



PARTNERSHIP *for*
HEALTH IT PATIENT SAFETY
Making healthcare safer together

Health IT Safe Practices: Toolkit for the Safe Use of Health IT for Patient Identification





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February 2017

About the *Partnership for Health IT Patient Safety (Partnership)*

In 2013, ECRI Institute convened the *Partnership for Health IT Patient Safety (Partnership)*. This multi-stakeholder collaborative includes healthcare providers, health information technology (IT) vendors, academic researchers, patient safety organizations (PSOs), professional organizations and societies, malpractice insurers and insurance specialists, and more recently governmental and regulatory authorities, and patient advocates. The purpose of the *Partnership* is for stakeholders to work together as a private sector initiative to make health IT safer and to develop new ways to use health IT to promote patient safety. By collecting, analyzing, and sharing information gathered from providers, PSOs, and vendors, the *Partnership* uses reports of hazards and events submitted under the protections of a PSO to identify and prioritize issues for focus and for safety initiatives.

ECRI Institute Undertakes Several Initiatives to Promote Accurate Patient Identification

ECRI Institute Patient Safety Organization's *Deep Dive: Patient Identification* (Volume 1) summarizes an analysis of more than 7,600 wrong-patient events occurring between January 2013 and August 2015 and reported to the PSO event report database. Based on the findings, recommendations and mitigating strategies are provided. The report is available for ECRI PSO members at <http://www.ecri.org/patientid>.

ECRI Institute's Health Technology Assessment Information Service's report *Patient Identification Errors* is an evidence-based review of the clinical literature that addresses key questions about the prevalence and causes of patient identification errors and identifies effective interventions for decreasing wrong-patient mistakes. The report is available for members at https://www.ecri.org/Resources/HIT/Patient%20ID/PatientIDErrors_EvidenceReport.pdf.

The ***Partnership for Health IT Patient Safety***, a private sector initiative, has assembled a multi-stakeholder workgroup to clarify the role of health information technology (IT) in either mediating or preventing patient identification errors by reviewing the evidence, sharing solutions, identifying challenges and barriers, considering product features and functionality, and creating recommendations for safe practices. Its findings are published in its report *Health IT Safe Practices: Toolkit for the Safe Use of Health IT for Patient Identification*. The *Partnership's* recommendations and toolkit will be publicly available at <https://www.ecri.org/resource-center/Pages/HITPartnership.aspx>.

ECRI Institute encourages its members to review these reports. More information is available at <http://www.ecri.org/patientid>.



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Partnership Collaborating Organizations



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The Safe Use of Health IT in Patient Identification

EXECUTIVE SUMMARY

Patient identification errors are ubiquitous and no single solution can eliminate all misidentifications. Patient identification errors can result in grave consequences when one patient's record contains information that is commingled with another patient's information; when information is not recorded in a single record for the same patient; or when identification problems cause previous care or conditions to go unrecognized because there is no appropriate place to record that information or because the information was recorded in the chart of another patient. Misidentifications can lead to treatment modalities becoming inaccessible (e.g., bar-code scanners, automatic dispensing cabinets, handheld monitors), inappropriately reported results, or incorrectly routed information. These issues and failures to separate inappropriately commingled records create safety issues, potentially leading to delayed or inappropriate care and often to misdiagnoses. Mistakes in patient identification are a significant patient safety issue that may be better managed through the use of health information technology (IT). Managing patient identification is a complex task that includes not only obtaining and recording the proper identification information, but also continuously authenticating that information across the continuum of care. Using health IT in patient identification facilitates ready and continued access to current and updated information, which plays a vital role in providing safe, quality care to the correct individual at the appropriate time.

The patient identification workgroup, chaired by Hardeep Singh, MD, MPH, from the Michael E. DeBakey VA Medical Center and Baylor College of Medicine, reviewed current evidence in order to make safe practice recommendations detailing how health IT can facilitate patient identification. Because patient identification issues are multifactorial, the workgroup focused on health IT strategies to mitigate those frequently reported patient misidentification issues. Recognizing that no single solution will be sufficient and that a multifaceted approach is essential, we divided the recommendations into two main areas: (1) attributes and (2) technology. A three-pronged analysis looking at catching, matching, and display completed the review of attribute and technology issues.

1. **Attributes.** Recommendations surrounding *attributes* address the information-gathering aspects of patient identification, including the fields and the formats that are available to accommodate acquisition of required information.
2. **Technology.** Recommendations involving *technology* address new technologies to improve identification and ways to leverage existing technologies for safe patient identification.

In developing the recommendations, the workgroup solicited information from professional organizations, providers, and experts; evaluated an evidence-based literature review that focused on three key questions (the prevalence, causes, and effective interventions for reducing misidentification); looked at ECRI Institute PSO's *Deep Dive: Patient*



Identification analysis of over 7,600 patient safety events; evaluated reports of present practices; ranked initial recommendations based on feasibility and priorities while using Sittig and Singh’s sociotechnical model to categorize causes and solutions; and then refined the recommendations in multi-stakeholder subgroups before soliciting additional review and comment. The workgroup specifically chose not to repeat the work, recommendations, or ongoing projects on patient identification from the Office of the National Coordinator for Health Information Technology (ONC) (the Safety Assurance Factors for EHR Resilience or SAFER guides); work of the College of Healthcare Information Management Executives (CHIME, HeroX) on development of a national patient identifier; work of the Healthcare Information and Management Systems Society (HIMSS “Patient identity integrity toolkit”); the American Health Information Management Association (AHIMA); and others diligently working to improve patient identification.

The recommendations developed by the workgroup are as follows:

IDENTIFY: Attributes and Technology—Safe Use of Health IT for Patient Identification

Attributes

- (I) A-1: Electronic fields containing patient identification data should consistently use standard identifier conventions.
- (D) A-2: Use a confirmation process to help match the patient and the documentation.
- (E) A-3: Use standard attributes and attribute formats in all transactions to improve matching.
- (N) A-4: Use a standard display of patient attributes across the various systems.

Technology

- (T) T-1: Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions.
- (I) T-2: Integrate new technologies to facilitate and enhance identification.
- (F) T-3: Implement monitoring systems to readily detect identification errors.
- (Y) T-4: Include high-specificity active alerts and notifications to facilitate proper identification.

Patient identification issues existed before the incorporation of technology and the electronic exchange of information in clinical care. While technology can introduce its own set of risks—for instance, errors can be rapidly disseminated electronically—harnessing the benefits of technology to facilitate accurate and complete identification is imperative in order to avoid the safety risks introduced by the rapid and diffuse propagation of incorrect identification information. Improvements in patient identification can best be achieved by examining more closely the present technology, anticipating future developments, and finding new ways to facilitate accurate identification for safer care. The recommendations are forward looking as providers and organizations deal with legacy systems and competing priorities, and as vendors prioritize changes and identify appropriate standards. The key to successful implementation of these recommendations depends on continued collaboration, prioritization, and identification of implementation standards as we all further the goal of making care safer.



Electronic fields containing patient identification data should consistently use standard identifier conventions

INCLUDE



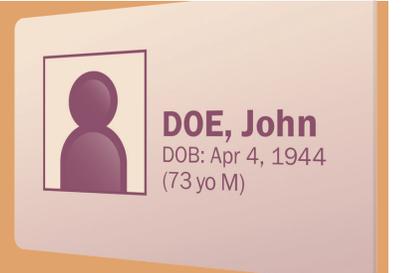
Use a confirmation process to help match the patient and the documentation

DETECT



Use standard attributes and attribute formats in all transactions to improve matching

EVALUATE



DOE, John
DOB: Apr 4, 1944
(73 yo M)

Use a standard display of patient attributes across the various systems

NORMALIZE



DOE, John
DOB: Apr 4, 1944
(73 yo M)

Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions

TAILOR



Integrate new technologies to facilitate and enhance identification

INNOVATE



Implement monitoring systems to readily detect identification errors

FOLLOW UP



Include high-specificity active alerts and notifications to facilitate proper identification

YIELD



Introduction

Improving how patients are accurately identified requires a multifaceted approach (AHIMA “Managing the integrity”). No single solution—including a single national patient identifier—is likely to immediately address all the patient identification issues that are being reported. Rather, the complexity and the variety of settings where patient identification issues arise become readily apparent when reviewing the evidence-based literature (ECRI Institute “Special report”) in this area or examining and analyzing the events that are associated with various misidentifications (see [Table 1](#)) (ECRI Institute “Deep Dive”). Not only can missing or incorrect information lead to incorrect identification, often with severe safety implications, but failure to accept a modality used in identification (e.g., providing correct legal name or fingerprints, allowing a photo to be taken) can impair the ability to correctly identify a patient in an unambiguous manner before any information is exchanged (AHIMA “Managing the integrity”). The *Partnership’s* workgroup on patient identification detected several failure points and focused on a

common thread that could improve several parts of the identification process—primarily the use of technology-based solutions. The goals for improving patient identification include eliminating inappropriate, delayed, or unsafe care that can result from inaccurate, inadequate, incorrect, or irretrievable patient information and consistently identifying and transferring proper and correct information.

Technology can enhance the ability to identify and match the correct individual with the correct intervention or documentation, but it is only one tool in the process of correct patient identification. Currently, no single nationwide patient-data-matching strategy exists to ensure the accurate, timely, and efficient matching of patients with their healthcare data (AHIMA “Patient matching in health information exchanges”). Additional considerations include knowing how and where information is being (or will be) exchanged and assessing what information is being obtained and in what format it is gathered and then used. Gathering information

using standardized formats and displaying that information in standardized positions consistently and correctly are vital to facilitate proper identification and matching within and across care processes. The lack of a standardized data set can lead to patient records not being appropriately linked to one another (AHIMA “Patient matching in health information exchanges”). When information is captured and stored in the same format, algorithms are able to more consistently match patient information.

The workgroup began with a triple-aim approach, looking for health IT to improve (1) accurate information gathering, or *catching*; (2) facilitation of accurate information *matching*; and (3) *display* of information to enhance patient identification. As an essential part of this process, it is necessary to consider how health IT can facilitate “identity proofing” (correct identification of the individual) and “authentication” (confirming that the information belongs to and is associated with the person who is using the information) (NIST SP 800-63-2). To date, processes have included asking for the

**Table 1. Sources and Areas of Patient Identification Errors****Policies**

- Lack of policies
- Failure to adhere to policies
- Poorly designed policies

Registration

- No photo ID required
- Highly variable processes
- Missing information (patients told to leave valuables at home)
- Inefficient access (must scroll multiple screens to find information)

Physical identifiers (wristbands)

- Missing wristbands
- Inaccurate information on wristband
- Incorrect placement
- Poor wristband design
- Wristband physically cannot be placed on patients (e.g., neonates)

Documentation

- Distraction, fatigue
- Overlap/similarity of names
- Patient proximity (records are close together in the electronic system, or names are similar in dropdown lists)
- Multiple charts open
- Patient's age or date of birth missing
- Inadequate double checks
- Communication errors
- Mislabeling

Technology

- Improperly stored information
- Incorrect display
- Bar-code errors

individual's legal name and date of birth (gathering *attributes*) but also viewing of a photo ID (*technology*). Obtaining a biometric identifier (e.g., fingerprint, palm scan) is yet another way to use technology to enhance identification even if or when other means of identification, including the consistent use of a single standard identifier, become available. This triple-aim approach will create the foundation for the interaction of

multiple strategies to improve proper identification and matching.

Catching. Gathering identifying information is impacted first by the choice of what data are collected and then by how the data are obtained—the process of “catching” data. Using a standardized and consistent set of data (Australian Commission on Safety and Quality in Healthcare; AHIMA (“Quality data starts with us”) in standard fields

is vital to the process (AHIMA). An important question for the workgroup to examine was, “Does the organization use a central registration process to gather standard identifiers in standard formats, take patient photos, incorporate biometric identifiers, and evaluate how that information is recorded, and in what fields and formats?”

Matching. The information obtained impacts how that information is correctly and consistently matched (AHIMA “Patient matching in health information exchanges”). Determining whether a matching algorithm is used and, if so, what type of algorithm—deterministic, probabilistic, or natural—impacts the information that must be gathered to correctly match the individual and his or her record (see Appendix A. Definitions). Matching techniques also determine the searches performed to avoid duplicate or overlaid records. Another essential part of matching includes how the data are managed, corrected, and sustained. (AHIMA “Data quality management model”). It is only through good “information stewardship” that the data can be associated with the correct individual for the process of “matching” (AHIMA “Data quality management model”).

Display. Finally, the human factors associated with this process must be considered, and this includes visualizing the information. While distractions and environmental complications are important considerations (AHIMA “Best practices”), the focus of the workgroup remained on the technology itself; thus how the information appears and how it is displayed are



also vital to correct patient identification. Display considerations include visual distinctions, the use of white space, alternate line shading in lists, providing information that is not truncated, and the incorporation of visual identification tools such as photos. (AHIMA “Best practices”)

The workgroup evaluated catching, matching (see also HIMSS), and display (see also NIST) using Sittig and Singh’s sociotechnical model. The purpose of using the sociotechnical model was to ensure a comprehensive evaluation of the recommendations within the complex environment in which they would function. The eight areas evaluated in the sociotechnical model (hardware/software; clinical content; human-computer interface; people; workflow and communication; organizational policies, procedures, and culture; external rules, regulations, and pressures; and system measurement and monitoring) provide a framework to assess those aspects of health IT—namely, the attributes and technology used to improve accurate identification. By considering each category of the model and how it related to the recommendation, the workgroup ensured that the recommendations were not in conflict with the environment in which they would function. As the workgroup moved through the process, they refined each of the health IT safe practice recommendations for the use of attributes and

technology in facilitating safe patient identification.

WORKGROUP PROCESS

Topic selection. The topic of patient identification was introduced at the 2014 inaugural in-person *Partnership* meeting. Patient identification was named as an area of concern when *Partnership* participants were queried about safety concerns that result from the use of technology and the safety issues that could be improved through the use of technology. In 2015, after the development and publication of its first set of safe practice recommendations, the *Partnership* decided to continue its work with a focus on patient identification (see [Figure 1](#)).

Meetings. The work commenced during the October 2015 in-person meeting, where *Partnership* members began planning our approach to the issue of patient identification safety. The workgroup began meeting monthly in November 2015 and continued work for approximately eight months. The patient identification workgroup, chaired by Hardeep Singh, MD, MPH, Michael E. DeBakey VA Medical Center and Baylor College of Medicine, was composed of *Partnership* members including providers, researchers, IT experts, healthcare organizations and PSOs, vendors, and a patient advocate. Two subgroups selected from the workgroup, one

concentrating on “attributes” and the other on “technology,” refined the recommendations initially agreed upon by the complete workgroup. The subgroups then met together and further refined the draft recommendations, clarifying the recommendations with rationales and implementation strategies. The *Partnership*’s entire workgroup comprehensively discussed the draft recommendations, and clarifications were incorporated ([Figure 2](#)).

Considerations. During our monthly meetings, the workgroup had the opportunity to gather information and feedback from various professionals, organizations, and providers—asking these contributors not only to describe their efforts in addressing this issue, but also to clarify the factors that must be considered in addressing possible solutions. Experts presenting to the workgroup included a human factors specialist from the Armstrong Institute at Johns Hopkins Medicine; staff from the Institute for Safe Medication Practices (ISMP), a fellow at ONC; and staff from AHIMA. The group also heard from ECRI staff who conducted the evidence review (ECRI Institute “Special report”) and from those involved in the data analysis (more information is available in ECRI Institute PSO’s *Deep Dive: Patient Identification*).

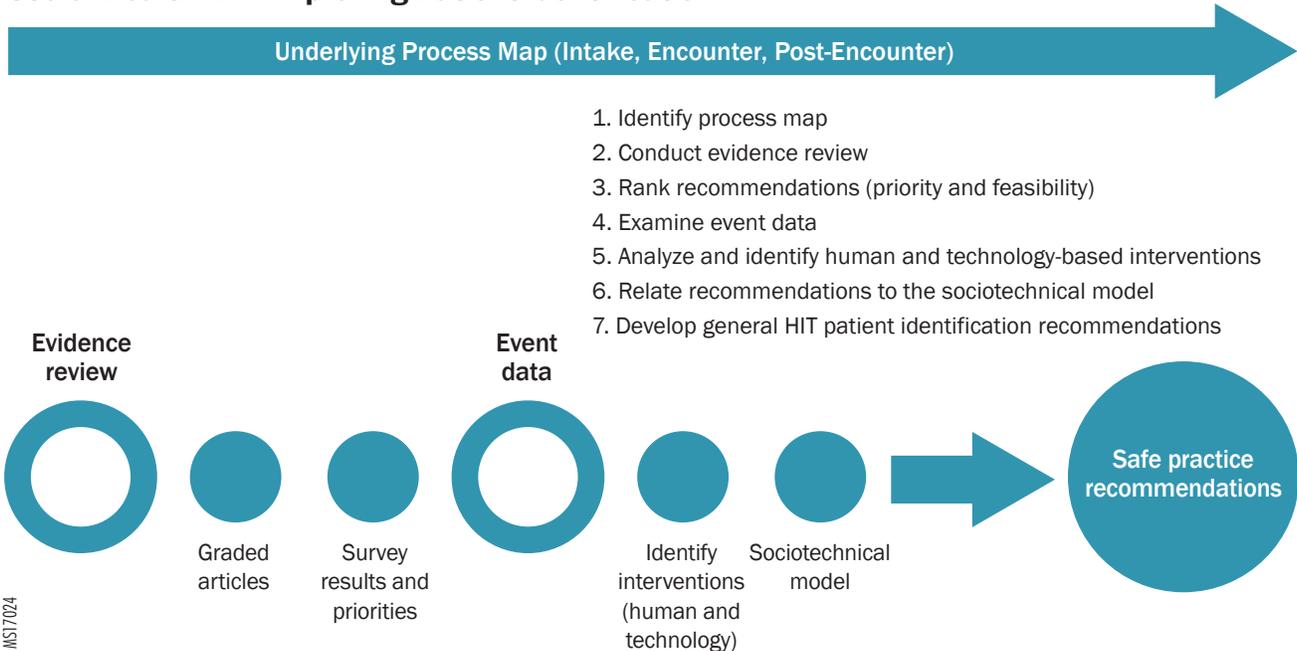
These sessions also provided an opportunity to evaluate how

Figure 1. Workgroup Process





Figure 2. Developing Recommendations for the Use of Health IT in Improving Patient Identification



others are currently addressing the issue of patient identification. The workgroup specifically chose not to repeat, but rather to move forward from and build upon, work previously completed by other organizations, including work done in the development of ONC’s SAFER Guides; work published on patient matching (ONC “Patient identification and matching”); work presently in process by CHIME on development of a national patient identifier (CHIME, HeroX); as well as work underway by HIMSS (“Patient identity integrity toolkit”), AHIMA, and others who have provided a foundation for improving patient identification.

Evidence reviewed. The workgroup reviewed and analyzed a targeted evidence-based literature review (ECRI Institute “Special report”) and patient identification events submitted by

various providers and provider organizations under the protections of ECRI Institute’s PSO (see also ECRI Institute “Deep Dive”).

Literature review. The comprehensive evidence-based literature review focused on three primary questions:

1. *What is the prevalence of patient identification errors in clinical care?*
2. *What are the causes of patient identification errors in clinical care?*
3. *What interventions are effective for decreasing patient identification errors in clinical care?* (ECRI Institute “Special report”)

To address these questions, a medical librarian conducted a search of PubMed, MEDLINE, EMBASE, CINAHL, and the Patient Safety

Network (PS Net) to identify studies published between January 2009 and January 2016. The search used both medical subject headings and keywords to identify studies in the areas of patient identification, wrong-patient incidents, identity fraud, and biometrics (ECRI Institute “Special report”).

