Nurses Exchanging Information: Understanding Electronic Health Record Standards and Interoperability

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Health care information systems began in the late 1970s and were described as modular designed systems with a specific focus to admit and discharge patients or order diagnostics tests (Peterson & Jelger, 1988). Clinical computers were used to calculate cardiac outputs or to measure rates and pressures within the heart. The storage of clinical data was not captured except by a nurse documenting data on paper records. Historically, nurses have used a variety of technologies, but they have used them more often to support other professional departments or

The complexity in adopting health information technology (IT) standards is not from lack of standards. Rather, there are a vast number of standards that overlap and some that are missing. The objective of this article is to provide nurses with an understanding of the importance of the National Health IT Agenda and be empowered to influence the processes to ensure nursing is represented. Several aspects include harmonization and adoption of standards necessary to achieve interoperability, and the strategies for nursing leaders to advocate for adoption of those standards.

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Key Words:  Electronic health record (EHR), EHR interoperability, Health Information Technology Standards, interoperability specification, National Health IT Agenda, personal health record (PHR), Use Cases, Technology Informatics Guiding Education Reform (TIGER) Initiative.

Objectives
1. Discuss the importance of interoperability in health care.
2. Explain the difference between an electronic medical record, an electronic health record, and a personal health record.
3. Describe the National Health IT Agenda and its implication on for nurses.
4. Identify the goals of the TIGER Initiative.

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Note: Objectives and CNE Evaluation Form appear on page 314.
administrative statistics. These basic technical functions were intermittently used by nurses to communicate with other clinical departments. Early technologies for the exchange of information required standard codes (often acronyms) that were used to order the correct diagnostic tests and procedures. Nurses exchanged information using many of these early information systems.

Today, health information technology (IT) is developed to increase the capabilities of exchanging protected health information beyond the hospital or clinic. As in the past, there are standard clinical terms and steps for exchanging this information. These emerging technologies used in health care settings, schools, and communities demand standard methods of use. The purpose of this article, in part, is to inform nurses of how health IT standards are formulated within the United States to promote interoperability (technical exchanging of patient information, such as allergies and health conditions) among systems and discuss the active role taken by nurses to support practice, education, and research using health IT. The overall goal is to present what nurses must know to use health information technology to its fullest, which will benefit themselves, patients, families, and other disciplines. Definitions of the core concepts to describe health IT systems are provided in Table 1.

The role of informatics nurses as educators, researchers, and designers was to give clinicians the informatics tools, principles, theories, and practices to make health care safer, effective, efficient, patient-centered, timely, and equitable. Informatics nurses help nurses to interweave enabling technologies transparently into nursing practice and education, making information technology the stethoscope for the 21st century (Technology Informatics Guiding Education Reform [TIGER] Standards and Interoperability Workgroup, 2009).

### Importance of Interoperability

Evolving health IT and interoperability standards are foundational elements to enable the use of information technology across the health care industry. Interoperability is the ability to share patient information among health information systems by authorized users (Thede & Sewell, 2009). Nurses are empowered to make informed decisions to provide safer, higher-quality patient and family care when data are captured, shared, and reused multiple times.

Key differences between an EMR, EHR, and PHR are highlighted in Table 1 and are related to who can access the information. The evolution of health IT will move toward the inclusion
missions (FCC). AHRQ provides a National Resource Center Web site for health IT, which posts many tools and best practices from multiple organizations online (AHRQ, 2005). These planning and implementation projects provide a wealth of resources for local communities and hospitals.

In 2006, the Secretary of the DHHS accelerated the National Health IT initiative by establishing the American Health Information Community (AHIC). The AHIC was a federal advisory group to the Secretary of the DHHS that identified priority areas from which scenarios for use were developed. These are now known as Use Cases (see Table 2) (DHHS, 2009). These Use Cases represent the first national effort to describe the requirements for the interoperability standards that would guide the work of technology vendors for ambulatory and inpatient systems. The Use Cases identified the health information necessary within the workflow of all clinical and business stakeholders as they related to three perspectives: provider, consumer, and population health. The Healthcare Information Technology Standards Panel (HITSP) received the Use Cases, harmonized standards, and developed interoperability specifications that provide implementation guidance for the health IT and interoperability standards. HITSP uses a public-private process that takes the clinical Use Cases and harmonizes standards for adoption at the national level.

