phone systems to locate the nearest nurse. Hospitals are using both RFID and bar code tags together as a failsafe mechanism in case the RFID becomes unreadable. In a systematic review of recent studies on RFIDs, they were found to improve
patient safety, patient tracking and verification, tracking surgical items, operational efficiency (tracking equipment), and clinical errors (improve work-flow of doctors, nurses, and caregivers). Disadvantages included high cost of complicated systems. Even with the high cost of these systems, the advantages outweigh the disadvantages. Ultimately, RFID systems are cost effective when you consider the improved quality of healthcare.

Security is always an issue with wireless communication and RFID tag security is no exception. The Health Insurance Portability and Accountability Act (HIPAA) governs and protects the security of the patient’s medical information and RFID tags could reveal personal and private information. A breach in privacy is a serious concern. There are four ways security can be breached; interception (identity theft), interruption (degrading system performance), modification (injecting false data on the tags), and fabrication (duplicating valid tags or readers). Physical security and limiting access can help prevent attacks to these systems. Coupling RFID with bar coding can be a check on patient identification. Programming the tags to transmit only a short distance is another way to avoid this problem. Using middleware systems that retrieve RFID data using security protocols to avoid privacy concerns is also being used. Ongoing research must be done to avoid security issues.

**Electronic Patient Tracking Boards**

Areas of the hospital where high numbers of patients are managed for short periods, such as emergency departments (ED) and surgical areas have traditionally used dry-erase white boards to track patients’ status. Seen recently, is the use of electronic whiteboards or electronic patient tracking boards that can integrate whiteboard information with the EHR. They can broadcast information to multiple whiteboards, save information for later use, and improve communication. Electronic whiteboards can offer a quick status update of patient’s current activity and streamline
communication and coordination of patient care. Due to current technology; one can find these boards on many inpatient units, not just the ED or surgery. Patient flow can be monitored by tracking patients, equipment, or staff members with RFID tags, which is transmitted and displayed real-time on electronic tracking boards. The term real-time location systems is also used for electronic patient tracking and report patient location, times, characteristics, and status, sometimes overlaid with a floor plan of a unit. These systems communicate with EHR, which provides information for areas besides nursing, such as bed management, patient admissions, and procedures.

In a literature review of 21 studies on electronic whiteboards, it was found that there were positive and negative concerns for workflow of EDs. One of the problems cited was accuracy of the board’s information. Rasmussen also found that the board moves from being a clinician’s tool to an administrative tool. Positive findings were in patient satisfaction, length of stay, financial and administrative aspects. In a single study by Hertzum and Simonsen, it was found that nurses were able to spend more time with their patients and less time at the control desk. Physicians did not report spending more time with patients.

Use of electronic patient tracking is low at this time, but growing. ED and surgery department use is most common. Half of all patients go through the ED and efficient placement of those going out to the hospital is essential. Surgery has the highest revenue, which makes efficient throughput and patient management crucial for financial health. The investment return on these systems is not well studied, but there is a significant capital expenditure needed for these systems. Overall, studies have shown among the many benefits of electronic patient tracking, decreased length of stay, improved utilization of resources, saved time for nurses, faster
revenue generation, decreased paper costs, improved staff morale, better recordkeeping, and decreased liability.  

**Smart Pumps**

Historically, in the hospital setting, the administration of intravenous (IV) fluids were first administered with a drip rate calculated as drops per minute followed by infusion pumps which have been around for about 40 years. IV fluid administration carries a high risk for adverse drug events leading to the need for safety features on simple infusion pumps which has evolved to smart pumps. Smart pumps have software programs built into them to help prevent drug errors and include a drug library that has pre-defined parameters. Drug libraries include tailored pre-loaded lists to a specific facility and patient care area. The design is to ensure administration of appropriate dosing for a specific drug and therefore reduce medication miscalculations and errors. There are hard limits, which are restrictive and do not allow the nurse to override, and soft limits that are not restrictive. They also record all of the events for quality improvement.

Smart pumps do not eliminate the need for vigilant medication administration and the use of the five rights; right dose, right time, right drug, right patient, and right route. Nurses still need to assess the patient’s vital signs and the IV site for phlebitis, infiltration, or extravasation. Despite the advanced technology of smart pumps there continues to be programing and administrative errors. The software relies on the accuracy of the programed data entered into the smart pump. There have been are cases reported by FDA where programming the smart pump incorrectly by the pharmacist or administrator and another where the pump malfunctioned. Workarounds are also a problem, this is when nurses use a nonstandard approach to solve a problem presented by technology and can put patients at risk. An example of a workaround is
bypassing the safety features on a smart pump. A nurse can be found at fault for negligence, if the smart pump is not used correctly and harms a patient. The adoption rate of smart pumps has doubled since 2005 as other technologies have evolved such as EHRs, computerized physician order entry, and barcode medication administration. If smart pumps are used at a facility, then they become standard of care and must be used when available to enhance patient safety.