Evaluation of the literature indicated that patient identification errors are prevalent and occur in multiple areas of the care continuum (e.g., registration; wristbanding; charting and order entry; clinical laboratory, medication, and substance administration; surgery and other procedures; pathology; radiology; and transfusions) (ECRI Institute “Special report”) (Table 2). Issues identified as contributing to misidentification included time constraints, distractions, fatigue, electronic



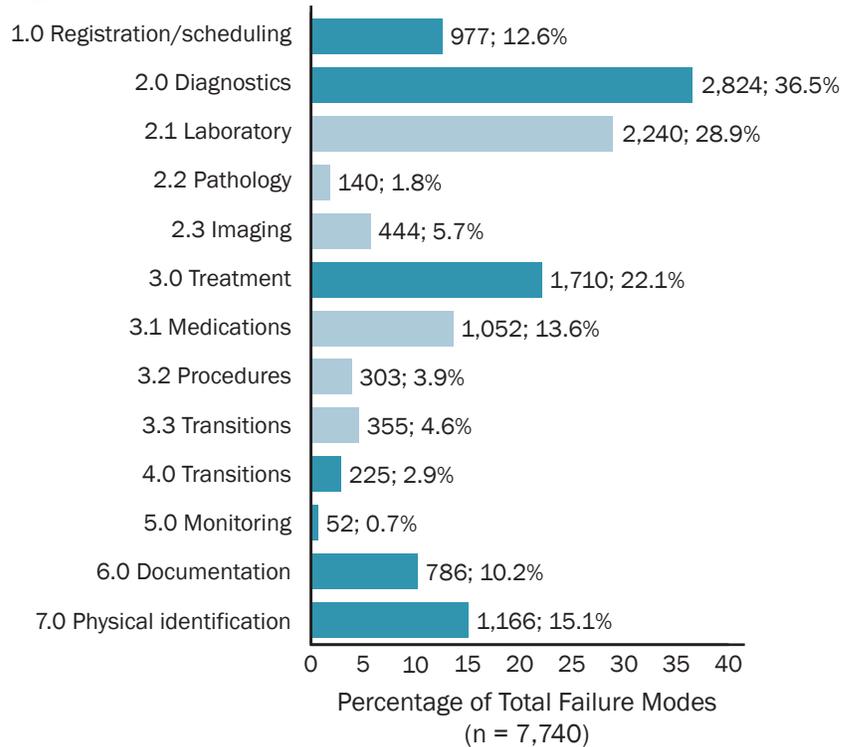
environments (e.g., screen appearance and refresh times, cached information, “down” times), the number of charts open, communication issues, patient characteristics and the use of aliases or impersonations, and staff workarounds. This information is consistent with the data obtained from events. (ECRI Institute PSO “Deep Dive”; ECRI Institute “Special report”; NISTIR 7804-1; SAFER)

Event review and analysis. After evaluating information from the evidence review, the workgroup assessed summaries of more than 7,600 patient-identification-related events submitted under the protections of the PSO (see also ECRI Institute PSO “Deep Dive”) (see **Figure 3**). First, the workgroup looked at where in the care process events most commonly occurred. The breakdown of events by stage of the care continuum is depicted in **Figure 4**, and in **Table 3**.

Analysis of the reports revealed that events occur during intake, encounter, and the post-encounter phase, with the greatest percentage occurring during the encounter phase (87.2%), which includes under this taxonomy diagnosis, treatment, monitoring, laboratory encounters, medication administration, radiology, and transitions or handoffs of care. Less frequently identified were events occurring during intake (12.6%); events reported as occurring during the post-encounter phase* (0.2%) were noted least

* This can include, among others, electronic lab result delivery, e-prescribing, electronic referrals, sharing of encounter-based information (dictations), and exchange of clinical summaries.

Figure 3. Patient Identification Events



Key: Darker bars depict the larger categories and lighter lines depict the subcategories (e.g., Diagnostics includes Laboratory, Pathology, and Imaging; Treatment includes Medications, Procedures, Transfusion).

Note: Events can be tagged with more than one code from the taxonomy. For example, an event coded as a documentation error (e.g., “Wrong chart retrieved”) could also be coded as a medication error (e.g., “Medication ordered for wrong patient”). (See also ECRI Institute PSO “Deep Dive.”)

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often. This lower rate of post-encounter events reported is due, in part, to the areas where reporting most frequently occurs—directly associated with treatments and not necessarily capturing outpatient reports. This does not, however, diminish the importance of identification issues occurring during the post-encounter phase.

Events involving encounters. Incorrect patient identification was most frequently reported during the encounter phase of treatment. These events involved interventions that were either ordered for or performed

on the wrong patient; results (e.g., laboratory, radiology, pathology) that were associated with, or reported for, the wrong patient; or specimens, reports, or monitors that were mislabeled (see **Table 4**) (see also ECRI Institute PSO “Deep Dive”). Because the greatest number of reported events where technology-related interventions are possible occurred in the “encounter” phase, the workgroup focused its attention here.

The workgroup noted the important fact that incorrect patient identification events reported as occurring during registration and

**Table 2. Frequency, Location, and Examples of Patient Identification Errors***

Area Involving Patient Identification	Patient Identification Errors	Patient Identification Errors (Compared with Other Errors)	Patient Identification ECRI Institute PSO <i>Deep Dive: Patient Identification</i> % Failure Modes	Case Studies from Submitted Events
Registration (1 study)	Manual error rate 0.075% Electronic error rate 0.04%	NR	Registration/scheduling: 12.6%	Patient was registered as Mary Smith. Patient's mother noted that the patient was actually Mary Smythe, and she had an existing MRN. Providers were notified and chart correction was requested. Charts were marked for merge.
Wristbanding (2 studies)	8.67% of wristbands had name errors 4.33% of wristbands had wrong MRNs	NR	Physical identification: 15.1%	Nurse was unable to scan or use patient ID bracelet because visit numbers on medication labels did not match the current encounter. Further investigation found that the clerical staff had canceled the encounter and rescheduled it. The current procedure is that medication orders are released the day before the encounter for infusion patients. If the infusion encounter is canceled after medications are released, the new infusion encounter created will not match the visit numbers on the patient's medication labels or ID bracelet.
Charting and order entry (4 studies)	Reported rates: 0.049%–0.064%	0.025% of medication order entry errors	Documentation: 10.2% Diagnostics/treatment (ordering): 12.1%	Patient was scheduled for computed tomography scan. The order requisition from the physician had the correct spelling of the patient's name (MEARES, Michelle), DOB, and MRN. This information was verified by calling the physician's office. Interventional radiology order-tracking sheet had incorrect spelling (MEARS, Michelle), but correct DOB and MRN.
Clinical laboratory (9 studies)	Reported rates: 0.07%–0.37%	35%–70% of specimen labeling errors	Diagnostics (laboratory): 29.8%	Patient has a hyphenated last name with too many characters for the computer field. First name on encounter spelled Johnath. First name on blood bank specimen spelled Johnathan. Name mismatch deviates from blood bank policy and procedure for accurate identification of patient specimens.
Medication/substance administration (4 studies)	0.12% of warfarin prescriptions 0.014% of enteral feedings (breastmilk) Up to 0.38% of all medication dispenses	5.2%–8.3% of medication administration errors	Treatments (medication): 13.6%	Preoperative antibiotic order was entered on the wrong patient. Drug was ordered for "Garrett, Sara," but order was entered for "Garrett, Allison." The nurse caught the error before it reached the patient, reentered the order under the correct name, and administered the medication to the correct patient. Investigation uncovered that when the order was reentered, "Sara Garrett" was not in the pharmacy system, but "Allison Garrett" was. An ADT interface problem had occurred the previous day, so some transactions were not updated automatically in the pharmacy system.

scheduling most often involved duplicate record creation or incorrect associations between information and patients (see [Table 5](#)). This was seen as a slightly different identification issue, and one which the workgroup acknowledged was the focus of other groups' work.

To better understand the events reported and identify the interventions needed to specifically address those issues, it was important to first identify and examine the specific patient identification issue and then to study the impact of that

misidentification on patient safety (see [Table 3](#) and [Table 6](#)).

Consequences related to events.

What occurs when patients are not correctly identified? During the encounter phase, misidentification events frequently involve medication



Table 2. Frequency, Location, and Examples of Patient Identification Errors* (continued)

Area Involving Patient Identification	Patient Identification Errors	Patient Identification Errors (Compared with Other Errors)	Patient Identification ECRI Institute PSO <i>Deep Dive: Patient Identification</i> % Failure Modes	Case Studies from Submitted Events
Surgery and procedures (4 studies)	NR	0.09% of all adverse surgical events 15%–30% of surgical incident reports	Treatments (procedures): 3.9%	Results from a procedure were scanned into the wrong chart. The patient called and identified herself and stated that when she viewed her records through the patient portal, she noted the error, which she wanted removed from her medical record. Investigation revealed that the results should have been scanned into the chart of a patient with the same first and last names, but with a different middle initial.
Pathology (4 studies)	0.4% of all cases mislabeled (includes other error types)	7.6%–27.5% of specimen labeling errors	Diagnostics (pathology): 1.8%	Amniotic fluid cytogenetics results for a patient were reported in the computer system under another patient’s order. The error was discovered and corrected within minutes. A new staff member was in training, who switched places with another staff person at the computer. The staff member did not double check the patient’s identity, so results that were already reported for the correct patient were also entered/ released for this patient.
Radiology (1 study)	0.004% of radiology reports contain “wrong patient” or “wrong dictation”	NR	Diagnostics (imaging): 5.7%	Technologist performed exam on the correct patient, but did not check identifiers on the ultrasound machine, causing the wrong name to be attached to the images. This was discovered during a billing record check of the patient’s records.
Transfusion (10 studies)	Reported error rates: 0.0018%–0.04% Reported near misses: 0.15%–0.45% 0.2% of cord blood samples mislabeled	NR	Treatments (transfusion): 4.6%	Cord blood was ordered on the wrong patient: not baby Smith, but an adult patient named Smith who was being admitted at the same time. The label contained the wrong patient’s name. The baby’s specimen had to be drawn for typing.

* Table contains de-identified event information. See also ECRI Institute Special report “Deep Dive.”
ADT, admission, discharge, transfer; DOB, date of birth; MRN, medical record number; NR, not reported.

or treatment errors where patients receive interventions intended for another patient, or patients miss or are unable to receive needed treatments or medications. This can create a serious safety issue, or severely impede the provision of needed care. One such instance is seen in the following example.

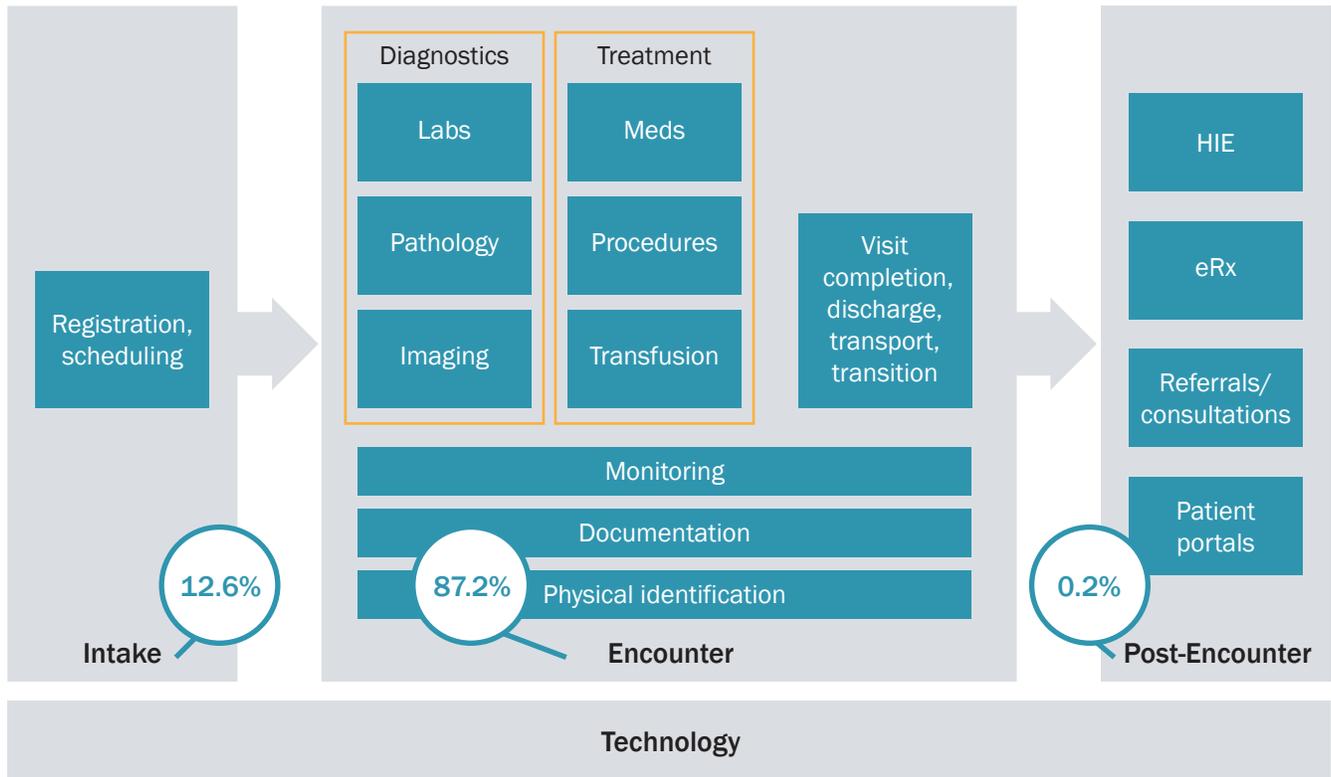
A patient was admitted to the hospital from the emergency department. Upon admission

to the hospital, the patient was found to have two different account numbers. Notification that the patient had two differing account numbers was provided to the admitting attending physician, the charge nurse, administration, and IT. This issue was not immediately resolved. As a consequence of these differing accounts, it became impossible to access the patient’s medications from the

automated dispensing cabinet, to scan the patient’s armband to verify medications and procedures, or to access integrated technologies (in this case, the blood glucose monitor). Moreover, the patient was being prepared for surgery at an associated facility and staff needed to ensure the accurate transfer of information for her continued care and treatment. Accurate information



Figure 4. Patient Identification Process Map (Percentage of Issues according to Phase of Care)



MIST 7026

eRx, electronic prescribing; HIE, health information exchange

transfer would not be possible without resolution of the error created by information being recorded under two different accounts for this same patient, as it resulted in two different documents capturing only portions of the care received for the same admission.

The events described in [Table 3](#) are just a few examples from the ECRI Institute PSO database of events collected between January 2013 and August 2015 (see also ECRI Institute PSO “Deep Dive”). Further analysis of these and similar events helped to define the specific identification issues encountered, their impact, their likely causes, and

possible interventions to mitigate any similar misidentifications.

Final analysis and review. Once the workgroup was able to integrate the information from the evidence review, information from event analysis, and the various presentations, the focus of technology-related interventions became clear. To further clarify the interventions, they were divided into two distinct categories, those addressing *attributes* and those addressing *technology*. The attribute interventions build a foundation for the technology-based recommendations. When assessing “attribute” recommendations, “catching” the appropriate information becomes a priority. When the

same information exists in the same format, consistent “matching” then becomes feasible and can open the door for improvements through technology. The “technology” recommendations focused on all three building blocks as they addressed catching, matching, and display. This is consistent with interventions found in the literature and suited to address the reported events. The workgroup found that the recommendations would impact not only hardware and software but also workflow and communication, as well as people and their organizational environment.

Next, the workgroup matched events with the types of

**Table 3. Patient Identification Events and Analysis***

Event	Batch checking of identification components misses problems <i>During the registration process the computer froze after only the patient's name had been entered. After the computer "unfroze," a DOB of 03/17/1912 was displayed. The patient's correct DOB was 03/17/2012. Thinking that only the year was wrong, staff changed the year in the DOB, and completed the registration. However, this created a duplicate MRN.</i>
Issue and impact	Issue: Problems entering information Impact: In this case it was difficult to enter the patient's DOB. When the system was again active, staff focused only on the DOB, because up until the screen froze all information was believed to be correct. "Batching" multiple components and checking all at the same time, here assuming all of the entries were correct after the DOB was modified—instead of checking one at a time—complicates correct identification, fragments records, and delays care.
Event	Sound-alike names cause confusion <i>A patient in the emergency department was registered incorrectly under the name John D. Schmidt. Registration realized the mistake and then registered the patient correctly as John D. Schmitt. The registration team member advised the clinical staff of the overlay and of the new registration for John D. Schmitt. However, the staff could still view and record information in the overlaid account (John D. Schmidt). Radiology exams had been logged in to that (incorrectly created) account. Further, the clinical staff was reluctant to chart on the corrected account (John D. Schmitt) and continued entering information into the incorrect chart (John D. Schmidt).</i>
Issue and impact	Issue: No single complete chart Impact: Inaccurate, incomplete information hinders the provision of timely, safe, correct care. Also, the financial costs associated with the processes necessary for merging and/or separating information negatively impact the organization.
Event	Armband not checked against test order <i>A patient presented for radiographic exams. The technician asked the patient his name and DOB and verified the information against the patient's armband but not against the order. The physician had placed the order for the wrong patient; however, the exam was performed on the correct individual. The exams were then reordered on the correct patient. The system administrator was notified and asked to copy and paste findings to the correct patient's record and to delete the study results reported under the wrong patient's record.</i>
Issue and impact	Issue: Failure of the staff to recognize and address an identification error despite completing a verification protocol Impact: Propagation of incorrect information, delays in diagnoses, or improper diagnoses and treatment can result.
Event	Breastmilk label for wrong infant <i>Nurse scanned a syringe of breastmilk and attached breastmilk label to the infant. Nurse received an error message on the breastmilk scanner and upon further inspection realized that the breastmilk identification band attached was for a different baby. The incorrect band was removed.</i>
Issue and impact	Issue: Incorrect/inaccurate/missing wristband Impact: Often wristbands are missing, incomplete, inaccurate, degraded with use or water exposure, illegible, have fallen off or were taken off, or are attached to intravenous tubing, the bed, or another piece of equipment. This is frequently seen in neonates, in whom band sizing becomes an issue.
Event	Cached information from machine yields incorrect results for many patients <i>After a computer update, while staff downloaded Holter monitor results the following problem arose: unbeknownst to the staff, every patient result (tracing) was the same; the tracing was being generated from one patient's test. Even though all Holter results that were returned had correct demographic information (i.e., correlating correctly to the patient on whom the Holter was ordered), the tracings and interpretations were all obtained from one patient.</i>
Issue and impact	Issue: Incorrect information transmitted Impact: Display of incorrect results from clinical testing for multiple patients (cached information from earlier patient displayed). Improper care and propagation of incorrect information can result, impacting future care.
Event	Test completed on wrong patient <i>Lab assistant pulled up the wrong patient's record when placing an order. The error was discovered after the testing had been completed and the results reported. The test results were corrected and the test was credited.</i>
Issue and impact	Issue: Incorrect individual identified from a list Impact: Delayed or missing results; information is unavailable and delayed diagnosis or misdiagnosis is possible.

* See also ECRI Institute Special report "Deep Dive"

DOB, date of birth; MRN, medical record number.



Table 4. Encounter Phase: Diagnostics/Treatment/Monitoring Failure Modes

Diagnostics/treatment/monitoring	# Failure mode*	% Failure mode
Ordered for wrong patient	937	12.1%
Performed on wrong patient	911	11.8%
Results associated with wrong patient	525	6.8%
Results reported on wrong patient	228	2.9%
Mislabeled specimens, reports, monitors	1,649	21.3%

* Out of 7,740.