During this period, nurses were involved in the standards' harmonization efforts and recognized the need to have broader input from nurses from clinical practice. Through the Technology Informatics Guiding Education Reform (TIGER) Initiative (specifically the Standards and Interoperability Collaborative) and in concert with other nursing informatics professional organizations (see Table 3), an outreach effort was implemented to ensure that nurses were aware of and engaged in the identification and adoption of health IT interoperability standards. It became apparent that for the nursing perspective to be incorporated into the health IT interoperability initiatives, nurses would need to:

- Understand and embrace these initiatives.
- Get involved with Use Case development.
- Respond to public comment opportunities.
- Attend educational workshops.
- Incorporate health IT standards into systems.
- Participate in committees at the federal, state, and local levels.

In Fall 2007, nurses within professional organizations, academic institutions, and vendor organizations increased their engagement in these national activities. Nursing organizations have been successful in reaching a variety of nursing specialties (including oncology, nurse practitioners, occupational health) to provide feedback directly to the Office of National Coordinator and during public comment periods for AHIC Use Cases and HITSP interoperability specifications. This engagement ensures that nursing concepts are recognized and incorporated within the national health IT initiatives and the standard setting process (personal communication, D. Hunt, June 6, 2008). Many nursing recommendations are incorporated into the HITSP Use Case documents through the work of the Office of National Coordinator after HITSP panel approval.

The American Nurses Association (ANA) Scope and Standards for Clinical Practice (see Table 4) (ANA, 2008) are standards that guide workflow for practice and were very useful as supporting documentation during the public comment period in the development of the
<table>
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<tr>
<th>Table 2. American Health Information Community (AHIC) – Now Healthcare Information Technology Standards Panel (HITSP) Use Cases</th>
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<tr>
<td><strong>2006 Use Cases</strong></td>
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<tr>
<td>• Harmonized consumer empowerment (includes registration</td>
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<td>and collecting medication history)</td>
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<tr>
<td>• Harmonized electronic health record (include steps for</td>
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<td>laboratory result reporting)</td>
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<td>• Harmonized biosurveillance (includes the collection within</td>
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<td>a visit, utilization, and laboratory result data for</td>
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<td>infectious diseases and more)</td>
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<tr>
<td>• Emergency responder – Electronic health record</td>
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<tr>
<td>(includes pre-hospital care and emergency care)</td>
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<tr>
<td>• Consumer empowerment: Consumer access to clinical</td>
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<tr>
<td>information</td>
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<tr>
<td>• Medication management (includes the medication cycle</td>
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<td>of assessment and reconciliation, prescribing, verification</td>
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<td>and dispensing, evaluation and administration)</td>
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<td>• Quality (includes reporting needs)</td>
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<td><strong>2007 Use Cases</strong></td>
</tr>
<tr>
<td>• Remote monitoring</td>
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<tr>
<td>• Patient-provider secure messaging (includes external</td>
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<td>communications)</td>
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<td>• Personalized health care</td>
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<td>• Consultations and transfers of care (includes sharing</td>
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<td>information between multiple providers of health care)</td>
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<td>• Public health case reporting</td>
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<td>• Immunizations and response management</td>
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<td><strong>2008 Use Cases</strong></td>
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<td>• Newborn screening</td>
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<td><strong>2009 Use Cases</strong></td>
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<td>• General laboratory orders</td>
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<td>• Medication gaps</td>
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<td>• Medical home: Problem lists and practice-based registries</td>
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<td>• Consumer adverse event reporting</td>
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<td>• Scheduling</td>
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<td>• Prior authorization in support of treatment, payment, and</td>
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<td>operations</td>
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<td>• Consumer preferences</td>
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<td>• Common data transport</td>
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**Source:** DHHS, 2008.

health IT standards. The Committee for Nursing Practice Information Infrastructure (CNPII) has served nurses at the policy level as a primary authority for ANA on the nursing practice

information infrastructure and influencing health information policy. The Alliance for Nursing Informatics (ANI) also supports CNPII efforts at the national and state levels related to maintain-

ing quality, integrity, security, and confidentiality of personal, professional, and organizational or enterprise health care data and information (ANI, 2008; CNPII, 2007). CNPII disseminates knowledge about nursing’s information infrastructure to support nurses and develops the plan for managing and presenting nursing’s information legacy.

In December 1995, nurses through the CNPII established the National Information and Data Set Evaluation Center (NIDSEC) standards (ANA, 2003), which were the first efforts by nurses to influence the design and development of information technologies to meet the needs of practicing nurses. These NIDSEC standards identified the clinical terminologies to document nursing care, the linkages or branching pathways to efficiently document and retrieve information about patient care from EMR and EHR systems for workflow, and the ability to store common data for exchanging continuity of care nursing information (nursing minimum data set) across health-care information systems (ANA, 2003). Today, many of these standards are being incorporated into HITSP standards for decision making to ensure the inclusion of nursing documentation to support nursing decision making in the care process.