Benefits of smart pumps include preventing medication errors such as wrong rate, wrong does, wrong pump setting, reduction of adverse drug event rates, cost effectiveness, and practice improvement. Other benefits include reduction of calculations, warnings, and alarm systems. Negative effects include lower compliance of using smart pumps, overriding soft alerts, non-intercepted errors, or using the wrong drug library. Smart pumps will continue to evolve and interface with other technologies in the healthcare setting.

**Simulation**

The use of high fidelity simulation has become more acceptable in the hospital setting. Hospital care has become more complex and nurses make critical decisions associated with the care of more acute patients. Critical thinking, prioritization, and appropriate clinical decision making is a necessity in the nursing profession today. Sound clinical judgment depends on being aware of what is happening during the episode and weighing how information, events, and your own actions will affect patient goals and objectives. Nurses must be able to not only gather information, anticipate patient needs, but to make decisions in the best interest of their patients. It is critical to prioritize the urgency of care, give care safely, detect changes in symptoms, voice concerns, and respond quickly. As more of the current nursing workforce retires and newer
nurses are employed within hospital systems, the educational challenges are providing opportunities to develop and or enhance critical thinking and prioritization skills.

High-fidelity simulation provides an ideal environment to address and improve teamwork in high acuity, stressful patient care scenarios and thereby mitigate the potential for human error. For better results in a specific area of training, it is important to mirror the clinical environment as much as possible. Providing an opportunity that allows multiple professional roles to interact will help with interdisciplinary communication as well.

Cost may be a barrier to simulation as simulators and the cost to create the environment is very expensive. There are an increasing number of simulated virtual world and simulation apps that could be an adjunct to live simulation. Employees could decrease training time by preparing for live simulation using these types of adjuncts. Major health care institutions may consider offering simulation aimed at higher levels appropriate for senior staff related more to clinical judgment, clinical management, and organizational issues.

**Telehealth and mHealth**

Advancements in technology have allowed for services such as telehealth which bring new ways to educate and access patients. In the following discussion telehealth, mHealth, and remote monitoring will be discussed. Telehealth is a means to communicate electronically between patient and healthcare providers, allowing for real-time healthcare. mHealth utilizes mobile devices to communicate with healthcare providers and to acquire information and self-help type applications. Remote monitoring monitor environmental changes that can offer seniors independence.

**Telehealth**
Telehealth offers low-cost healthcare with mobile devices, such as laptops, tablets, and smartphones. These devices can replace expensive face-to-face visits with the use of video conference capabilities. There are a wide varieties of services offered including video consultation, asynchronous transfer of medical images, and the use of remote monitoring devices. They can transmit vital signs and medical history to receive remote diagnosis and monitoring. Medicare has approved payment for services provided for home health care services, which includes telehealth services. The American Telemedicine Association defines telehealth as the delivery of remote healthcare using technology but not necessarily clinical services. Telemedicine is differentiated as remote healthcare using technology that does offer clinical services.

The use of telehealth is especially helpful for rural areas, the ageing, and those with chronic illness. The Veterans Affairs (VA) reported that with telehealth services, mental health and counseling services, and those with chronic health conditions had a long-term effect of reduced hospital use. The use of telehealth in nursing homes has also dramatically reduced face-to-face consultation.

**Remote monitoring**

Remote monitoring is another technology that improves quality of life. With the use of sensors, motion detectors, and wireless technology changes in behavior and activity is recorded and transmitted to the healthcare provider. These are considered passive sensors, when information in monitored around the clock, such as vital signs, motion, falls, or even temperature of a stovetop. For the most part, these monitoring devices offer the senior autonomy but sometimes false alerts can be frustrating to the patient and the healthcare provider. Active monitoring is when the senior interacts with the technology to record information such as vital
signs or blood glucose level and then transmits the information to a healthcare provider. These systems can remind the senior of tasks, like medication reminders, or to keep legs elevated.

The use of remote monitoring allows seniors to “age in place” and gives them the opportunity to stay in familiar settings where they are comfortable. This enhances quality of life, increases autonomy, and provides emotional benefits. Telehealth technologies in general will continue to advance to offer more services as technology continues to advance.

**mHealth**

Mobile health also referred to as mHealth is the use of mobile devices to download medical information and to communicate with health care providers. mHealth is one of the top 10 consumer mobile applications (apps) for 2012. Cell phones are providing Latino, African American communities, and illegal aliens a way for nurses to reach out with health tips and reminders concerning maternal health, HIV/AIDS, and drug addiction. Apple iPhone has over 213 apps that are related to chronic disease and even more for maternal health, with over 5000 apps that are health related. For example, a medication reminder app will let the patient know when it is time to take medicine. A smoking cessation app will send text messages requesting support during cravings or withdrawal symptom.