Table 5. Intake Phase: Registration/Scheduling Failure Modes

Registration/scheduling	# Failure mode*	% Failure mode
Duplicate record created	38	0.5%
Patient associated with another patient's record	457	5.9%
Info from prior encounter not updated/verified	24	0.3%
Error in values entered	458	5.9%

* Out of 7,740.

interventions best suited to facilitate improvements in identification. Fifteen percent of the total events reported between January 2013 and August 2015 were reported as having technology components contributing to misidentification. Categorizing and ranking interventions for attributes and technology addressed these events as well as the other observed and reported events (see [Table 6](#) and Appendix B. Evidence Table).

As stated, the two categories of interventions—attributes and technology—became readily apparent during this analysis; any improvements using health IT to mitigate events involving patient identification had to incorporate these areas. However, it is important to remember that both of these areas can also create new areas of concern, especially when new technologies are first introduced (see [Figure 5](#)). The recommendations

also had to take this into account as they were refined.

The workgroup began with a broad array of recommendations. To limit these recommendations, the workgroup used a priority matrix. This process helped assess the feasibility and importance of each recommendation as well as its overall safety impact. Recommendations that were deemed feasible and that were of high importance in addressing patient identification events were selected for further refinement. However, recommendations were not eliminated from consideration if they were forward looking, meaning that the technology or method of implementation was currently not yet available.

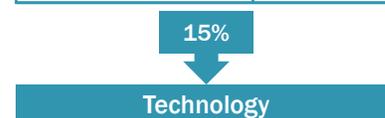
To refine those feasible, high-priority recommendations, the workgroup next matched them to the evidence, evaluating and weighing each, discussing its priority, and

considering its impact on safety on each of the stakeholders. The workgroup also scrutinized and considered other completed projects and projects currently in process, including SAFER; the ONC Matching project (ONC “Patient identification and matching”); the work of the National Institute of Standards and Technology (NISTIR7804-1); CHIME’s National Patient ID Challenge; the work of HIMSS (“Patient identity integrity toolkit”); the work of the National Quality Forum (NQF); AHIMA’s My HealthID and other identification projects; the Sequoia Project in conjunction with the Care Connectivity Consortium; and the work of the Australian Commission on Safety and Quality in Healthcare. The workgroup chose not to duplicate any of these ongoing efforts, but rather worked instead on improving safe identification practices with a health IT focus.

The group next examined these interventions using the elements of Sittig and Singh’s sociotechnical model (see [Figure 6](#)). The eight

Figure 5. Technology Commonly Reported in Patient Identification Issues

Technology	# of Issues
Bar coding	204
CPOE/EHR	158
Interfaced systems	83
Monitors	25
Point-of-care testing	666



CPOE, computerized provider order entry; EHR, electronic health record

MS17007



Table 6. Classification of Events and Interventions

			Physical Verification (Non-HIT)	Verbal Verification (Non-HIT)	Attributes - Patient Identifiers	Process Standardization	Patient Involvement	Biometrics	Barcode/RFID	Patient Photo in EHR	Clinical Decision Support (CDS)	Algorithms	Unique Patient Identifier	
			Interventions											
Registration/scheduling	# Failure mode	% Failure mode	Human					Technology						
Duplicate record created	38	0.5%			✓	✓	✓	✓			✓	✓	F	
Patient associated with another patient's record	457	5.9%	✓	✓	✓	✓	✓	✓		✓	✓	✓	F	
Info from prior encounter not updated/verified	24	0.3%		✓	✓	✓	✓				✓	✓		
Error in values entered	458	5.9%	✓	✓	✓	✓	✓				✓	✓		
Diagnostics/treatment/monitoring	# Failure mode	% Failure mode	Human					Technology						
Ordered for wrong patient	937	12.1%			✓	✓				✓	✓			
Performed on wrong patient	911	11.8%	✓	✓	✓	✓	✓	F	F	✓				
Results associated with wrong patient	525	6.8%			✓	✓			✓		✓	✓	F	
Results reported on wrong patient	228	2.9%		✓	✓	✓								
Mislabeled specimens, reports, monitors	1649	21.3%	✓	✓	✓	✓	✓		✓	F	✓			
Documentation	# Failure mode	% Failure mode	Human					Technology						
Wrong chart retrieved	47	0.6%			✓	✓			F	✓	✓			
Documentation done on wrong chart	548	7.1%			✓	✓	✓		✓	✓	✓			
Wrong patient records in chart/ no patient information	191	2.5%			✓	✓	✓		✓			✓	F	
Transitions	# Failure mode	% Failure mode	Human					Technology						
Discharge/follow-up instructions/prescription given to wrong patient	149	1.9%	✓	✓	✓	✓	✓			✓			F	
Error in patient transfer/transport	66	0.9%	✓	✓	✓	✓	✓			✓				
Discharge to wrong caregiver	4	0.1%	✓	✓	✓	✓	✓			✓				
Referral/consult on wrong patient	6	0.1%	✓	✓	✓	✓	✓			✓			F	
Physical identification	# Failure mode	% Failure mode	Human					Technology						
Wristband missing/not applied	406	5.2%	✓		✓	✓	✓							
Wristband identifiers incorrect	335	4.3%	✓	✓	✓	✓	✓					✓	F	
Wristband illegible/unreadable	26	0.3%	✓				✓							
RFID misapplied/malfunction	4	0.1%				✓								
Patient identity not verified	370	4.8%	✓	✓	✓	✓	✓							
Impersonation	25	0.3%				✓		✓		✓			F	
Total failure modes	7740		F=Potential Future Intervention											

Note: Red lines denote events most commonly addressed by these interventions.



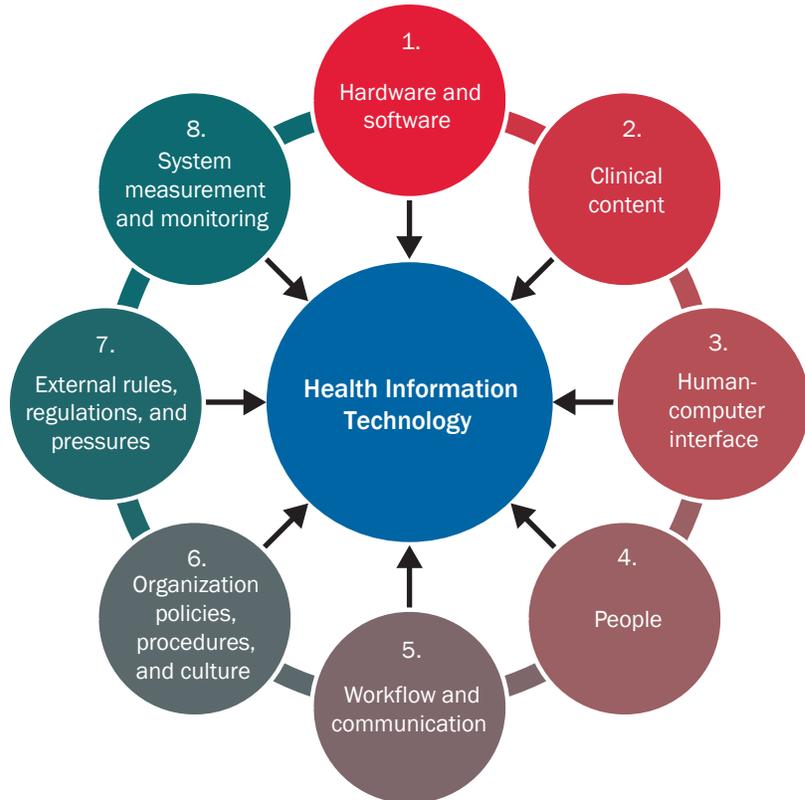
dimensions of the sociotechnical model include hardware/software; clinical content; human-computer interface; people; workflow and communication; organizational policies, procedures, and culture; external rules, regulations, and pressures; and system measurement and monitoring (see also Appendix B. Evidence Table) and were each considered in evaluating the recommendations. The recommended interventions thoughtfully address each of the eight aspects of the sociotechnical model, although none of the recommendations can account for every element of the model.

The workgroup reached a consensus on the language for each of the recommendations. The recommendations were broadly worded to allow flexibility for each of the stakeholder groups. In particular, the recommendations accommodate limited budgets, legacy systems, and the development and adoption of new technologies.

Review. The final eight draft recommendations were scrutinized and dissected by the various *Partnership* participants. Following revisions by the workgroup, the group presented the recommendations to the *Partnership's* expert advisory panel for their input and evaluation, and then to the *Partnership* as a whole. Each member of the *Partnership* had the opportunity to review the recommendations, the evidence behind the recommendations, the suggested rationales, and the suggested implementation strategies (see also Appendix B. Evidence Table).

As part of evaluation and review of the draft recommendations,

Figure 6. Sittig and Singh's Sociotechnical Model



Source: Sittig DF, Singh H. A new sociotechnical model for studying health information technology in complex adaptive healthcare systems. *Qual Saf Health Care* 2010 Oct;19(Suppl 3):i68-74. http://qualitysafety.bmj.com/content/19/Suppl_3/i68.long

Partnership participants were asked to focus on the following questions:

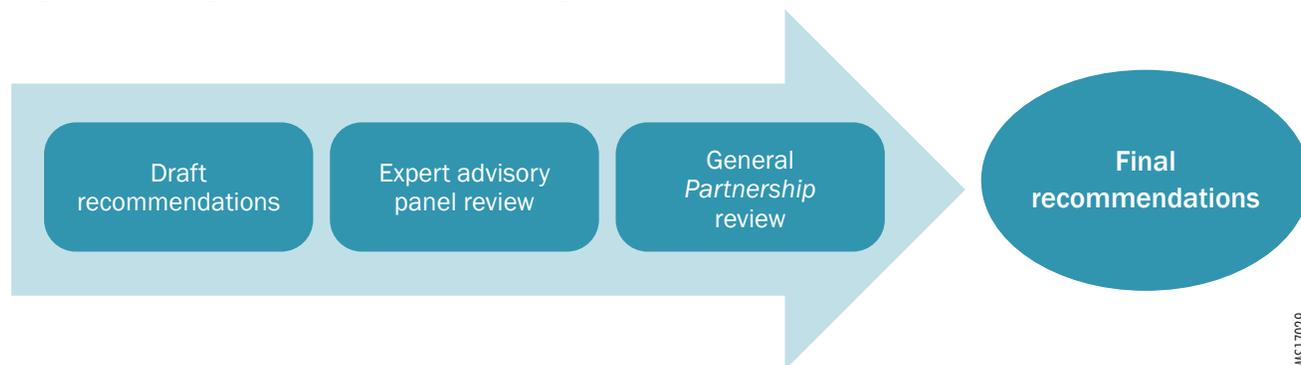
- Will the recommendations help with current patient identification issues?
- What are the various barriers in implementing the recommendations?
- What will help in implementing the recommendations?

Partnership members' comments and responses were examined, evaluated, and weighed before a final version of the recommendations

was determined (see Figure 7). The group reached a general consensus that the recommendations would be useful in addressing patient identification issues, but that consideration must also be given to the development, availability, and adoption of the modifications necessary to implement them. Several reviewers indicated that they had adopted or implemented several of these recommendations or were in the process of doing so. The following recommendations are the result of the robust multi-stakeholder process.

MS17028

Figure 7. Workgroup Process for Reaching Final Recommendations



MS17029

RECOMMENDATIONS: IDENTIFY—Safe Use of Health IT for Patient Identification

Attributes

- (I) A-1: Electronic fields containing patient identification data should consistently use standard identifier conventions.
- (D) A-2: Use a confirmation process to help match the patient and the documentation.
- (E) A-3: Use standard attributes and attribute formats in all transactions to improve matching.
- (N) A-4: Use a standard display of patient attributes across the various systems.

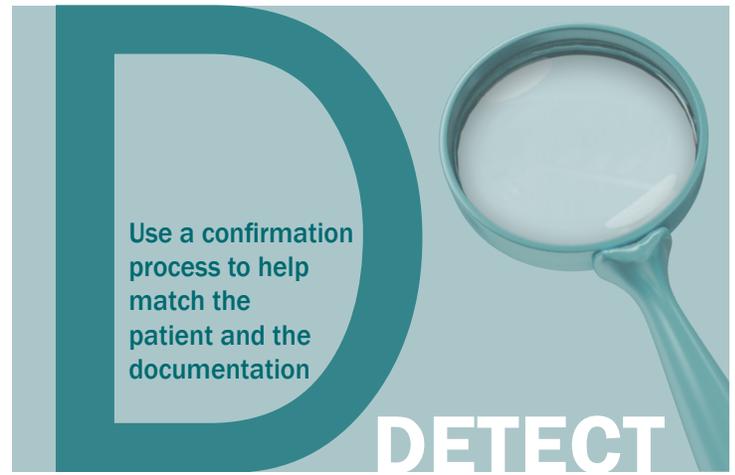
Technology

- (T) T-1: Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions.
- (I) T-2: Integrate new technologies to facilitate and enhance identification.
- (F) T-3: Implement monitoring systems to readily detect identification errors.
- (Y) T-4: Include high-specificity active alerts and notifications to facilitate proper identification.



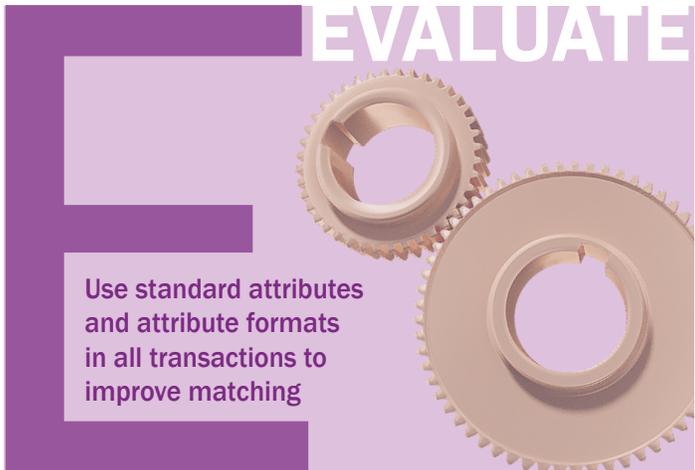
Electronic fields containing patient identification data should consistently use standard identifier conventions

INCLUDE



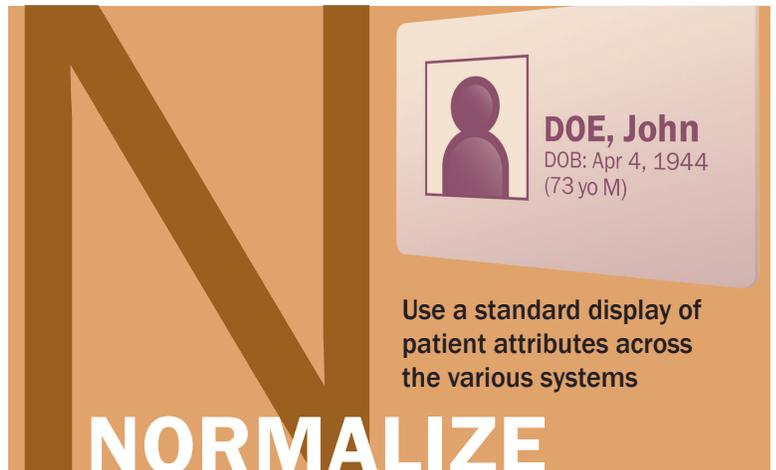
Use a confirmation process to help match the patient and the documentation

DETECT



Use standard attributes and attribute formats in all transactions to improve matching

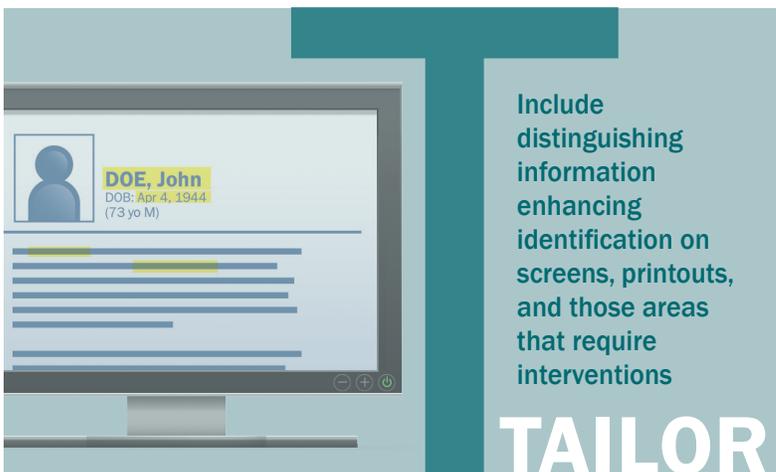
EVALUATE



DOE, John
DOB: Apr 4, 1944
(73 yo M)

Use a standard display of patient attributes across the various systems

NORMALIZE



DOE, John
DOB: Apr 4, 1944
(73 yo M)

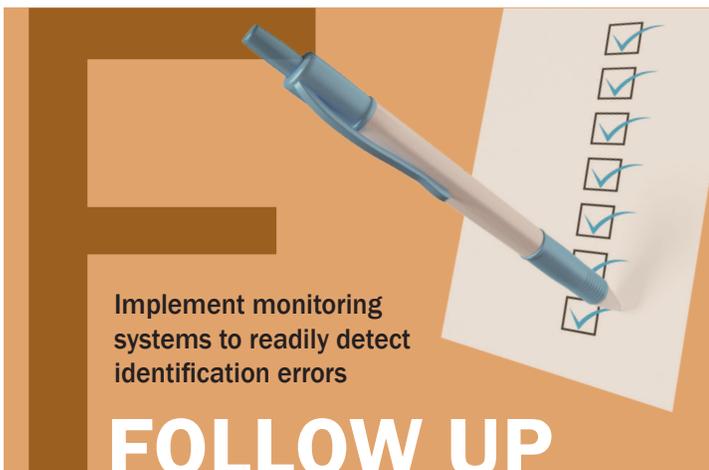
Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions

TAILOR



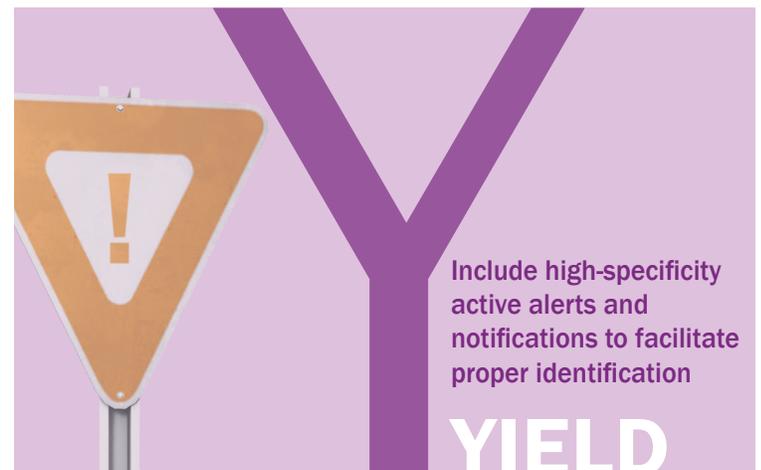
Integrate new technologies to facilitate and enhance identification

INNOVATE



Implement monitoring systems to readily detect identification errors

FOLLOW UP



Include high-specificity active alerts and notifications to facilitate proper identification

YIELD

ATTRIBUTES

Recommendation A-1: Electronic fields containing patient identification data should consistently use standard identifier conventions.

Stakeholders impacted: Vendors, provider organizations (IT, leadership, registration)

- Normalize and structure data—capture the information using the greatest level of granularity, placing information into fields to specifically accommodate that data.
- Use this format: LAST NAME, First Name, Middle Initial—using the individual’s legal, not common name.
- Conduct uniform gathering and recording of information in a centralized location.
- Use standard conventions that users cannot modify.