In January 2008, the Secretary of the DHHS recognized the first set of interoperability standards recommended by the American Health Information Community and approved by HITSP. This first set included standards for exchanging laboratory results, a consumer’s PHR, and biosurveillance information. As stated by former DHHS Secretary Michael Leavitt, the problem to be solved through the National Health IT Agenda is as follows: “Information technology is a pivotal part of transforming our health care system. We are at a critical juncture. Working in close collaboration, the Federal government
Table 3.
Alliance for Nursing Informatics and the Health Information Management Systems Society’s Nursing Informatics Committee

- Alabama Society for Clinical Informatics (ASCI)
- American Medical Informatics Association (AMIA)
- American Nursing Informatics Association (ANIA)
- Association of periOperative Registered Nurses (AORN)
- Association of Women’s Health, Obstetric and Neonatal Nurses (AWHONN)
- CARING
- Center for Nursing Classification and Clinical Effectiveness (CNC)
- Central Savannah River Area Clinical Informatics Network (CSRA-CIN)
- Center Nursing Advisory Board
- Connecticut Healthcare Informatics Network (CHIN)
- Croatia Nursing Informatics Association (CroNIA)
- Delaware Valley Nursing Computer Network (DVNCN)
- Health Informatics of New Jersey (HINJ)
- Healthcare Information and Management Systems Society (HIMSS)
- Informatics Nurses from Ohio (INFO)
- MEDITECH Nursing Informatics program
- Midwest Nursing Research Society – NI Research Section (MNRS)
- Minnesota Nursing Informatics Group (MINING)
- NANDA International
- New England Nursing Informatics Consortium (NENIC)
- North Carolina State Nurses Association Council on NI (NCSA CONI)
- Perinatal Information Systems User Group (PISUG)
- Puget Sound Nursing Informatics (PSNI)
- SNOMED CT Nursing Working Group
- South Carolina Informatics Nursing Network (SCINN)
- Utah Nursing Informatics Network (UNIN)

Related Organizations
- American Nurses Association (ANA)
- American Nurses Credentialing Center (ANCC)

Table 4.
Scope and Standards of Practices for the American Nurses Association

- Nursing: Scope and Standards of Practice
- Cardiovascular Nursing: Scope and Standards of Practice
- Corrections Nursing: Scope and Standards of Practice
- Faith Community Nursing: Scope and Standards of Practice
- Genetics Genomics Nursing: Scope and Standards of Practice
- HIV/AIDS Nursing: Scope and Standards of Practice
- Holistic Nursing: Scope and Standards of Practice
- Home Health Nursing: Scope and Standards of Practice
- Hospice and Palliative Nursing: Scope and Standards of Practice
- Intellectual and Developmental Disabilities Nursing: Scope and Standards of Practice
- Neonatal Nursing: Scope and Standards of Practice
- Nursing Informatics: Scope and Standards of Practice
- Pain Management Nursing: Scope and Standards of Practice
- Pediatric Nursing: Scope and Standards of Practice
- Plastic Surgery Nursing: Scope and Standards of Practice
- Psychiatric Mental Health: Scope and Standards of Practice
- Public Health Nursing: Scope and Standards of Practice
- Radiology Nursing: Scope and Standards of Practice
- School Nursing: Scope and Standards of Practice
- Scope and Standards of Diabetes Nursing Practice (2nd Edition)
- Scope and Standards of Gerontological Nursing Practice (2nd Edition)
- Scope and Standards of Neuroscience Nursing Practice
- Scope and Standards of Vascular Nursing Practice


and private sector can drive changes that will lead to fewer medical errors, lower costs, less hassle, and better care” (Leavitt, 2005, p. 31).

Several National Health IT Agenda Initiatives, including AHIC, HITSP, the Certification Commission for Healthcare IT (CCHIT), and the Nationwide Health Information Network (NHIN), are dependent on health IT standards. These standards come from the numerous International Standards Development Organizations (SDOs), including Health Level Seven (HL7), International Health Terminology Standards Development Organization (IHTSDO), and National Council for Prescription Drug Programs, Inc. (NCPDP). Health IT standards also come from regulatory and credentialing organizations, such as the Centers for Medicare and Medicaid Services (CMS), Food and Drug Administration (FDA), and The Joint Commission, to name a few. Nurses have realized the significance of health IT standards in the National Health IT Agenda and the important role for nursing in embracing the requirements for exchanging common data formats to promote continuous care within and across all levels of care.