In a systematic review of 75 randomized control trials of mHealth health care studies, 26 interventions to increase healthy behaviors, and 49 targeted disease management interventions were reviewed. Results of the review offered mixed evidence about the benefits of the interventions. Smoking cessation support more than doubled verified smoking cessation. However, diabetes control, medication reminders and diet and exercise apps offered borderline
clinical significance. More research is needed to establish benefits of mHealth to optimize health intervention apps.

**eICU**

Another telehealth service is eICU. Intensive care units in remote areas can be monitored at a central location where intensivist physicians staff an eICU. Through a constant link, small microphones, cameras, vital information such as heart rate, blood pressure, medications, and test results are transmitted to the central location in real time. If a change occurs, the eICU nurses or physicians can activate a two-way visual and audio link for immediate consultation.

The costs of implementation, operation, and staffing were a major concern for hospitals adopting eICU. Responses from 10 eICUs lauded the eICU software and liked the immediate response to emergencies. In a study of intensive care units in rural and urban rural regions in a developing country found that eICU was associated with significant improvement in mortality. Contrary to other results of eICU research, a study that looked at two large eICU programs to study the effectiveness of selected parameters. Parameters looked at were rate of falls, mortalities, incidence of code blues, and length of stay before and after eICU implementation. The outcome showed no statistically significant differences between before and after implementation. It is estimated that only 9% of ICU beds in the US use eICU, however there are few studies that have looked at the effectiveness.

**Conclusion**

The HITECH Act of 2009 encourages healthcare providers to become “meaningful users” of EHRs. Beginning in 2015 reimbursement for healthcare services will be based on the adoption and use of the EHR. “Meaningful Use” includes the use of certified EHRs to improve
quality, safety, efficiency, and reduce health disparities. Unfortunately, a 2012 survey reported that only 44% of hospitals used at least a basic EHR system.

EHRs can leverage other technologies and incorporate other digital processes. In addition, EHRs can transform the way healthcare is delivered and compensated. Healthcare quality and convenience is improved for both the provider and patient with quick and remote access to patient records. Experts agree that EHRs can benefit patients and society when widely adopted and used meaningfully.

Examples of technology that complement EHRs are CDS and CPOE and when used with bar-code scanning technology can greatly reduce medication errors with a 55% reduction in serious medication errors. Patient health records also known as patient portals are vehicles for meeting meaningful use criteria by enabling secure messaging with health care providers and giving patient’s access to their personal health records.

The need for mobile tools can reduce errors and redundancy allowing the nurse to be at the patient’s side more, instead of having to run to the nurses’ station to gather information or communicate. Examples of mobile technology include VOIP phone systems that allow nurses to be at the bedside more and RFID tags that can track nurses, patients, equipment, medication, and supplies. Mobile charting makes it easier to perform electronic charting and can save time and increase efficiency. Electronic patient tracking boards can offer a quick status update of patient’s current activity and streamline communication and coordination of patient care. Smart pumps can prevent medication errors such as wrong rate, wrong does and pump setting, reduction of adverse drug event rates, cost effectiveness, and practice improvement. High-fidelity simulations provide an ideal environment to address and improve
teamwork in high acuity, stressful patient care scenarios and thereby mitigate the potential for human error. Advancements in technology have allowed for services such as telehealth which bring new ways to educate and access patients.\textsuperscript{49} With the use of sensors, motion detectors, and wireless technology changes in behavior and activity is recorded and transmitted to the healthcare provider.\textsuperscript{50}

Nurses are “caring” and therefore must use technology to complement patient care.\textsuperscript{5} In this ever-changing healthcare environment, caring and technology must go hand-in-hand to create a culture in nursing that embraces transformative technologies that are emerging every day.\textsuperscript{5}
References


29 Peck AD. Optimize your patient portal: The key to persuading patient to use your portal is developing strategy based on communication and education, physicians say. Med Econ, 48-52


Hirsch, A. Technology management strategies for nurse leaders. Nurs Manage. February 2014; 41-43. DOI-10.1097/01.NUMA.0000442645.01325.fe

Hader, R. How connected are you?. Nurs Manage. February 2013; 19-23. DOI-10.1097/01.NUMA.0000426136.37915.b2


Reeder, S. Radio frequency identification device (RFID) and real time location systemes (RTLS) enhance nursing care delivery. 25th International Nursing Research Congress July 2014.


Rasmussen, R. Electronic whiteboards in emergency medicine: A systematic review. In Proceedings of the 2nd ACM SIGHIT International Health Informatics Symposium (pp. 483-492). ACM


Monigle, D, Mastrian, K. Introduction to information, information science and information systems. In: Mcgonigle D., Mastrian, K, Nursing informatics and the foundation of knowledge 2nd ed., UA: Jones & Barlett Learning (2012): 22