INCLUDE

Purpose: In order to promote patient safety, to avoid duplicate record creation, to keep information from appearing in the wrong record, and to facilitate matching and interoperability, the fields containing patient identification data should consistently use standard identifier conventions that are recorded consistently and in standard formats that can be exchanged without losing or altering the information. The following are examples of implementations of this recommendation:

- Capture information using the greatest level of granularity (e.g., include sufficient space for LAST NAME, First Name, and Middle Initial) (AHIMA).
- Capture data in its own field to distinguish items and promote uniform recording of the information (e.g., LAST NAME, First Name, Middle Initial, date of birth, zip code, phone number, historical phone number) [see HL7 version 2.6 PID-5, length 48, Date Type: XPN; HL7 Format: Family Name, Given Name, Middle Initial; ASC X12 Basic Character set] (AHIMA “Best practices”; NISTIR 7804-1).
- Use standard naming conventions, standard data format, standard data positions (AHIMA “Best practices”).
- Use an established standard for hyphenated names, prefixes, and suffixes (current last or family name and previous last or family names used in combination), allowing adequate space to document this information: Current variations include Sue Smith Jones, Sue Smith-Jones (hyphen), Sue Smith-Jones (en dash), Sue SmithJones (CAQH).
- Standardize the treatment of apostrophes: John O’Reilly, John OReilly.
- Use legal and not “common” names: for example, Robert, not Rob, Bob, Bobby, Robby.
- Use a standard convention for recording dates of birth: Jan 7, 2013 (e.g., current uses include MMDDYYYY; DDDMMYYYY; January 7, 2013), placing information in individual and distinct fields (see also Appendix C. Empirically Based Human Factors Guidance for Safety-Enhanced Design of Health Information Technology).
- Display information similarly across applications (e.g., headers, banners, wristbands); users should not be able to modify these standardized layouts.
- Use automated systems to detect typographical errors, misspellings, transposition of information.
- Develop policies and processes (e.g., standard placeholders) to avoid empty fields or fields with intentional false information, and determine whether standard “null” values are incorporated (e.g., 000-00-0000 for the Social Security number).
- Have a centralized registration process and standards for capturing specific information (SAFER).

Implementation strategies: Develop appropriate policies and procedures for attribute capture and continued use of data attributes (which attributes, the number of gathered attributes, the format of attributes). Identify whether and when to use standard null values. Conduct regular training and conduct retraining for those using unacceptable/inappropriate data elements. Conduct regular assessments, including monitoring (e.g., the number or percentage of records) and correct any and all records that are duplicates and/or overlaid.* Recognize that changes may require upgrades or technology development.

* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



Recommendation A-2: Use a confirmation process to help match the patient and the documentation.

Stakeholders impacted: Vendors, providers, provider organizations

- Select and verify standard attributes (e.g., Name, date of birth (DOB), medical record number (MRN), “years old” or YO, gender).
- Use initials, a photo, or entry of other identifying information as an active verification process (e.g., in a dialogue box that opens prior to confirming orders or that opens after periods of inactivity, or for resuming documentation after an interruption).
- Develop policies and procedures for the collection, use, entry, and reentry of confirmatory information.
- Monitor for appropriateness.

Purpose: A confirmatory step is necessary to facilitate a match between the patient and the documentation used throughout the encounter. In order to accomplish this, attributes such as a patient’s name and date of birth, initials, photo, or medical record number, when entered or viewed at various stages in the care process, provide an opportunity to confirm that the information being entered is for the correct individual. Incorrect entries jeopardize privacy, impacts care processes (leading to delayed or missed diagnoses), and can have devastating consequences in some circumstances. Confirmatory steps (e.g., viewing a photo and entering initials; or entering initials, gender, and provider info) are also useful in situations where multiple records are open at the same time and when the individual documenting must verify that he or she is in the correct location in the electronic system. Such verification processes are also helpful in high-risk scenarios. A dialogue box with confirmatory information aids in matching the record, report, order, or result with the appropriate individual while accounting for workplace distractions and a high-risk environment. The following are examples of implementations of this recommendation:

- Require at least two forms of identification at registration, such as a photo (preferably government issued) or a biometric marker, in combination with a knowledge-based identifier (“something you know”) (AHIMA).
- Assess the use and usability of an active verification process (e.g., provider dialogue boxes at key junctures requiring confirmation of patient initials or patient gender or similar information before any action can be continued), to help ensure that information, orders, prescriptions, therapies, evaluations, findings, and actions are directed to the correct record for the correct individual.
- Provide the capability to view a photo of the individual prior to entering an order or proceeding with an intervention or treatment or completing documentation.
- Require that the clinician enter a patient’s initials and additional identifier (e.g., gender) in a dialogue box prior to completing documentation or after an interruption. Once entered, this information allows the provider to proceed to task and enter information into the record, complete an order, or other task related to this identified individual. Other identifiers suggested for this validation process have included medical record number and date of birth, but these elements may be more difficult to obtain at the time they are needed and should be used with caution (AHIMA).

Implementation strategies: Develop policies and procedures for the collection, use, entry, and reentry of confirmatory information and evaluate usability issues related to these changes. Provide explanations, rationales, and appropriate training for those entering information into the medical record to achieve compliance.* Recognize that changes may require usability assessments, upgrades, or technology development.

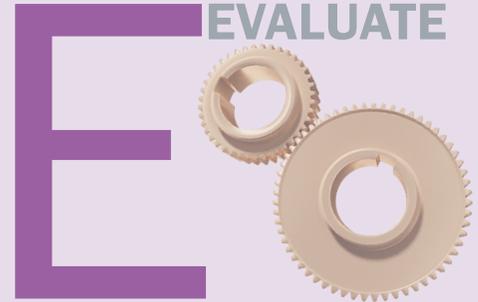
* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



Recommendation A-3: Use standard attributes and attribute formats in all transactions to improve matching.

Stakeholders impacted: Vendors, provider organizations (IT, registration)

- Develop and use a master patient index (MPI, EMPI), collect and record standard attributes, and evaluate, monitor, and correct any inaccuracies at regular intervals.
- Use techniques to match information by means of algorithms (i.e., probabilistic, deterministic, natural) capturing standard attributes and monitoring for overlays and duplicates.



Purpose: Standard attributes and attribute formats should be used in all transactions in order to improve patient matching. The lack of a standardized data set can lead to records not being linked to one another (AHIMA “Patient matching in health information exchanges”). “When EHR [electronic health record] systems are able to capture and store patient demographic elements in the same format, algorithms [are] able to match patient records consistently . . .” (AHIMA “Patient matching in health information exchanges”). Poor data integrity and data that are not standardized, are missing, or are outdated are inherent to incorrect identification and prohibit accurate matching. Matching patient information—whether dealing with a single self-contained organization, a single organization with multiple sites, or multiple organizations—or transmitting information for health information exchanges (HIEs) requires attention to the attributes collected. These attributes must be available, correctly documented, and derived from a reliable source (e.g., an MPI), and the techniques used to acquire, match, and link those attributes must be compatible. Standard attributes facilitate matching and validating procedures. Accurate matching of attributes should use the most sophisticated algorithms available. The following are examples of implementations of this recommendation:

- Develop an MPI with standard attributes (HIMSS “Patient identity integrity”) collected in a standard manner to facilitate accurate patient matching ([ONC Standards and Certification Regulations](#) October 6, 2015 and [ONC Standards and Certification Regulations](#), corrections and clarifications December 11, 2015).
- Collect information in the same format (ONC “Patient identification and matching”) and document in the appropriate individualized fields in order to facilitate linking.
- Enforce standard data collection practices, platforms, and management techniques (AHIMA).
- Attributes to collect in standard formats include current LAST/FAMILY NAME; previous LAST/FAMILY NAME; First/Given Legal Name; Middle Name or Middle Initial; suffix; date of birth (in this format: Jan 4, 2013); current address (street address, city, state, zip code); historical address (street address, city, state, zip code); current phone number (enter all XXX XXXXXXX); historical phone number; gender (M, F, O). AHIMA. See also IHE PIX (Patient Identifier Cross-Referencing Integration); ISO 8610 (International Organization for Standardization); Centers for Disease Control and Prevention race and ethnicity codes; Department of Labor/industry codes.
- Matching techniques can include matching of standardized data attributes or use of sophisticated machine-matching algorithms (deterministic, probabilistic, or natural). In order to appropriately use these techniques and tools, standardized, accurate, and complete information must be available and this information must then be linkable.
- Use advanced algorithms (see also AHIMA “Managing the integrity”; and see Appendix A. Definitions)—not basic or intermediate—to identify duplicate records (AHIMA).
- Monitor and correct for accuracy in the data at regular intervals, paying attention to overlays and duplicates and incorporating record-matching validating procedures on a routine basis (AHIMA).

Note: The workgroup did not provide any recommendations regarding development or use of a single national patient identifier, as other organizations are working on this project at present.

Implementation strategies: Develop appropriate policies and procedures for information capture, use, and verification. Conduct appropriate training of individuals capturing information that is later used in linking of attributes or in matching algorithms. Implement centralized registration processes using standardized attributes. Use the standard information from an MPI throughout all areas of identification.* (AHIMA) Recognize that changes may require upgrades or technology development.

* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



Recommendation A-4: Use a standard display of patient attributes across the various systems.

Stakeholders impacted: Vendors, provider organizations (IT, registration)

- Displays should be consistent, for example, LAST NAME, First Name, Middle Initial (if available), date of birth, “years old” or YO, medical record number.
- Consider the available space on wristbands, banners, headers, and displays.
- Inventory systems for consistent capture of information.
- Adopt a standardized protocol to verify a patient’s identity (include time-outs).

Purpose: To facilitate accurate identification, patients’ attributes should be displayed and represented in a standardized format across the various health IT systems. Initially, the focus can be within a healthcare organization, and as technologies are standardized, this can be incorporated across various organizations. The information should appear in the same format regardless of where the information is being displayed (e.g., on headers, wristbands, lists). This standardization allows those looking for identifiers to readily recognize and visualize them in any system. Human factors experts recommend that “information should be presented in consistent, predictable locations.” (NISTIR 7804-1, p. 42). Special circumstances that may limit the ability to display the standardized information (e.g., wristbands on a neonate) should be taken into consideration during standardization procedures. The following are examples of implementations of this recommendation:

- Always display a current photo as part of the patient identifier.
- Consistently display patient information in the same order: LAST NAME, First Name, Middle Initial (if available), date of birth in the format MMDDYYYY or MM/DD/YYYY, and age to enable users to readily recognize that information (NISTIR 7804-1).
- Use CDA R2 header formats (Clinical Document Architecture, release 2, became an HL7 and ANSI standard in 2005, and later became an ISO standard in 2009) to represent patient attributes (ONC “Patient identification and matching”).
- Display the information in the same location regardless of scrolling or other movements within the EHR (NISTIR 7804-1).
- Give consideration to the available space in areas such as wristbands, banners, headers, and various displays.
- Adopt protocols and procedures to verify a patient’s identification, being certain to incorporate time-outs.

Implementation strategies: Inventory systems to determine the ways that information is currently being displayed. Identify which attributes are presently used in the various systems and the formats in which they appear (Last Name, LAST NAME). Identify which systems allow these attributes or their appearance to be altered. Develop systems that consistently display information in the recommended format.* (AHIMA “Best practices”) Recognize that changes may require upgrades or technology development.

* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



TECHNOLOGY

Recommendation T-1: Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions.

Stakeholders impacted: Vendors, provider organizations

- Make information visually distinct on all systems by use of fonts, white space, shading, photos, and the incorporation of other identifiers such as age and gender.
- Include visual distinctions in areas where there are lists, by alternating shading or making distinctions visible by other means.



Purpose: In order to facilitate and improve patient identification, visual displays, including screens and printouts, should provide distinct visual clues. For example, the appearance of the attribute information (font, order, type of information), the use of white space (NISTIR 7804-1), the location of identifying information, and the incorporation of technology (e.g., photographs), in conjunction with attributes, can aid in distinguishing patients and improve identification. Visual distinctions in the display of information, such as changes in shading in patient lists and appearance of dropdown lists, along with the addition of technology such as photos in combination with those attribute identifiers, can facilitate accurate identification and selection. Photos are useful if they are current, clear, and distinguishable (e.g., no confusion between siblings, twins, or triplets). Inclusion of age or gender in addition to names and dates of birth can provide keys to facilitate proper patient identification. The following are examples of implementations of this recommendation:

- Always display a current color photo as part of the patient identifier.
- Incorporate distinguishing information on screens, printouts, and areas where interventions occur (e.g., placing/verifying orders).
- Visually differentiate information from information adjacent to it (SAFER).
- Employ white space, shading, or a line to distinguish information (NIST; see also Appendix C. Empirically Based Human Factors Guidance for Safety-Enhanced Design of Health Information Technology).

Implementation strategies: Complete an assessment of present capacities: Ask whether the system that is presently being used has the capacity to include photos in patient headers, on patient lists, and in dropdowns or when printing labels. When using photos, consider the recency of the photo, whether it is color or black and white, the photo size (which may impact the performance of older systems), the system's scanning capabilities (how photos are incorporated), and the ability to take photos or to have patients upload recent photos through portals. Identify ways to make the distinguishing information uniform in appearance and readily apparent. Create appropriate policies and procedures regarding the taking, use, incorporation, and updates of photos. Work with internal IT systems and with vendors to capture and transmit the information needed.* Recognize that changes may require upgrades or technology development.

* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



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INNOVATE

Recommendation T-2: Integrate new technologies to facilitate and enhance identification.

Stakeholders impacted: Vendors, provider organizations (IT, registration), providers

- Adopt and integrate new technologies once appropriately vetted.
- Utilize existing technologies (e.g., bar coding) to full capacity.
- Evaluate and weigh the use and cost of technologies (e.g., radio-frequency identification [RFID], biometric scanning) and the possible acceptance of the modality in order to select appropriate venues that can fully benefit from their use.

Purpose: New technologies (and new uses of existing technologies) should be evaluated and incorporated into patient identification processes. New technologies, once appropriately vetted and sufficiently mature, have the ability to facilitate accurate and timely identification. Moreover, the improved use of technology allows for matching of the patient with the correct treatment, diagnostic test, or other modality. Technology can also facilitate patient and record matching from any entry point. Some technologies are no longer new (e.g., bar coding) but have not yet been fully utilized. Bar coding is presently used in labs, blood product management, and medication identification, stocking, and administration. Opportunities to include bar coding in patient identification face challenges because of the size and area available for use in such things as wristbands. The integrity of the bar code and the amount of information that can be encoded also potentially limit the use of this technology. Other possible technologies (e.g., RFID) are expensive, but when used selectively (e.g., in blood banking) they have been shown to contribute to correct identification. Still other technologies such as vein (e.g., palm) and retinal scanning are still in their infancy. The incorporation of these technologies can mitigate the creation of overlays or duplicate records. As new technologies are tested and become more readily available, they may positively impact accurate patient identification. The following are examples of implementations of this recommendation:

- Investigate and incorporate technologies such as photos or other items to facilitate identification.
- Incorporate bar coding or RFID as appropriate for the setting and use.
- Incorporate biotechnologies as they become fully vetted and sufficiently mature (e.g., palm and retinal scanning).

Implementation strategies: Develop and revise appropriate policies and procedures. Assess and evaluate technical and workflow barriers and usability issues prior to adding any new technology. Recognize and mitigate the use of possible workarounds, or other implications created by the implementation of any new technology.* Recognize that changes may require upgrades or technology development.

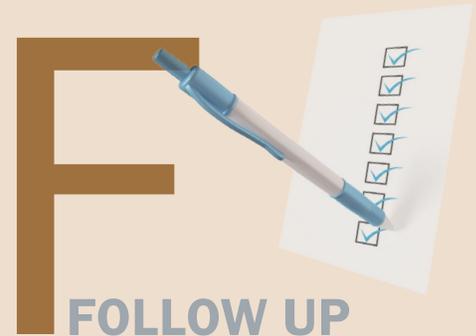
* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



Recommendation T-3: Implement monitoring systems to readily detect identification errors.

Stakeholders impacted: Provider organizations, vendors, providers, patients

- Use automated systems to detect inconsistencies, confirm identities, and reduce errors through both proactive and reactive monitors.
- Incorporate systems such as “check digits” or other technologies that verify identity, such as those that compare physical characteristics (e.g., comparison of organs in radiology).
- Develop protocols and processes for surveillance and measurement.



Purpose: Automated monitoring of current systems to detect errors in patient identification is yet another use of technology. In order to readily detect errors in identification before the errors are propagated, automated systems provide additional checks. These systems can detect inconsistencies, aid in confirming identities, and reduce error. Monitoring systems can include both proactive and reactive components, thus avoiding patient misidentification and preventing procedures from being performed on the wrong patient. Systems that “check digit(s),” identify similar or misspelled names, or compare physical characteristics (e.g., organs or organ size, as used in radiology) are just a few of the methods of detection that can then be used to propagate an alert that there is a discrepancy or a potential for error owing to similarities. To improve accurate matching, technology systems can be used to avoid duplication (e.g., alerting to similar names and sounds) and to alert staff to the potential for overlaid records. Better use of these technologies will facilitate correct identification and enhance data collection and integrity. The following are examples of implementations of this recommendation:

- Use advanced algorithms to identify duplicate records.
- Incorporate record-matching validating procedures on a routine basis (AHIMA).
- Incorporate Patient Identifier Cross-Referencing Integration (PIX, an IHE integration profile) (AHIMA) (see also: <http://www.openempi.org/confluence/pages/viewpage.action?pageId=2654507>).
- Incorporate Patient Data Query (PDQ, an IHE integration profile) (AHIMA) (see also: <http://www.openempi.org/confluence/pages/viewpage.action?pageId=2654507>).
- Incorporate Patient Administration Management (PAM) integration profiles (AHIMA “Managing the integrity”).
- Routinely monitor and correct duplicate patient records.
- Routinely monitor the percentage of incorrect patient identification alerts.
- Incorporate tools and advanced algorithms to account for data entry errors (e.g., edit distance calculations, frequency indexing) (ONC “Patient identification and matching”).

Implementation strategies: Use attribute algorithms and monitoring systems as appropriate. Develop protocols and processes for organization surveillance, monitoring, and measuring of the frequency of errors (e.g., duplicate record rates, incorrect identification in result reporting). Measure the improvements seen when effectively using such technologies. Also measure and monitor whether such technologies fail to identify irregularities.* Recognize that changes may require upgrades or technology development.

* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



Recommendation T-4: Include high-specificity active alerts and notifications to facilitate proper identification.

Stakeholders impacted: Vendors, provider organizations (IT, registration), providers

- Use actionable alerts when users attempt to create a new record for an individual who has a current record.
- Actively alert users when they attempt to select an incorrect individual (similar name, sound-alike name, nickname), when they enter a name that may contain errors (typos, transpositions, misspellings), or when information is missing.

Purpose: High-specificity alerts and notifications are yet another use of technology for facilitating accurate patient identification.

Actionable alerts can inform users when they (1) attempt to create a new record for an individual who has a current record; (2) select an incorrect individual, such as someone who has a name similar to or variant of the patient's name (e.g., nickname file, Soundex); or (3) enter a name that may contain typos, transpositions, or misspellings. As with other alerts, those receiving the alert or notification must take action in order for the alert to be effective. Monitoring how these alerts are used and providing direct feedback will improve the use of this technology. The following are examples of implementations of this recommendation:

- Incorporate actionable alerts that present when users attempt to create a new record for an individual who has a current record.
- Alert users when they access the record of an individual who has a similar name, sound-alike name, or nickname (e.g., nickname file, Soundex).
- Incorporate alerts to detect errors in fields, including typographical errors, transpositions, and misspellings.
- Alert users when required information is missing.

Implementation strategies: Identify the current rates of duplicate record creation and identification errors, and monitor how alerts impact these rates. Develop actionable alerts so that those receiving the alerts perform specific actions when they receive them. Monitor rates of alerts, measure effectiveness of alerts, and avoid creating additional "alert fatigue." Provide education and training regarding the actions to be taken upon receipt of alerts.* Recognize that changes may require upgrades or technology development.