TIGER Standards and Interoperability Collaborative began taking an active role to ensure that the nursing perspective is considered, nursing input is included throughout the process, and the nursing community is engaged in these efforts. For example, the input of nurses has led to the addition of medication indications added to the data exchanged with medication lists. The planned and performed nursing interventions were included within standards for the common data transport among health care providers.

In 2009, President Barack Obama continued the emphasis on health IT by allocating substantial funding for health IT in
the American Recovery and Reinvestment Act (ARRA) to step forward in computerizing Americans’ health records. The goal was to reduce medical errors, with the hope of saving billions of dollars in health care costs (ARRA, 2009).

**National Initiatives Impacting EHR Standards and Interoperability**

There are five core areas for development use in health IT systems (Goossen et al., 2004; Goossen, 2006). These five core areas are composed of the following standards: 1) technology and security structures, 2) standardized terminologies, 3) an information framework and model for organizing data and information, 4) evidence-based knowledge designs for clinician and patient use, and 5) engineered workflows redesigned to ensure the best use of the technology and available data, information, and knowledge within the health IT system. All core standards are being incorporated into patient and consumer case studies for educational purposes. In this way, all nurses will see the workflow of how data, information, and knowledge are used everyday on nursing units in hospitals, clinics, homes, schools, and communities. Several HITSP standards currently guide the design of health IT systems to ensure vendor technologies meet the needs of practicing nurses, physicians, and many others. These standards are presented in Figure 1 as Use Cases, which discuss the workflow of all health care providers with many stakeholders who will use the information.

**What Do Nurses Need To Know?**

Nurses are the largest group of health care professionals and have taken the lead to developing new competencies and skills. The TIGER Initiative was established in 2006 to enable practicing nurses and nursing students to fully engage in the unfolding digital era of health care. Through its agenda and action plans outlined at the inaugural TIGER Summit in Fall 2006, TIGER was charged with providing tools and resources for nurses to become educated in using technology and informatics, and thereby empowered to deliver safer, higher-quality patient care. More specifically, the TIGER Standards and Interoperability Collaborative, which is one of nine TIGER collaboratives, identified the AHIC Use Cases that would impact nurses and began identifying educational methods to teach others about harmonized standards. This group worked with eight other collaborative workgroups of nurses across the country to fulfill the goals of the TIGER Initiative (ANI, 2008). The framework from the TIGER Summit defined a total of seven pillars for planning the action to achieve education of all nursing constituents in all specialties and fields (ANA, 2008). The Information Technology pillar emphasized the need to embrace smart, people-centered, affordable technologies that are universal, usable, useful, and standard-based.

This action plan identified three critical components for nurses. First, nurses need to understand the importance of the health IT industry standards being integrated into EHRs, including clinical standards for practice and education. Second, nurses need to know what the relevant health IT standards harmonized by HITSP are as outlined in Figure 1. Third, nurses need to establish the adoption and use of the HITSP standards within the next 5 to 6 years so interoperable EHRs can be accessed securely by health organizations, clinics, pharmacies, or consumers across the U.S.

**Standards and Interoperability**

As defined by HITSP, the term “standard” refers to specifications, implementation guides, code sets, terminologies, and integration profiles. It is a well-defined approach that supports a business process and:
- Has been agreed upon by a group of experts.
- Has been publicly vetted.
- Provides rules, guidelines, or characteristics.
- Helps ensure that materials, products, processes, and services are fit for their intended purpose.
- Is available in an accessible format.
- Is subject to an ongoing review and revision process (HITSP, 2009).

In the context of health IT interoperability, standards must be maintained to meet the information-sharing needs across care settings, providers, patients, and population health care environments. The ability for computer systems to communicate with each other, share information, and understand what is being shared is the fundamental interoperability notion. It is through the interoperable exchange of health information that expected decreases in costs will be realized, such as eliminating duplicate tests, improving administrative efficiencies, increasing access to patient clinical results, and providing information to decrease repetitive input. Improvement in the quality of care will be realized by decreasing errors related to lack of information, such as allergic reactions to medication or current medication lists, and increasing a patient’s access to his or her health information.