* While policies, procedures, and training are often a crucial first step in implementation, additional efforts may be required to recognize the value of the recommendations.



INCLUDE

Electronic fields containing patient identification data should consistently use standard identifier conventions.

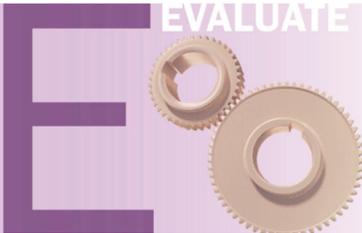
- Rationale: To promote patient safety, avoid duplicate record creation, keep information from appearing in the wrong record, and facilitate matching and interoperability, the fields containing patient identification data should consistently use standard identifier conventions to capture information using the greatest level of granularity.



DETECT EVALUATE

Use a confirmation process to help match the patient and the documentation.

- Rationale: A confirmatory step is necessary to facilitate a match between the patient and the documentation used throughout the encounter. Attributes such as a patient's name and date of birth, initials, photo, or medical record number, when entered and/or viewed at various stages in the care process, can provide an opportunity to confirm that the information being entered is for the correct individual.



Use standard attributes and attribute formats in all transactions to improve matching.

- Rationale: The use of standard attributes and attribute formats should be part of all transactions in order to improve patient matching. Patient demographic elements should be captured and stored in the same format. The lack of a standard data set can lead to records not being correctly linked to one another, impeding proper identification.



NORMALIZE

Use a standard display of patient attributes across the various systems.

- Rationale: For accurate identification, the patient's attributes should be displayed and represented in a standard format across the various health IT systems. The information should appear in the same format regardless of where the information is being displayed (e.g., on headers, wristbands, lists) throughout an organization or across organizations.



TAILOR

Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions.

- Rationale: Visual displays, including screens and printouts, should provide distinct clues. The appearance of the attribute information (font, order, type of information), the use of white space, the location of identifying information, and the incorporation of technology (e.g., photographs), in conjunction with attributes, can aid in distinguishing patients and improve identification.



INNOVATE

Integrate new technologies to facilitate and enhance identification.

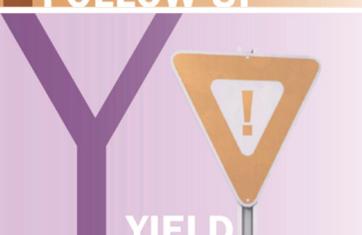
- Rationale: New technologies and new uses of technology should be evaluated and incorporated into patient identification processes. New technologies, once appropriately vetted and sufficiently mature, can facilitate accurate and timely identification. The improved use of technology facilitates matching of the appropriate patient with the correct treatment, diagnostic, or other modality.



FOLLOW UP

Implement monitoring systems to readily detect identification errors.

- Rationale: Automated monitoring of current systems, whether used to detect errors in patient identification before they are propagated (proactive) or to provide additional checks, detect inconsistencies, and aid in confirming identity (reactive), can prevent duplication and record overlay.



YIELD

Include high-specificity active alerts and notifications to facilitate proper identification.

- Rationale: Highly specific alerts and notifications can be used to alert users when they attempt to create a new record for an individual who has a current record, select an incorrect individual, or enter a name that may contain typos, transpositions, or misspellings. Monitoring how alerts are used and providing direct feedback will improve proper identification.



DISCUSSION

Correct identification through catching and matching is accomplished using both human functions, via the collection of attributes (e.g., soliciting and validating information, visual inspection), and technological means, by using those attribute components to complete the identification process (e.g., algorithms for matching or recognition) (see also Australian Commission; ONC “Patient identification and matching”). The processes of catching and matching occur at all of the points along the Patient Identification Process Map (Figure 4) and involve all stakeholders, including the patients themselves. Display of this information also impacts and

contributes to proper identification, therefore necessitating attention to catching, matching, and display.

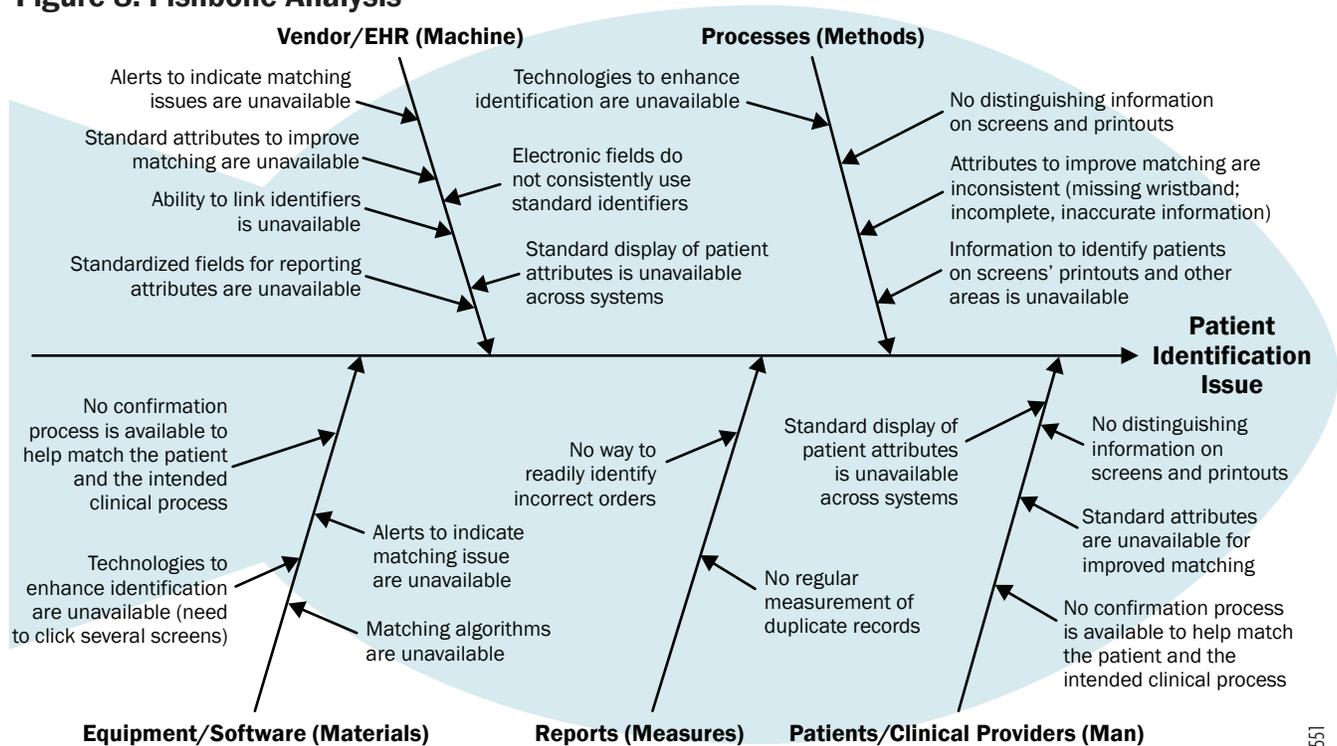
Using the SAFER guide for patient identification is one way to evaluate where misidentification breakdowns occur. Another way is to use an assessment tool such as the fishbone diagram (see Figure 8). A fishbone analysis looks at five main areas: machine, methods, materials, measures, and man. Breakdowns resulting in patient misidentification related to each of these areas are illustrated in Figure 8. What becomes readily apparent is that there is no one single area for targeted improvement. Identification issues are multifaceted and changes are implicated in all of these areas.

Additionally, recommendations in any of these areas may take time to implement as new technologies are developed and legacy systems are eventually retired.

Addressing the issues.

Recommendations for the use of standard procedures (e.g., asking for and checking two identifiers) have addressed “catching” and have improved identification issues to a limited extent. The development of routine processes (e.g., the use of wristbands) was also aimed at improving patient identification, in this example by improving “matching.” However, these interventions are still inadequate. They do not fully take advantage of, or completely utilize, the available technology.

Figure 8. Fishbone Analysis



EHR, electronic health record.

MST16551



One solution is to improve the amount and type of data collected (see **Table 7** [ONC “Patient identification and matching”]). When data are collected and confirmed using the suggested quality levels, not only “catching” but also “matching” techniques using those same attributes are improved. Suggestions for improvements in collecting attribute information appear in **Table 8** (ONC “Patient identification and matching”).

In 2014, AHIMA recommended practices and processes to ensure proper patient identification. These recommendations incorporate technology but also focus on other facets of improving identification. See Recommended Practices and

Processes (AHIMA “Managing the integrity”).

NIST (NISTIR 7804-1) has also provided specific usability guidance for patient identification (see Appendix C. Empirically Based Human Factors Guidance for Safety-Enhanced Design of Health Information Technology). In 2016, The National Quality Forum published a report entitled “Identification and Prioritization of HIT Patient Safety Measures” recommending essential measures to improve patient identification (NQF). To fully examine these issues, how the data are, or will be, exchanged, discovered, and retrieved must also be considered (IHE). These findings were evaluated

and incorporated into the process of drafting recommendations.

The development and availability of improved algorithms, the use of photos, bar coding, and RFID, and the introduction of various biometric identifiers have all improved both “catching” and “matching.” Moreover, the increased sharing of information through HIEs has bolstered discussions around patient identification practices. Discussions have also intensified regarding a single standard identifier. Each of the suggested interventions may be beneficial but each also has limitations (see **Table 9**) (see also Australian Commission). Building, improving, and implementing systems to ensure correct interventions in the

Table 7. Attributes—Catching

Item	Level 1	Level 2	Level 3	Level 4	Level 5
Data attribute	Given Name* Last Name* Date of birth* Gender* Middle Initial Suffix** Race Primary Phone number* Address* Street* State* Zip code*	Middle Name Mother’s Maiden Name Prefix** Marital status**	Alias or previous Name USPS address** Identifier Last 4 digits of Social Security number* Driver’s license Passport Alien ID number	Multiple birth** Birth order** Birth place E-mail address* Previous address** Previous cell phone number(s)** Quality assurance process**	Insurance* ID/policy* Insurance plan Name** Previous insurance Medicaid ID Medicare ID Biometric ID*
Supporting process	—	—	Daily reconciliation	Quality assurance process	—
Required reporting	Confirm percent captured	—	—	—	—

* In the proposed rule.
** Require structured data capture.

Source: Office of the National Coordinator of Health Information Technology. Guidelines for pilot testing of data management maturitysm model for individual data matching. 2015 Sep 28 [cited]. <https://www.healthit.gov/sites/default/files/pilottestingpm.pdf>



RECOMMENDED PRACTICES AND PROCESSES (AHIMA)

Require at least two forms of identification at registration; identification with a photo and preferably government issued, a biometric marker in combination with a knowledge-based identifier.

- Use of standard naming conventions, search methodologies, training and retraining programs
- Use and enforcement of standard data collection practices, platforms, and management techniques
 - Standard data format
 - Standard data positions
 - Consistent completion of HL7 Patient Identification (PID) segments
 - Implementation of use components of HL7 Patient Identification
 - Upgrading, using, and incorporating the newest version of HL7 Standards (vendors and providers)
 - Incorporate Patient Identifier Cross Referencing Integration (PIX)
 - Incorporate Patient Data Query (PAQ)
 - Incorporate Patient Administration Management (PAM) integration profiles
 - Incorporate record-matching validating procedures on a routine basis
 - Use advanced¹ (not basic² or intermediate³) algorithms to identify duplicate records
 - Maintain data integrity within and across systems
 - Implement policies and procedures to address data storage and data/information governance

¹ “Advanced algorithms contain the most sophisticated set of tools for matching records and rely on mathematical theory.” “The core intelligence within advanced algorithms can include bipartite graph theory, probability theory, mathematical and statistical models, and machine learning, which are applied to determine the likelihood or probability of a match on specified data elements.” “Probabilistic matching uses the frequency of specific demographic data elements with an objective probability score assigned to each to adjust the relative value of the match or mismatch for the specified elements.” “Advanced algorithms can also include machine learning such as natural language processing and neural networks, which use forms of artificial intelligence that simulate human problem solving.” (AHIMA “Managing the Integrity”)

² “Basic algorithms are the simplest technique for matching records and this approach is used by most healthcare information systems today. Comparisons are made on selected data elements—usually the name, date of birth, [Social Security number], and sometimes gender. Exact match and deterministic algorithms are both basic matching tools. With exact matching, the data elements used to search must match exactly with those in the database in order to return a particular record. Deterministic matching is slightly more sophisticated; in addition to exact matches, partial matches may be used to return a record.” (AHIMA “Managing the Integrity”)

³ “Intermediate algorithms use more advanced techniques to compare records. Fuzzy logic, nickname tables, phonetic encoding and arbitrary or subjective scoring systems are added to exact match and deterministic tools. A field match weight is subjectively assigned to key patient identifying attributes such as last name, first name, date of birth, and [Social Security number] . . . Records presented to the searcher must reach a minimum cumulative scoring threshold to qualify for inclusion. Fuzzy logic and rules-based algorithms also may be a component of intermediate algorithms. These tools may utilize nickname tables, rules to address transposition of characters or names, digit rotations, and typographical errors within the [master patient index] database. Phonetic encoding is typically utilized in intermediate algorithms. These encoding systems, such as Soundex, the New York State Identification and Intelligence System (NYSIIS), or single, double, or triple metaphone, attempt to identify records with similar sounding names . . . Intermediate algorithms may include a limited automated frequency adjustment. This adjustment will decrease the score assigned to a field match across two records if the actual field value (such as a common last name or a common date of birth like 01/01/2001) is computed to be present in a high volume of records in that data set. (AHIMA “Managing the Integrity”)

**Table 8. Recommendations for Data Attributes for Transactions and Ways to Improve Those Attributes**

Data Attribute	Strategy for Improvement
First/given name	(1) Improve data consistency and normalize data
Current last/family name	(1) Improve data consistency and normalize data (2) Follow the CAQH Core 258: Eligibility and Benefits 270/271, Normalizing Patient Last Name Rule, version 2.1.0 (addresses whether suffix is included in the last name field)
Previous last/family name	(1) Improve data consistency and normalize data (2) Follow the CAQH Core 258: Eligibility and Benefits 270/271, Normalizing Patient Last Name Rule, version 2.1.0 (addresses whether suffix is included in the last name field)
Middle/second given name (includes middle initial)	(1) Improve data consistency and normalize data
Suffix	(1) Improve data consistency and normalize data (2) Suffix should follow the CAQH Core 258: Eligibility and Benefits 270/271, Normalizing Patient Last Name Rule, version 2.1.0 (JR, SR, I, II, III, IV, V, RN, MD, PHD, ESQ) (3) If no suffix exists, should be null
Date of birth	(1) YYYYMMDDHHMMSS (2) If HHMMSS is not available, the value should be null (3) Precise year, month, and day are required
Current address (street address, city, state, zip code)	(1) Evaluate the use of an international or USPS format
Historical address (street address, city, state, zip code)	(1) Evaluate the use of an international or USPS format (2) If unavailable, the value should be null
Current phone number (if more than one is present in the patient record, all should be sent)	(1) Utilize an ISO format that allows for the capture of country code (2) Allow for capture of cell, home, and work phone numbers
Historical phone number	(1) Utilize an ISO format that allows for the capture of country code (2) Allow for capture of cell, home, and work phone numbers
Gender	(1) ValueSet Administrative Gender (HL7 V3): M, F, UN

Source: Morris G, Farnum G, Afzal S, Robinson C, Greene J, Coughlin C. Patient identification and matching: final report. 2014 Feb 7 [cited 2015 Nov 6]. https://www.healthit.gov/sites/default/files/patient_identification_matching_final_report.pdf

appropriate settings will require collaboration among all stakeholders. The first step, however, is identifying and building a foundation. The proffered recommendations are a first step on focus on maximizing and utilizing the capabilities of health IT in catching, matching, and display.

Whether HIT-based patient identification entails the incorporation of RFID or biometrics or the creation of a single patient identifier, correct identification depends first on

standardization of the form and format of data collected (the attributes). This is also necessary for the correct exchange of information within organizations and between providers. The workgroup recognized that any recommendations proffered would encounter potential barriers, and we considered these barriers in proposing these safe practice recommendations (Table 10). However, once standardized attributes are determined, technology can then

be used to facilitate identification through various forms of matching.

To effectively implement the safe practice recommendations, however, additional clarifications may still be needed (see recommendations: IDENTIFY—Safe Use of Health IT for Patient Identification). For instance, certain technologies may be unavailable because legacy systems remain in place, accommodating the recommendations may require further technological developments, or

**Table 9. Risks and Benefits of Various Patient Identification Modalities***

Modality	Risks	Benefits
Wristbands	<ul style="list-style-type: none"> • Not universally used (outpatient settings, long-term care) • Patient refusal • Easy to remove • May be illegible when space is limited • Difficult to apply in some situations (neonates) 	<ul style="list-style-type: none"> • Inexpensive • Portable • Frequently accepted • Usually legible
Bar coding*	<ul style="list-style-type: none"> • Limited information encoded • Need appropriate line of sight (reading on curved wrist is difficult) • Workarounds (scanning bar code from list) • Requires reader; not readable by staff, patients, relatives • Bar code may bleed if wet, damaged • Limited by battery life of reader 	<ul style="list-style-type: none"> • Can be attached to other modalities (wristbands, labels) • Inexpensive • Quick • Easy to copy and print • Applicable in multiple settings (pharmacy, patient care)
Radio-frequency identification	<ul style="list-style-type: none"> • Expensive • Limited storage capacity • Interference with other radio frequencies • Short-range data transfer • Difficult to edit or change information • No absolute unique identification • Limited by battery life of reader 	<ul style="list-style-type: none"> • Can provide a unique ID • Can link information to other sources • Allows for tracking • Tags can be reused
Biometric devices	<ul style="list-style-type: none"> • General resistance to acceptance because seen as intrusive • Expensive • Privacy, consent, and information collection concerns • Cumbersome • Age or physical restrictions • Additional training may be required • Need to repeat at select intervals • Must still link biometric and historical data • May be difficult to coordinate with older electronic health record systems • Inability to recognize digital identities 	<ul style="list-style-type: none"> • Quick • Accurate • Noninvasive • For some technologies, minimal training needed • Ability to link information
Photos	<ul style="list-style-type: none"> • General resistance to acceptance • Need to repeat periodically • Not helpful for neonates/infants • Clarity of image may be inadequate 	<ul style="list-style-type: none"> • Quick • Inexpensive • Rapid capture
National identifier	<ul style="list-style-type: none"> • General resistance to acceptance • Need to gather information prior to assigning • Security • Useful in limited settings 	<ul style="list-style-type: none"> • Ability to link patients to documentation and procedures • Helpful in information exchange

* See also Australian Commission on Safety and Quality in Healthcare. Technology solutions to patient misidentification: report of review—final. 2008 Oct [cited 2016 Aug 11]. <http://www.safetyandquality.gov.au/wp-content/uploads/2012/01/19794-TechnologyReview1.pdf>

6th International Organization for Standardization, the Food and Drug Administration, and others provide standards for bar codes and other modalities (e.g., magnetic strips). See: https://ansi.org/news_publications/news_story.aspx?menuid=&articleid=e7ac0a3e-5fe8-4c49-b553-f2a731643516 and https://www.ansi.org/news_publications/news_story.aspx?menuid=7&articleid=1941ae68-7307-4738-a066-a2a036213e8a. As technology is changing the way information is collected, the need to standardize continues. See also: https://share.ansi.org/Shared%20Documents/News%20and%20Publications/Links%20Within%20Stories/2013Biotechnology+Standards_ConferenceSummary.pdf



Table 10. Barriers in Incorporating Recommendations on Attributes and Technology

Barrier	Means of Addressing
Organization's culture	Establish a strong safety culture from leadership to staff, and emphasize the goals to patients and their families
Expense	Identify potential alternatives and ways to centralize
Technology interactions	Identify obstructions to effective use and availability of technologies (low batteries, connectivity, interference, interoperability)
Processes currently available	Confirm processes, workflows, training, and technologies currently in place; revise appropriately and monitor for effectiveness
Regulations	Privacy and security regulations
General acceptance	Staff training, patient education to facilitate acceptance of procedures and processes for obtaining information

funding for improvements may be limited. However, in order to fully implement and then monitor the success of the recommendations, all stakeholders will need to work collaboratively.

CONCLUSION

Accurate patient identification is essential for the provision of timely, safe care. We have seen that patient identification errors are common and that they occur in multiple clinical care areas and in the exchange

of information within and between networks. The causes of misidentification errors are multifactorial, as are the solutions. The workgroup initially identified several goals when examining patient identification issues, chief among them clarifying the role health IT may play in either contributing to or helping to prevent patient identification failures. The workgroup examined the settings and stages where misidentification most often occurs and then evaluated ways to best address technology complications and solutions.

While new technologies may be on the horizon, it is important to harness the existing capabilities of health IT to improve patient identification. Misidentification is clearly not a product of health IT; providers struggled with problems related to patient identification well before these systems were implemented. Solutions to proper, accurate, consistent, and timely identification should seize upon and incorporate health IT and utilize it to focus attention on structured patient attributes and the greater use of technology.



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RESOURCE LIST

American Health Information Management Association (AHIMA):

- [Information governance](#)
- [Losing the match game: study reveals gaps in HIM's patient identity integrity practices](#) [Dooling JA, Fernandes LM, Kirby A, Kadlec L, Landsbach G, Lusk K, Munns M, Noreen N, O'Connor M. J AHIMA 2016 Oct;87(10):39-47]
- [Patient identity integrity toolkit](#)
- [Patient matching problems routine in healthcare](#)
- [Quality data starts with us](#)

Healthcare Information and Management Systems Society (HIMSS):

- [Patient identity integrity toolkit: glossary](#)
- [Vendor questions for master patient index](#)

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Office of the National Coordinator for Health Information Technology (ONC):

- [Patient identification and matching: final report](#)

The Sequoia Project

- [A framework for cross-organizational patient identity management](#)



Toolkit Materials

Leadership Tool: Evaluating Safety in Patient Identification

Evaluating Safety in Patient Identification

	Incorporated in Operations	Routinely Assess and Evaluate	Not Presently a Consideration
Develop the business case for proper patient identification within your organization			
Recognize the patient safety implications and costs associated with misidentification			
Identify and obtain the support of the key stakeholders from all areas where patients are registered			
Identify and monitor identification errors and the resulting consequences			
Identify educational opportunities for leaders, staff, and patients in order to improve patient identification			
Assess the present use and availability of technologies that could enhance patient identification			
Facilitate procedures for interruptions in technology or its availability			
Support the adoption and inclusion of technology that will facilitate identification and matching			
Provide funding and resources needed to evaluate and upgrade technologies and processes to improve identification practices and strategies			
Develop a process measure for each step and intervention planned for improving patient identification			
Review measures regularly and assign appropriate actions			



Self-Assessment Checklist

PATIENT IDENTIFICATION RECOMMENDATION CHECKLIST

	This has been Implemented	In the Process of Implementing	Discussed and Considered but not Implemented	No Plan to Implement
For provider organizations				
Have you identified all personnel who presently enter patient identification data into the system?				
Have those who enter patient identification data into the system been adequately trained and are they regularly retrained?				
Are standard procedures and fields available for collecting a particular set of attributes to facilitate identification?				
Can aliases or nicknames be accommodated during registration?*				
Are standard fields available for attribute collection across various systems and departments?				
Do you currently have standards for attribute collection?*				
Are patients involved in validating their data?				
Does your organization have a master patient index?*				
Is there appropriate space available to completely and accurately convey the identification information?				
Do you consistently manage special characters (e.g., hyphens)?*				
Can demographic data be modified outside of the registration/admission process?*				
Are routine monitoring and feedback provided to those entering patient identification data into the system?				
Are alerts available in order to identify potential duplicate records during the registration process?*				
Are alerts available in order to identify potential errors, transpositions, or name similarities during the registration process?				
Does the available search function identify records with a partial name, a similar-sounding name, a partial record number or a partial encounter number, date of birth, or other attribute combinations?*				
Does your organization have an embedded algorithm to identify duplicate accounts?*				
Is there an ability to merge two records for the same person?*				
Can records be unmerged if they are incorrectly linked?*				
Are alerts available when changes have been made to demographic information?*				
Are data standards established and followed?				
Are processes available for evaluating new technologies prior to implementation?				

* Questions based on HIMSS (“Patient identity integrity”) evaluation questions.



Self-Assessment Checklist (continued)

	This has been Implemented	In the Process of Implementing	Discussed and Considered but not Implemented	No Plan to Implement
Are new technologies to enhance identification considered and implemented?				
Do monitoring and follow-up occur after new identification technologies have been implemented?				
Are photos available or incorporated in electronic documentation?				
Are photos included on wristbands?				
Are alternative procedures available when identification technologies fail?				
For clinical providers				
Are clinical staff trained in the patient safety implications of improper identification?				
Are patients involved in validating their data?				
Are clinical staff aware of the appropriate naming conventions for yet-unnamed newborns and unidentified individuals?				
Are clinical staff trained in the proper use of patient identification technologies?				
Are photos available and visible when orders are being entered?				
Do all staff check patient identifiers?				
Are pop-up windows available and used as a secondary check to match the correct intervention to the correct individual?				
Are dialogue boxes available and used to confirm identifiers (e.g., patient initials and gender) prior to proceeding after screens have been inactive?				
Are identifiers displayed in the same manner throughout (e.g., screens, printouts, order forms)?				
Are providers alerted when there is the potential for incorrect selections based on identification? (e.g., similar name alert)				
Are systems configured such that providers cannot modify the established layout of patient identification information?				
Are staff aware of and consulted prior to the implementation of new identification technologies?				
For vendors				
Are there standards for patient identification?				
Are standard definitions conveyed to organizations implementing and utilizing products?				
Is a standard data set available for the collection of patient demographic information?				
Are there visual distinctions (e.g., alternate line shading, color differences) when identification information is displayed?				



Self-Assessment Checklist (continued)

	This has been Implemented	In the Process of Implementing	Discussed and Considered but not Implemented	No Plan to Implement
Is appropriate space available to completely and accurately convey the identification information?				
Are appropriate fields available to accommodate the collection of data attributes?				
Is there the opportunity to test patient identification standards within the organization's environment?				
Are advanced algorithms available for patient identification?				
Are alerts available when duplicate information is entered?				
Are alerts available to inform users about missing or incorrect information?				
Can alerts be monitored to identify what alerts are ignored or bypassed?				
Are methods available to address and correct errors in timely fashion?				
Can duplicate records be appropriately merged?				
Is it possible to separate overlaid records?				
Are data elements defined?				
Are there standard definitions for algorithms?				
Are record-matching requirements defined?				
Is the performance of matching algorithms measurable and monitored?				
Are duplicate record rate calculators available?				
Are alternatives to matching algorithms in development?				
Is a measure available to detect and monitor potential duplicate records?				
Is a measure available to detect and monitor record overlay?				



Recommendation and Implementation Action Benefits and Considerations Tool

Benefits of Safe Practice Recommendations	Considerations for Safe Practice Recommendations
<ul style="list-style-type: none"> • Contribute to patient safety • Mitigate misidentifications • Decrease duplicate records • Facilitate information exchange • More fully use existing technology 	<ul style="list-style-type: none"> • May not be implementation-ready at present or within a precise time frame • Some individual electronic health records (EHRs), depending on unique design or configuration properties, may not be able to address specific recommendations • Additional work may be needed to achieve stakeholder consensus • Innovative changes in provider workflow may be required • Innovative support from EHR developers may be needed

Attributes

(I) A-1: Electronic fields containing patient identification data should consistently use standard identifier conventions.

Benefits	Considerations
<ul style="list-style-type: none"> • Normalize and structure data to facilitate data capture and matching • Uniform data collection • Standard conventions 	<ul style="list-style-type: none"> • Requires development of stakeholder consensus around conventions • Will require “cleanup” of existing information within records • May need to identify a point in time to initiate new practices

(D) A-2: Use a confirmation process to help match the patient and the documentation.

Benefits	Considerations
<ul style="list-style-type: none"> • Facilitate correct identification in documentation processes • Aid in addressing disruptions during work activities 	<ul style="list-style-type: none"> • Development of provider consensus around workflows will be necessary before EHR developers can innovate with workflow support • May necessitate the use of application intelligence to catch the use of incorrect initials • May require additional “clicks,” impacting usability; innovative approaches required to address • More evidence required to balance safeguards versus workflow disruption

(E) A-3: Use standard attributes and attribute formats in all transactions to improve matching.

Benefits	Considerations
<ul style="list-style-type: none"> • Standard information identified and collected • Facilitates matching • Assists with data exchange 	<ul style="list-style-type: none"> • May require the capture of additional consent for using and taking photos

**(N) A-4: Use a standard display of patient attributes across the various systems.**

Benefits	Considerations
<ul style="list-style-type: none"> Facilitates workflow by making information similarly visible Predictability 	<ul style="list-style-type: none"> May need evaluation of intra- and extra-enterprise display standards Changes in information displays may require modifications to the technology Some items may inhibit standardized material display (e.g., wristbands)

Technology**(T) T-1: Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions.**

Benefits	Considerations
<ul style="list-style-type: none"> Provision of visual clues 	<ul style="list-style-type: none"> Information may be more difficult to incorporate into lists and dropdowns Technology interoperability Reproducibility and acceptance Legacy systems

(I) T-2: Integrate new technologies to facilitate and enhance identification.

Benefits	Considerations
<ul style="list-style-type: none"> Reduce duplicate records and increase the accuracy of patient matching Improve safety 	<ul style="list-style-type: none"> Additional costs potentially associated with the use of new technologies Interoperability with legacy systems Determining when new technologies are appropriate to incorporate

(F) T-3: Implement monitoring systems to readily detect identification errors.

Benefits	Considerations
<ul style="list-style-type: none"> Readily detect errors Provide an opportunity for more immediate corrections Can be both proactive and reactive 	<ul style="list-style-type: none"> Interoperability Legacy systems May be disruptive to workflow and therefore overridden without appropriate attention

(Y) T-4: Include high-specificity active alerts and notifications to facilitate proper identification.

Benefits	Considerations
<ul style="list-style-type: none"> Inform user for more immediate interventions Facilitate proper selection and identification 	<ul style="list-style-type: none"> Significant research, innovation, and development may be required to effectively provide monitors and alerts May impact workflow or EHR usability, or result in alert fatigue Will require vendor assistance



Educational Materials

PATIENT IDENTIFICATION TRAINING CHECKLIST: A FOCUS ON ATTRIBUTES AND TECHNOLOGY

Attributes. Recommendations surrounding attributes address the information-gathering aspects of patient identification, including the fields and the formats that are available to accommodate acquisition of the information used to identify individuals.

Technology. Recommendations involving technology address new technologies to improve identification and also leverage ways to better utilize existing technologies for safe patient identification.

- Conduct patient identification training for all staff and retrain regularly (e.g., yearly competencies).
- Identify the attributes that must be collected and define how to collect and use those attributes throughout the care process for identification validation.
- Familiarize staff with the use and incorporation of other identifiers, including photos (scanning driver's licenses, taking registration photos) and biometric identifiers (retinal or palm scans, fingerprints) to improve identification.
- Identify all individuals who need to complete training and continuing education, tailoring modules as needed to the areas of care.
- Identify policies and protocols that must be followed surrounding patient identification (see "Recommended Policies and Procedures").
- Ensure that staff engage patients in patient identification practices (obtaining and validating attributes, explaining the use of biometric identifiers).
- Ensure that staff in need of remediation receive the appropriate instruction to address any deficiencies.



Safe Practice Recommendations for the Use of Health IT in Patient Identification

PARTNERSHIP for HEALTH IT PATIENT SAFETY
Making healthcare safer together

PARTNERSHIP for HEALTH IT PATIENT SAFETY
Making healthcare safer together

JAYNE KOSKINAS TED GIOVANIS Foundation for Health and Policy

GORDON AND BETTY MOORE ECRI Institute
FOUNDATION The Discipline of Science. The Integrity of Independence.

Misidentifications: Why Is Health Information Technology (IT)'s Role in Patient Identification Important?

- ▶ *A worker scanned the wrong patient ID when entering a pregnancy test. The pregnancy test result was entered on a male patient.*



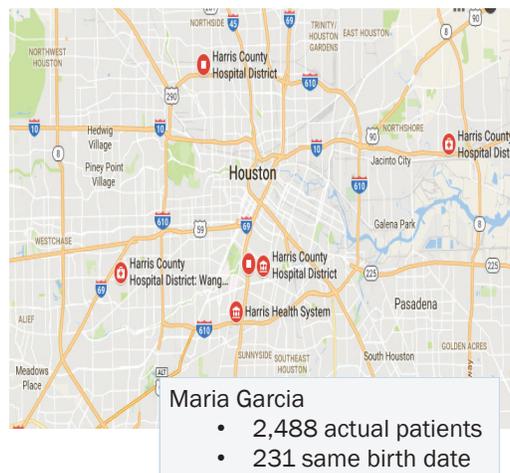
Misidentifications: Why Is Health IT's Role in Patient Identification Important?

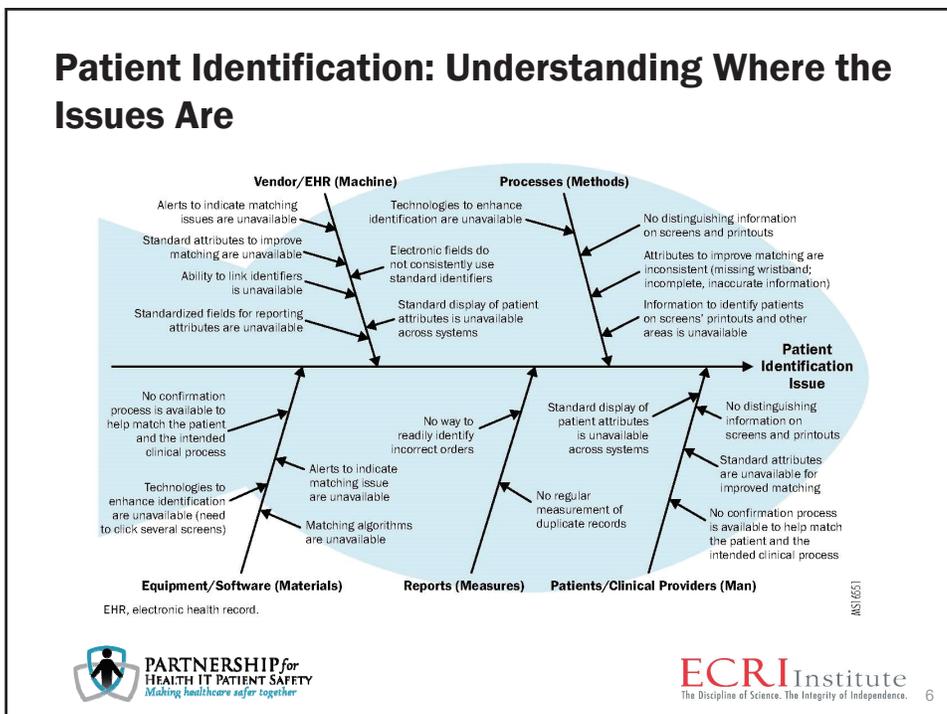
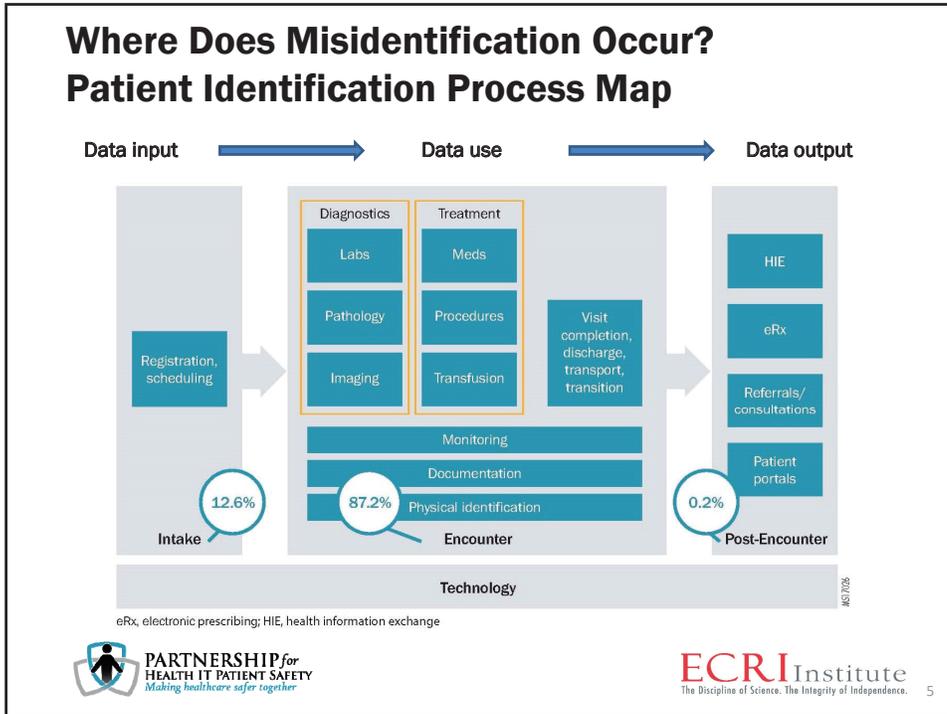
- ▶ *The surgical history appearing on a magnetic resonance imaging (MRI) form did not match the pediatric patient's chart. The MRI technician questioned the parent about whether the child had a history of cardiac procedures. The parent stated that the child had not undergone cardiac surgery, but that his uncle, who had the same name, had a cardiac surgery history.*



News Reporting: Overlaps in Identification

- ▶ *There are 3,428,925 patients in the database of the Harris County Hospital district in Houston, TX*
- ▶ *Two or more patients share the same last and first names 249,213 times*
- ▶ *There are 2,488 patients named Maria Garcia*
- ▶ *231 of those Maria Garcias share the same birth date*







Goals for Improving Patient Identification Using Health IT

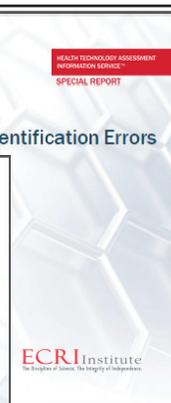
- ▶ Establish standard identifiers and collection methods
- ▶ Maintain identification consistently throughout all phases of the process map and at every intervention (treatment, medication, procedure)
- ▶ Use technology to assist in identifying each patient in a unique and unambiguous manner
- ▶ Appropriately link documentation, consultations, medications, procedures to the correct patient
- ▶ Routinely monitor and audit



Patient Identification



Patient Identification Errors





Triple-Aim Approach to Improving Patient Identification: Catching, Matching, and Display



CATCHING

Accurate information gathering—*catching*



MATCHING

Facilitation of accurate information—*matching*



DISPLAY

Display of information to enhance patient identification

Recommendations

Attributes:

- I** A-1 Electronic fields containing patient identification data should consistently use standard identifier conventions.
- D** A-2 Use a confirmation process to help match the patient and the documentation.
- E** A-3 Use standard attributes and attribute formats in all transactions to improve matching.
- N** A-4 Use a standard display of patient attributes across the various systems.