In conversation between two people, standard language rules are required to understand the message being spoken, heard, or read. If such a discussion occurs over a telephone, the content is sent and received using technology standards to transmit the voices between both parties. Health IT standards work in a similar fashion; standards provide structured content and formatting to
Figure 1. 2006-2009 HITSP Interoperability Specifications


Source: Used with permission from Raford, 2009.
ensure that the sending and receiving system accurately compiles and interprets a message. For example, a provider reviews nurse-documented pain assessments and enters a pain medication order into an EHR system. A pharmacist receives the medication order and processes it within the pharmacy information system. Finally, the nurse receives the verified order, administers and documents the medication delivery in the clinical documentation system, and receives a reminder to reassess the patient’s pain level within 30 to 60 minutes. To ensure the proper medication order information (patient, medication, drug strength, form, dose, route, schedule, and indication) is filled properly by the pharmacist and administered correctly by the nurse to the patient, the provider uses a standard terminology that is understandable and meaningful to all three disciplines. Therefore, the standard pain score level or the medication strength (units/min or mg/kg/day) are interpreted by all providers involved in the workflow. Once a patient is discharged, ensuring that the electronic version of the medication list is securely and accurately made available to the patient and/or providers requires interoperable health IT standards to be in place.

**TIGER Actions to Help Nurses**

Various educational opportunities will be available to nurses through continuing education forums, formal academic course work, and nursing literature. *Urologic Nursing* is one of the first specialty nursing practice journals to provide a special issue on nursing informatics. The articles within this journal will highlight many areas for standards, such as terminology, security, evidence-based nursing, preparation for health IT, educational needs for staff learning a new EMR or EHR system, and more. In addition, the TIGER Standards and Interoperability Collaborative has provided several educational forums, disseminated information regarding national standards adoption efforts, provided public comment forums, and coordinated nursing input into the National Health IT Agenda activities throughout nursing informatics organizations. These organizations bridge the gap between technology and nursing practice.

Nurses joining the profession will need to demonstrate technical skills in the use of computers and patient care technologies for monitoring and gathering data, as well as patient care interventions, such as smart pumps and medication administration bar code scanning devices (AACN, 2008). The use of clinical information systems will include decision support systems used to gather evidence and guide practice. Electronic clinical information systems allow the capture of data on quality, safety, and regulatory requirements; monitor trends; and evaluate outcomes and performance. These systems enable clinicians to search for information through databases while at the bedside.

Educational and knowledge resources will be available through online Web-based learning using Desire-to-Learn and WebCT technologies within universities, at conferences through nursing organizations (such as the Society of Urologic Nurses and Associates [SUNA]) and other health IT organizations, including American Medical Informatics Association (AMIA), Healthcare Information and Management Systems Society (HIMSS), American Nursing Informatics Association (ANIA), and federal agencies (AHRQ), community and private colleges, and within your home through Webinar conference sessions or in virtual conferences where there is no longer a need to travel to attend.

**Importance and Implications For Nurses**

The key for nurses to become IT competent includes learning and demonstrating several important skills. These competencies include computer skills to perform basic desktop software; information literacy skills to use drug, laboratory, or disease databases; information and knowledge resources to access evidence-based protocols that support decision-making; and informatics knowledge and skills to evaluate information to improve patient and population health. Computer skill competencies also include monitoring and medication administration devices, communication devices, documentation electronic forms and flow sheets, education modules, and many other biomedical systems for patient care. Information literacy competencies include the demonstration of privacy, confidentiality, and security policies, and using technical features to secure and protect the health information. These competencies include the ability to critique and identify credible Internet resources and research evidence that may apply to specialty nursing practice, such as urologic nursing.

Informatics competencies include understanding the organizational change management necessary to continuously improve patient care services and redesigning the workflows of all providers, so they may use best evidence and health IT tools as a primary means of patient safety. In short, a nurse should not take shortcuts when using the technology and associated devices designed to protect patients and health care professionals. The informatics competency is important as the health care industry achieves interoperable systems allowing the exchange of common data and an ongoing need to report any technical and content issues or problems with the
health IT systems (EMR, EHR, PPR, or biomedical devices). Today, many other health professionals use standardized data nurses enter or upload into the system from biomedical devices. All errors or defects need to be resolved to protect the patient from harm.

**Summary**

In conclusion, the National Health IT Agenda continues to advance the standards that will move us to an interoperable community of nurses. The vision for interoperability is realized in small sectors where components of the health record can be accessed and used in remote sites. Like other technologies, such as monitors and ventilators, there has always been a level of standardization with a regulated process for using devices safely and to the greatest efficiency. The National Health IT Agenda intends to ensure that health care providers can share information about patients and know that the receiver and the sender are interpreting the information in the same way. The use of standards can increase a nurse’s efficiency, ensure patient safety, and improve the quality of care by reducing variability (Institute of Medicine, 2001). This vision will move beyond focusing on a single shift or visit to being able to make decisions based on a patient’s lifetime of outcomes.

**References**


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