Technology:

- T** T-1 Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions.
- I** T-2 Integrate new technologies to facilitate and enhance identification.
- F** T-3 Implement monitoring systems to readily detect identification errors.
- Y** T-4 Include high-specificity active alerts and notifications to facilitate proper identification.



Electronic fields containing patient identification data should consistently use standard identifier conventions.



INCLUDE

Rationale:

- ▶ To promote patient safety, avoid duplicate record creation, keep information from appearing in the wrong record, and facilitate matching and interoperability.
- ▶ The fields containing patient identification data should consistently use standard identifier conventions to capture information using the greatest level of granularity.



Use a confirmation process to help match the patient and the documentation.



DETECT

Rationale:

- ▶ A confirmatory step is necessary to facilitate a match between the patient and the documentation used throughout the encounter.
- ▶ Attributes such as a patient's name and date of birth, initials, photo, or medical record number, when entered and/or viewed at various stages in the care process, can provide an opportunity to confirm that the information being entered is for the correct individual.





Use standard attributes and attribute formats in all transactions to improve matching.



Rationale:

- ▶ The use of standard attributes and attribute formats should be part of all transactions in order to improve patient matching.
- ▶ Patient demographic elements should be captured and stored in the same format.
- ▶ The lack of a standard data set can lead to records not being correctly linked to one another, impeding proper identification.



Use a standard display of patient attributes across the various systems.



Rationale:

- ▶ For accurate identification, the patient's attributes should be displayed and represented in a standard format across the various health IT systems.
- ▶ Information should appear in the same format regardless of where the information is displayed (e.g., on headers, wristbands, lists) throughout an organization or across organizations.



Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions.



Rationale:

- ▶ Visual displays, including screens and printouts, should provide distinct clues.
- ▶ The appearance of the attribute information (font, order, type of information), the use of white space, the location of identifying information, and the incorporation of technology (e.g., photographs), in conjunction with attributes, can aid in distinguishing patients and improve identification.

Integrate new technologies to facilitate and enhance identification.

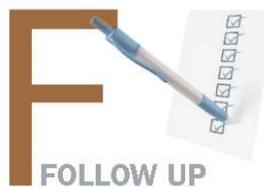


Rationale:

- ▶ New technologies and new uses of technology should be evaluated and incorporated into patient identification processes.
- ▶ New technologies, once appropriately vetted and sufficiently mature, can facilitate accurate and timely identification.
- ▶ The improved use of technology facilitates matching of the appropriate patient with the correct treatment, diagnostic, or other modality.



Implement monitoring systems to readily detect identification errors.



Rationale:

- ▶ Automated monitoring of current systems, whether used to detect errors in patient identification before they are propagated (*proactive*) or to provide additional checks, detect inconsistencies, and aid in confirming identity (*reactive*), can prevent duplication and record overlay.



Include high-specificity active alerts and notifications to facilitate proper identification.



Rationale:

- ▶ Highly specific alerts and notifications can be used to alert users when they attempt to create a new record for an individual who has a current record, select an incorrect individual, or enter a name that may contain typos, transpositions, or misspellings.
- ▶ Monitoring how alerts are used and providing direct feedback will improve proper identification.





Improving Patient ID Practices with Technology to Increase Safety

Areas and implementations of attributes and technology to make a positive impact:

- ▶ Intake—registration and scheduling
 - Biometrics
 - Patient photos
 - Alerts
 - Algorithms

- ▶ Encounter—ordering, results and document review, task performance
 - Bar coding, radio-frequency identification
 - Patient photos
 - Clinical decision support, alerts
 - Algorithms



How to Drive Potential Solutions

- ▶ Tackle identification at the vendor level
- ▶ Develop national standards
- ▶ Define best practices at various steps
- ▶ Involve all parties





Potential Barriers

- ▶ Difficulties in cleaning up past data
- ▶ Lack of policy/process enforcement due to culture
- ▶ Definitions are vendor- and not organization-controlled
- ▶ Available time/resources
- ▶ Legacy systems
- ▶ Resistance to new process implementation
- ▶ Present electronic health record is unable to detect or monitor ID errors



What Can I Do Today?

- ▶ Adopt uniform policies regarding data collection
- ▶ Incorporate standards into data collection
- ▶ Confirm the correct patient, correct site, correct procedure using standard identifiers
- ▶ Use a standard data set in a standard format in all areas (banners, headers, wristbands)
- ▶ Identify and use appropriate technologies (including biometrics when available and practicable)



What Is Next?

- ▶ Determine where patients are registering—list all areas
- ▶ Ascertain how identifications are displayed on various systems
- ▶ Ask vendors if identification appearance can be altered
- ▶ Incorporate new identification technologies
- ▶ Monitor changes

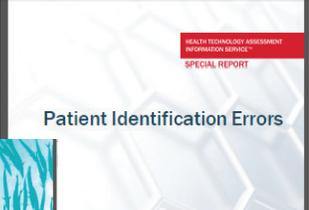
Desired Outcomes

- ▶ Standard identifiers are collected and verified at all patient access points
- ▶ Patient information is displayed consistently in the various health IT systems
- ▶ Identification processes using technology are monitored and improved
- ▶ Leadership, frontline staff, and patients recognize the importance of proper patient identification



Patient Identification:

- ▶ *Deep Dive*
- ▶ Evidence Report
- ▶ Safe Practices





The Deep Dive is available for ECRI members at: https://www.ecri.org/components/PSOcore/Pages/DeepDive0816_Patient ID.aspx




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Recommended Policies and Procedures

Below are examples of various types of policies to facilitate the use of health IT in patient identification.*

Area	Recommended Policy	Stakeholder
Registration	<ul style="list-style-type: none"> Establishing accurate patient registration and validation processes for new and existing patients Addressing name changes Using the master patient index Developing search strategies for patient inquiries Using biometrics in validating patient identification for clinical care (including what to do when the technology is unavailable) Using and taking patient photographs Responding to record creation alerts Preventing and addressing the creation of duplicate or incorrect records Establishing use of the medical record number and single identifier Registering unidentified and unnamed individuals Training for the registration staff Establishing security, breach, and privacy practices Addressing identity theft and fraud in patient identification Determining newborn identification practices Using bar codes in identification 	Patients, registration staff, leadership, vendors, information technology/health information management, finance
Clinical care, social work, behavioral health, pastoral care, rehabilitation, and discharge planning	<ul style="list-style-type: none"> Implementing identification practices for safety Using patient photos Using confirmation and validation practices Using technology at the bedside Providing training to improve identification for patient safety Establishing security, breach, and privacy practices 	Patients, clinical providers and those in all care areas, patient care technicians, lab, radiology, pharmacy, transport, nutrition and dietary services, vendors, information technology/health information management, education, discharge, social work, behavioral health
Laboratory, radiology, and pathology	<ul style="list-style-type: none"> Using bar codes in identification Using proper labeling and verification practices Establishing security, breach, and privacy practices 	
Pharmacy	<ul style="list-style-type: none"> Using bar codes for patient and medication identification and validation Establishing security, breach, and privacy practices 	
Billing	<ul style="list-style-type: none"> Validating and verifying identification Establishing security, breach, and privacy practices Addressing identity fraud 	Finance, leadership, information technology/health information management, vendors
Device/bioengineering	<ul style="list-style-type: none"> Standardizing displays to improve identification Implementing identification practices for safety Using patient photos to improve identification Using bar codes in identification Integrating legacy systems Conducting medical device risk assessments 	Leadership, information technology/health information management, clinical care providers, vendors, bioengineering
Information technology/health information management	<ul style="list-style-type: none"> Monitoring duplicate record rates Merging multiple records Correcting overlays Monitoring matching and matching algorithms across care areas Developing search strategies Monitoring the error rate and the rate of creation of duplicate records Data management and data quality Assessing interoperability for systems and devices Training for improved identification Creating, merging, and modifying records Addressing identity fraud Establishing security, breach, and privacy practices Using and managing data conversions Managing legacy integration Implementing alarm management practices to enhance identification 	Leadership, information technology/health information management, vendors

* This list is not meant to suggest that all of these policies are needed across facilities or that those shown are the only policies that might be needed.



Audit Tools

Measuring Duplicate Record Rates

The process of patient identification starts with collecting or matching the correct identifying information of patients at the beginning of the episode of care in order to prevent downstream events from misidentification. Measuring the duplicate record rate is one way to assess data quality related to patient attributes (other ways include evaluation of demographic changes and reconciliation of temporary values). Duplicate record rates can be measured by determining the existence rate or by determining the creation rate, calculated as follows: (AHIMA “Managing the Integrity”)

Existence rate: percentage of duplicate records in the entire master patient index (MPI) at a given point in time

Number of duplicate records / total number of MPI records × 100 = % duplicate records in existence

Creation rate: percentage of duplicate records created over a specified period

Number of duplicate records created / number of registration events × 100 = % duplicate records created

The sample [Duplicate Medical Record Dashboard](#) for health information management professionals can be utilized in communicating the incidence of potential patient identification events. Caution is warranted when comparing results as duplicate rates alone are not representative of how well or poorly a facility is doing (see also Dooling et al.).

Patient Identification Process Audits—Observational

Wrong-patient errors can occur at multiple points during a healthcare encounter and can involve nearly anyone on the healthcare team. Safe patient identification requires multipronged solutions. To understand the various issues and locations where errors in patient identification may occur, the following observational audit tools are provided for both clinical and patient access staff. The audit tools include collection of information about the method of identification, the staff accountable for that process, and the specific healthcare process involved. The goal of these audit tools is to identify possible failure modes in the patient identification process so that mitigation strategies can be developed.

The sample observational Patient Identification Audit Tools for both [clinical care areas](#) and [patient registration points](#) can be utilized by management/staff of clinical areas and patient access.



Appendices

Appendix A. Definitions

Biometrics: Use of a technological solution to identify a person through his or her biological or behavioral traits (e.g., fingerprints, iris scans) (HIMSS “Patient identity integrity glossary”)

Data attributes: Specific demographic information that an organization maintains to identify a patient’s electronic record (Morris et al.)

Data governance: Decision-making and accountability structure for managing data. This can include organizational policies and strategies that define the purpose for collecting data, the ownership of data, and the intended use of data. A data governance plan serves as the framework for an overall organizational approach to data governance (HIMSS “Patient identity integrity glossary”)

Data integrity: The idea that information is correct, complete, whole, and has not been altered to conflict with the original intent of its creator (HIMSS “Patient identity integrity glossary”)

Data quality management: Business processes that ensure the integrity of an organization’s data during collection, application (including aggregation), warehousing, and analysis. While the healthcare industry still has a journey ahead to reach the robust goal of national healthcare data standards, the following list shows standards currently in use for data exchange and interoperability (Davoudi et al.):

- C-CDA: Consolidated Clinical Document Architecture
- DEEDS: Data Elements for Emergency Department Systems
- UHDDS: Uniform Hospital Discharge Data Set
- MDS: Minimum Data Set (long-term care)
- ICD-10-CM/PCS: International Classification of Diseases, Clinical Modification/Procedure Coding Systems
- SNOMED CT: Systematized Nomenclature of Medicine—Clinical Terms
- LOINC: Logical Observation Identifiers Names and Codes
- RxNorm: Standardized nomenclature for clinical drugs
- *DSM-5: Diagnostic and Statistical Manual of Mental Disorders*, 5th ed.



Data remediation: The process of detecting and correcting (or removing) corrupt or inaccurate records from a record set, table, or database to eliminate data quality issues (HIMSS “Patient identity integrity glossary”)

Deterministic algorithms: Algorithms that query for an exact match of specified demographic attributes

Deterministic matching/deterministic record linkage: The simplest kind of record linkage, also called rules-based; generates links based on the number of individual matching identifiers. Assigns weights or significant values to particular data elements and then uses these weights in comparing one record with another (HIMSS “Patient identity integrity glossary”)

Duplicate: When one patient has two or more different medical records within the same healthcare organization or health information organization. This may be caused by the existence of more than one unique identifier (e.g., MRN or person identifier) for the same person in the master patient index (HIMSS “Patient identity integrity glossary”)

Enterprise master patient/person index (EMPI): See “Master patient index.”

Enterprise master patient index matching validation (EMV): An analysis of the total EMPI matches, which confirms the following: total number of true matched pairs, false-positive matched pairs, false-negative matched pairs, and indeterminate matched pairs (HIMSS “Patient identity integrity glossary”)

False match: Occurs when the system incorrectly matches a pair of records when they instead represent data concerning two separate individuals (HIMSS “Patient identity integrity glossary”)

False match rate: Measures the percentage of invalid matched pairs that are incorrectly accepted as matched pairs (HIMSS “Patient identity integrity glossary”)

False negative/false-negative matched pair: Algorithm match error occurring when two different records for the same person are thought to represent different people (HIMSS “Patient identity integrity glossary”)

False positive/false-positive matched pair: Algorithm match error occurring when information for two different people appears to be a match representing the same individual (HIMSS “Patient identity integrity glossary”)

Fellegi-Sunter theory: Theory of probabilistic matching pioneered in the 1960s that recognizes that each field-by-field comparison is subject to error (HIMSS “Patient identity integrity glossary”)

Hybrid algorithm: A matching method that combines both probabilistic and deterministic algorithm rules (HIMSS “Patient identity integrity glossary”)

Indeterminate matched pair (IMP): Matches occurring when the pair of candidate records offered by the algorithm do not have sufficient information to make a clear determination of whether they are the same individual. IMPs provide an indication of poor data quality in data collection and field completion (HIMSS “Patient identity integrity glossary”)

Linkable: Information about or related to an individual for which there is a possibility of logical association with other information about the individual (NIST “Special publication”; McCallister et al.)

Linkage or potential linkage: Two separate records from different sources that may belong to the same patient and (if so) should be linked together in the master patient index (HIMSS “Patient identity integrity glossary”)

Linking records: A means of associating records in an EMPI data set to indicate that the records refer to the same person across different data sources (HIMSS “Patient identity integrity glossary”)



Master data management (MDM): Technology-enabled discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, semantic consistency, and accountability of the enterprise’s official shared master data assets. Master data is the consistent and uniform set of identifiers and extended attributes that describe the core entities of the enterprise, including customers, prospects, citizens, suppliers, sites, hierarchies, and chart of accounts.

Master patient index (MPI) or enterprise master patient/person index (EMPI): A database that contains a unique identifier for every patient/person in the enterprise as well as tables connecting the EMPI identifier to the identifiers in all registration systems. All registration systems would look to the EMPI to obtain patient information based on several identifiers. Healthcare organizations or groups of entities implement EMPIs to identify, match, merge, de-duplicate, and cleanse patient records to create an index that may be used to obtain a complete and single view for each patient. An EMPI also provides patient identification services based on demographic matching algorithms (HIMSS “Patient identity integrity glossary,” “Patient identity integrity toolkit”).

Match: Two or more records in a database that have been identified through an electronic or manual process as potentially containing information about the same individual; an initial match may require further validation (Morris et al.)

Matching algorithms: Rules used by matching software to match patient records by making use of patient demographics and data attributes (modified from ONC presentation)

Matching thresholds: Within an algorithm, set numeric scores at which records are automatically linked, rather than manually linked, within an electronic record system (Morris et al.)

Medical record number (MRN): Unique identifier assigned to a patient’s record within a specific EHR system or organization (Morris et al.)

Merge/unmerge: Merging two patient records combines them; unmerging involves creating two or more records from one record that has been previously merged, usually to separate out the information that is attached to two or more different patients and incorrectly combined into one. There are also merge and unmerge messages that can be sent under HL7 Master Patient Index Standards (Morris et al.)

Negative match threshold (NMT): The evaluation of nonmatch threshold (HIMSS “Patient identity integrity glossary”)

Nonmatch: A pair of records that are determined *not* to be the same individual (HIMSS “Patient identity integrity glossary”)

Overlap: Two or more of the same patients’ records from different facilities, using different MRNs, aggregated into an enterprise database (e.g., patient Sam Jones has MRN 54321 at facility A and MRN 4887733 at facility B). Each of these records has a unique enterprise identifier (HIMSS “Patient identity integrity glossary”)

Overlay: Two or more individuals incorrectly assigned the same identifier so that their health information is comingled in one record (HIMSS “Patient identity integrity glossary”)

Pair: Two records offered as a potential match (HIMSS “Patient identity integrity glossary”)

Patient identification: The process of correctly matching a patient to appropriately intended interventions and communicating information about the patient’s identity accurately and reliably throughout the continuum of care (Australian Commission)



Patient identification (PID) segment: Portion of the HL7 ADT message that contains 30 different fields of demographic information about the patient, with values ranging from name and date of birth to marital status and citizenship. The PID segment is used as the primary means of communicating the identifying information about a patient between electronic systems (HIMSS “Patient identity integrity glossary”)

Patient identity integrity (PII): The accuracy, quality, and completeness of demographic data attached to or associated with an individual patient (HIMSS “Patient identity integrity glossary”)

Probabilistic algorithms: Algorithms that work based on rules with various “weights” attached to different attributes to produce a composite “score”; if the score is above a threshold, the query results in a positive match (ONC presentation)

Probabilistic matching/probabilistic record linkage: A statistical linking process, sometimes called “fuzzy matching,” that takes into account a wide range of potential identifying data, computes weights for each identifier based on its estimated ability to correctly identify a match or a nonmatch, and uses these weights to calculate the probability that two given records refer to the same individual (HIMSS “Patient identity integrity glossary”)

Positive match threshold (PMT): The evaluation of definite-match threshold (HIMSS “Patient identity integrity glossary”)

Soundex: A phonetic algorithm for indexing names by sound as pronounced in English, developed by Robert C. Russell and Margaret K. Odell, patented in 1918 (Morris et al.)

Threshold: An organization’s predetermined level of acceptance of an algorithm’s match validity. Thresholds define the range of scores acceptable to the institution for an exact match; a high, medium, or low match; or no match (HIMSS “Patient identity integrity glossary”)

True matched pairs: Pairs generated by the algorithm or by external business processes that are confirmed, after manual validation, to be matched pairs; sometimes referred to as adjusted matched pairs (HIMSS “Patient identity integrity glossary”)



Appendix B. Evidence Table

Attributes

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence
<p>A-1</p> <p><u>Process map</u>: Registration, encounter, post-encounter</p> <p>Sociotechnical: Hardware and software Clinical content Human-computer interface External rules, regulations, and pressures</p>	<p>Electronic fields containing patient identification data should consistently use standard identifier conventions</p> <p>Additional examples: http://www.mscai.net/DesignGuide/NameDisplayInput.aspx; see also http://webarchive.nationalarchives.gov.uk/+http://www.isb.nhs.uk/use/baselines/cui</p>	<ul style="list-style-type: none"> Each field should be in its own box to distinguish items and for uniform reporting There should be appropriate space to accommodate the characters needed in each field All of the fields should be able to accommodate information with consistent standards (e.g., hyphens and hyphenated names, apostrophes, special characters, etc., all should be treated the same, and it should be possible to use and display them in the same manner—e.g., in headers, wristbands) Consider staging of implementation, noting that standardization across organizations may be adopted more quickly than national or international standards Fields should not include false data (e.g., 000, XXX, 123, etc.) <p>Rationale: Avoid duplicate record creation; prevent documentation, diagnosis, treatment, and/or results from appearing in the incorrect record</p>	<ul style="list-style-type: none"> Look at this feature when purchasing a system Provide training for all personnel who enter data Develop policies and procedures Provide regular monitoring and correction 	<p><i>“Standardized patient identifying attributes should be required in the relevant exchange transactions; any changes to patient data attributes in exchange transactions should be coordinated with organizations working on parallel efforts to standardize healthcare transactions.”</i></p> <hr/> <p><i>“Typos, misspellings, transpositions, fields left empty, or fields filled with false data can cause problems downstream from the point of entry.”</i> Morris et al., 2014, p. 9</p>



Attributes (continued)

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence
<p>A-2</p> <p><u>Process map:</u> Encounter, post-encounter</p> <p><u>Sociotechnical:</u> Hardware and software Workflow and communication Organizational policies, procedures, and culture External rules, regulations, and pressures</p>	<p>Use a confirmation process to help match the patient and the documentation</p>	<ul style="list-style-type: none"> Identify the minimally essential elements for confirmation of the correct patient (e.g., use of initials and DOB, use of name and MRN) Use dialogue boxes to validate such things as initials, DOB, MRN Revalidate gender, photo, height, weight, diagnosis, or other appropriate information Enter initials, DOB, etc., prior to signing an order or documenting in a record after a period of time has passed with the record open <p>Rationale: Use attributes at various stages to confirm a positive match for the patient during key transitions or when clinical interventions are taken (see also SAFER Guides)</p>	<ul style="list-style-type: none"> Vendor Providers Provider organizations 	<ul style="list-style-type: none"> Develop pop-ups that require completion at key junctures Develop policies and procedures Provide training <p>Adelman et al., 2015 <i>Standard naming convention</i></p> <p>Adelman et al., 2013 <i>ID verify alert (single-click confirmation)</i></p> <p>Wilcox et al., 2011 <i>Pop-up after note completion (name and MRN)</i></p> <p>Green et al., 2014 <i>Dialogue box (name, DOB, MRN) at beginning of ordering)</i></p> <p>Morris et al., 2014 <i>Alerts to identify duplicate entries</i></p>



Attributes (continued)

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence	
<p>A-3</p> <p><u>Process map:</u> Registration, encounter, post-encounter</p> <p><u>Sociotechnical:</u> Hardware and software Clinical content External rules, regulations, and pressures System measurement and monitoring</p>	<p>Use standard attributes and attribute formats in all transactions to improve matching</p>	<ul style="list-style-type: none"> Standard use of attributes for matching as a less expensive and effective alternative to algorithms; use of standard attributes, information collected in the same way in all locations, can facilitate matching Matching alternative instead of algorithms <p>Examples. Attributes that can be collected in standard formats include: First/Given name; Current Last/Family Name; previous Last/Family Name; Middle/Second Given Name (includes Middle Initial); suffix; DOB; current address (street address, city, state, zip code); historical address (street address, city, state, zip code); current phone number (if more than one is present in the patient record, all should be sent); historical phone number; gender (Morris et al., 2014, pp. 16-17)</p>	<ul style="list-style-type: none"> Provider organization Vendor 	<ul style="list-style-type: none"> Develop policies and procedures Provide training for appropriate capture of information that is later linked for matching 	<p>Morris et al., 2014, p. 16</p> <p><i>Helps small organizations without sophisticated algorithms to facilitate matching</i></p>
	<p>Rationale: Linking of identifiers is used in order to avoid duplicate records and facilitate the effective use of the EMI. Information available in the EMI includes demographic and medical record information from different parts of the same organization (see also SAFER Guides) and the use of these standardized data attributes supports multiple matching scenarios (see Morris et al., 2014). Linking of identifiers is another form of matching when facilities or providers do not have the capacity to use deterministic, probabilistic, or natural matching algorithms.</p>	<p>Resources:</p> <ul style="list-style-type: none"> https://www.caqh.org/sites/default/files/core/phase-ii/policy-rules/258-v5010.pdf http://www.iso.org/iso/catalogue/catalogue_tc/catalogue_detail.htm?csnumber=59755 			



Attributes (continued)

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence	
<p>A-4</p> <p><u>Process map:</u> Registration, encounter, post-encounter</p> <p><u>Sociotechnical:</u> Hardware and software Clinical content Human-computer interface People Workflow and communication Organizational policies, procedures, and culture System measurement and monitoring</p>	<p>Use a standard display of patient attributes across the various systems</p>	<ul style="list-style-type: none"> • Include visual distinctions • Fields should be readily visible and identifiable • Identification information should appear the same throughout the organization's systems (EHR, monitoring systems, wristbands, transcription records) and should be monitored to accommodate new devices 	<ul style="list-style-type: none"> • Provider organization • Vendor 	<ul style="list-style-type: none"> • Inventory systems to determine the ways information is currently displayed • Identify the attributes currently used • Seek vendor assistance in standardizing displays • Implement within-organizational systems first (easier, more economical) • Ensure that information appears in the same format across the EHR and, for example, on the wristband 	<p>Haynes et al., 2009 <i>Checklist</i></p> <hr/> <p>Probst et al., 2015 <i>Standardize armbands</i></p> <hr/> <p>Kim et al., 2013 <i>Specimen handling</i></p> <hr/> <p>Seferian et al., 2014 <i>Specimen labeling</i></p> <hr/> <p>Simons et al., 2014 <i>Standard operating procedures for identification</i></p> <hr/> <p>Walley et al., 2013 <i>Standardize ID bands</i></p> <hr/> <p>White et al., 2010 <i>Checklists (chemo pumps)</i> NIST standards</p>
<p>Rationale: Information should appear in the same format regardless of the system, so that providers and others can easily retrieve the needed information.</p>		<p>Examples and recommendations identified by the National Institute of Standards and Technology (NIST): see NISTIR 7804-1 (http://www.nist.gov/healthcare/usability/upload/NISTIR_7804-1_WERB_10_06_15.pdf)</p>			



Technology (continued)

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence
<p>T-1</p> <p><u>Process map:</u> Registration, encounter, post-encounter</p> <p><u>Sociotechnical:</u> Hardware and software Human-computer interface Workflow and communication System measurement and monitoring</p>	<p>Include distinguishing information enhancing identification on screens, printouts, and those areas that require interventions</p>	<ul style="list-style-type: none"> Use items such as photos or other distinguishing information on all screens (putting them in areas such as the header) and in areas where actions occur (e.g., charting or medication ordering) to facilitate identification <p>Rationale: Readily available information creates visual cues to facilitate identification; including such information makes the record visibly distinct</p> <p>Examples: Examples include photos in headers or in areas where orders are documented, using text that distinguishes information, or the use of other distinguishing attributes</p>	<ul style="list-style-type: none"> Provider organization Vendor <ul style="list-style-type: none"> Consider barriers to implementation and availability of information (e.g., photo file size, limitations on performance due to large files, need for extra space, degradation of data, color versus black-and-white photos) Assess access to current or recent photo Capture photo information: scan photo ID, take photos at entry points, allow patients to upload photos on the patient portal Develop policies and procedures Ensure that identifiers used in patient confirmation are also used in windows requiring confirmation 	<p><i>Hyman et al., 2012 photos</i></p> <hr/> <p>Tridandapani et al., 2014 <i>Radiograph/photo pairing</i></p> <hr/> <p>Tridandapani et al., 2013 <i>Radiograph/photo pairing</i></p>



Technology (continued)

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence
<p>T-2</p> <p><u>Process map:</u> Registration, encounter, post-encounter</p> <p><u>Sociotechnical:</u> Hardware and software Human-computer interface Workflow and communication</p>	<p>Integrate new technologies to facilitate and enhance identification</p> <p>Integrate new technologies as they become sufficiently mature for implementation and that most suit the particular area of care (e.g., RFID—blood banking, bar coding—medications)</p> <p>Rationale: New technologies are continually developed that facilitate proper identification</p> <p>Examples: Use of RFID in blood banking, use of bar coding with medication administration, use of biometrics during patient registration</p>	<ul style="list-style-type: none"> • Provider organization • Vendor 	<ul style="list-style-type: none"> • Develop or revise policies • Account for technical and workflow barriers (certain information cannot be bar coded, printer quality, amount of information in bar code, equipment availability) • Identify and prevent potential work-arounds that develop as a result of use of the particular technology (e.g., using a list of all patient bar codes so that caregiver does not interact directly with the patient) • Consider the use of multiple interventions for complex, high-risk workflows • Embed decision support 	<p>Askeland et al., 2009 (S) <i>Bar coding (blood)</i></p> <p>Bennardello et al., 2009 <i>Bar coding (transfusions/fingerprinting)</i></p> <p>Brown et al., 2011 <i>Bar coding</i></p> <p>Higgins et al., 2010 <i>Bar coding</i></p> <p>Hill et al., 2010 (S) <i>Bar coding</i></p> <p>Morrison et al., 2010 (S) <i>Bar coding</i></p> <p>Nuttall et al., 2013 <i>Bar coding</i></p> <p>Pagliari et al., 2009 <i>Bar-code scanner</i></p> <p>Poon et al., 2010 <i>Bar-code scanner</i></p> <p>Probst et al., 2015 <i>Bar-code scanner</i></p> <p>Sakushima et al., 2015 <i>Bar-code scanner, standardize specimen label, two-person verification of two identifiers</i></p> <p>Seferian et al., 2014 <i>Fingerprints</i></p> <p>Bennardello et al., 2009 <i>Bar-coding (medication administration)</i></p> <p>Young et al., 2010 <i>Bar-coding (medication administration)</i></p> <p>Francis et al., 2009 <i>RFID</i></p> <p>Marberger et al., 2011 <i>DNA profile</i></p>



Technology (continued)

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence	
<p>T-3</p> <p><u>Process map</u>: Encounter, post-encounter</p> <p><u>Sociotechnical</u>: Hardware and software Clinical content External rules, regulations, and pressures System measurement and monitoring</p>	<p>Implement monitoring systems to readily detect identification errors</p>	<ul style="list-style-type: none"> Automated monitoring systems are used in radiology to compare physical sizes and positions of organs in order to verify and confirm the identity of the individual 	<ul style="list-style-type: none"> Provider organization Vendor Provider 	<ul style="list-style-type: none"> Develop and use attribute algorithms (e.g., patient matching, indication based, gender based) to monitor incorrect identifications Be certain that business practices include routine review of duplicate error rates Have processes for organizational surveillance, monitoring, and measuring (e.g., frequency and occurrence of error rates, progress on improvements) 	<p>Jani et al., 2015 <i>Radiology, imaging, pathology (limited)</i></p> <hr/> <p>Alreja et al., 2011 <i>Radiology</i></p>
<p>Rationale: Items such as “check digit” are available to help prevent data entry errors (see SAFER Guides); these and other automated approaches are useful in confirming identification and reducing errors</p>	<p>Examples: National Quality Forum “reviewed and endorsed a measure related to patient identification (NQF #2723: Wrong Patient Retract and Reorder [WP-RAR]) ... this measure assesses the number of times an order was entered on the wrong patient, then retracted and reordered on another patient within a 10-minute period.” Other measures include the proportion of duplicate patients within an EHR, with measurement possible at both the facility and enterprise level (AHIMA “Best practices”). Measures could include % of duplicate patients; total number of duplicate patient records for a particular time frame; % of incorrect patient identification alerts; record overlay. (NQF)</p>				



Technology (continued)

Health IT Safe Practice Recommendations	Clarifications and Rationale	Responsibility	Strategies to Implement	Evidence
<p>T-4</p> <p><u>Process map:</u> Registration, encounter, post-encounter</p> <p><u>Sociotechnical:</u> Hardware and software Clinical content Human-computer interface Workflow and communication Organizational policies, procedures, and culture System measurement and monitoring</p>	<p>Include high-specificity active alerts and notifications to facilitate proper identification</p>	<ul style="list-style-type: none"> Alerts must trigger a subsequent follow-up action <p>Rationale: Users are warned when they attempt to create a new record for a patient whose first and last name are the same as another patient's (see SAFER Guides)</p> <p>Examples: Other available tools include a "nickname file" to check for different versions of the first name (e.g., Bob, Rob, Robert, Bobby, Robby); alerts present when a new record is created for the same or similar name; Soundex cross-reference (e.g., names ending in <i>-itt</i> and <i>-idt</i>)</p>	<ul style="list-style-type: none"> Vendors Provider organization Providers <ul style="list-style-type: none"> Create actionable alerts Educate and continue to train users Develop appropriate policies and procedures Monitor rates of alerts, measure effectiveness of alerts for learning and refinement, avoid creating additional alert fatigue 	<p>Galanter et al., 2013 <i>Alerts</i></p>

AHIMA, American Health Information Management Association; DOB, date of birth; EHR, electronic health record; EMI, enterprise-wide master patient index; MRN, medical record number; NIST, National Institute of Standards and Technology; NQF, National Quality Forum; RFID, radio-frequency identification



Appendix C. Empirically Based Human Factors Guidance for Safety-Enhanced Design of Health Information Technology

Information here is from [NISTIR 7804-1](#).

- 1. Consistently display information critical to patient identification in a reserved area (specified below) to avoid wrong-patient errors.**
 - 1.1 Patient identification information shall be displayed in the upper left hand corner of all screens/windows in a consistent order, so that users can efficiently and accurately find and verify patient identity.
 - 1.2 The information shall continue to be displayed in the same location regardless of scrolling or other navigational mechanisms to move within the screen/window.
 - 1.3 The order shall be to first display the patient's name with the last (family) name capitalized, followed by a comma and then first (given) name, middle name and modifier, followed by date of birth (e.g., using the format "Nov 9, 1961"), followed by age and gender, and then followed by medical record number (MRN).
 - 1.4 For mobile devices or tablets with smaller screen sizes, it may be preferable to display the information horizontally using the same ordering convention and white space between the three elements. The information should be demarcated on the bottom and/or the side, such as by employing white space, shading, or a line, from additional optional identifiers.
 - 1.5 An example of this reserved area is as follows:

SMITH, Walter Joseph III
Nov 9, 1961 (56 yo M)
MRN1348887
 - a. NAME: The last (family) name should be first and should be capitalized. It is followed by a comma (",") and space prior to a capitalized first (given) name, with the rest of the name in lower case. The capitalization is used to distinguish the last name in cases of ambiguity (e.g., Clark Kelly could be Clark KELLY or Kelly CLARK). It also reduces variation for names with multiple capitalizations, such as McDonald.
 - b. NAME MODIFIER: In the absence of a modifier (e.g., Jr., Sr., III), nothing shall be displayed in that location.
 - c. DATE: The month represented as the first three letters of the month (or four in languages other than English, such as Italian where this is needed to disambiguate months) shall be represented with a capitalized first letter with the rest in lower case in order to make the capitalized last name more distinguishable quickly on the display. The full year shall be displayed as four numeric digits.
 - d. AGE: Displaying the age reduces the cognitive work required by the user to convert date of birth into age. For "years old," the display convention is "yo" with a space after the number, rounded down to the nearest digit. Similarly, "months old" is displayed as "mo," "weeks old" as "wo," and "days old" as "do." In neonatal intensive care units, "DOL 1" is often used for "first day of life," which corresponds to 0 days old. Similarly, DOL 2 is the second day of life. Decisions on when to display "yo," "mo," "wo," "do," and "DOL" are expected to vary by institution. For example, a hospital may display "DOL" for the first five days of life, followed by "do" until 30 days old, then "wo" until 24 weeks old, then "mo" until 24 months old, and finally "yo" after 24 months of age. For the purposes of tracking accuracy of information, it should be possible to display on demand the value of the age in the original format in which it was stored or transferred with interoperable systems. Age for patients should not be displayed in values of less than 1 unit (e.g., 0.0001 yo).



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- e. GENDER: For gender, the display options should be “M” or “Male” for male, “F” or “Female” for female, and “Other.” Additional details specifying subcategories under “Other,” as necessary, shall be viewable on demand, such as transgender, or reasons the person’s gender was changed in the system.
- f. MRN: The allocation of digits to the medical record number (MRN) should be able to be modified in the future to accommodate future changes. Additional identifiers such as care episode can be included on this line after the MRN. The font size for MRN and other numeric identifiers can be smaller than the other information displayed in the reserved area or placed to the right of the name and date-of-birth information, but should still be viewable by older users (Kochurova et al.). MRN information may be displayed in the reserved area only in response to an explicit user action and/or when a bar-coded wristband is scanned. Other identifiers, such as encounter numbers, shall not be displayed in the reserved area in order to reduce the likelihood of confusing the identifiers.
- g. ADDITIONAL IDENTIFIERS: Optional additional identifiers shall not be included in the reserved area, as defined by being below a clearly demarcated horizontal line or to the right of the area above the demarcation line. The display of optional identifiers should not cover task-critical information except for short periods on demand. Additional optional identifiers include the following:
 - (1) Place of birth
 - (2) Picture—a color photograph taken within the past 5 years is recommended, with no other individuals in the picture, taken as a close-up of the head facing the camera
 - (3) Biometrics
 - (4) Genome
 - (5) Bar code
 - (6) Episode/encounter code
 - (7) Suspected, confirmed, or ruled out as having a highly infectious disease (e.g., “confirmed Ebola”)

2. Provide visual cues to reduce risks of entering information and writing orders in the wrong patient’s chart.

- 2.1 Visually differentiate a chart that enables a user to have unrestricted access to input information (i.e., input mode) from a chart that restricts the user’s ability to enter information (i.e., view-only mode). The 2002 AHIMA article “Maintaining a legally sound health record” defines a “chart” as “generated at or for a health-care organization as its business record . . . [it] is the record that would be released upon request. It does not affect the discoverability of other information held by the organization. The custodian of the legal health record is the health information manager in collaboration with information technology personnel. [Health information management] professionals oversee the operational functions related to collecting, protecting, and archiving the legal health record, while information technology staff manage the technical infrastructure of the electronic health record.”
- 2.2 Enable user to enter information on only one patient’s chart at one time.
- 2.3 Enable user to see a chart in view-only mode in parallel with a chart with unrestricted access to input information in order to support specialty-specific care needs (e.g., coordinated mother-and-child care following a birth, coordinated care of multiple-birth patients).



- 2.4 Enable user to easily transition from the current chart with unrestricted access to input information to another chart by a deliberate action (i.e., identification/activation of the patient chart) by the user.
 - 2.4.1 Categories of charts that are likely to be needed by clinical providers are (1) charts for patients who are scheduled to be seen in the near future (e.g., the next 24 hours); (2) charts that have recently had information input into them; (3) charts that have information on laboratory tests that have been ordered or imaging tests that have results pending; and (4) charts that have planned actions such as documenting progress notes that have not yet been completed.
 - 2.4.2 “Easily transition” implies that context must be preserved in a way that is clear to the user when the user transitions to another chart and back to a previous chart, and that it is easy to find and identify a desired patient’s chart for any relevant patient in the system. Context should be preserved in these transitions such that unsaved work-in-progress text is preserved by the system until saved (or deleted) by the user.
- 2.5 Visually distinguish the mechanism for moving within a single patient’s chart and transitioning from one chart with unrestricted access to input information to another.
- 3. Support efficient and easy identification of inaccurate, outdated, or inappropriate items in lists of grouped information by presenting information simply and in a well-organized manner.**

Ways to achieve this include the following:

- 3.1 Lists of patients assigned to a particular clinician-user should be presented in consistent, predictable locations within and across displays and printouts, and the content should not vary based on display location.
- 3.2 The status of a note and order as “draft” as compared with “final” shall be clearly indicated on appropriate displays.
- 3.3 Clearly indicate the method by which the system saves information, whether autosave or requiring deliberate action to save, or combinations thereof.
- 3.4 Information that has been input should be automatically saved when a user transitions from one chart to another.
- 3.5 The language used should be task-oriented and familiar to users, and should be consistent with expectations based on clinical training.
- 3.6 Enable a user to easily order medications that have a high likelihood of being the appropriate medication, dose, and route. The likelihood is increased when displays are tailored to specialty-specific user requirements; comply with national evidence-based recommendations; are in accordance with system, organizational, unit, or individual provider preferences specified in advance; or are similar to orders made by the same physician on similar patients, on the same patient in the past, or by providers with similar characteristics.
- 3.7 Support assessing relationships of displayed information and allowing users with appropriate permissions to modify locations and relationships for inaccurately placed information, including laboratory, imaging, or pathology results or consult notes and progress notes. This includes information within a single patient’s chart as well as information placed in the wrong patient’s chart. The information about the time and person who made the change should be viewable on demand.



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