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Final Report
White Paper
Patient Matching Community of Practice

Developing and Testing a Data Management Model and Maturity Scale Tailored to Improving Patient Matching Accuracy

Submitted to

Office of the National Coordinator for Health IT
In partial fulfillment of
Contract # 14-233-SOL-00533

Submitted by

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September 28, 2015

Health Information Exchange (HIE) Shared Collaborative Learning Combine
White Paper, Venesco and Patient Matching Community of Practice
Office of the National Coordinator for Health IT (ONC)
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Glossary

AHIMA American Health Information Management Association

BPC Bipartisan Policy Center

CHIME College of Healthcare Information Management Executives

CoP Community of Practice

EHR Electronic Health Record

HIE Health Information Exchange

HIMSS Healthcare Information and Management Systems Society

HIT Health Information Technology

MPI Master Patient Index or Master Person Index

RTI RTI International (large non-profit research and technical institute in North Carolina)

PCOR Patient-Centered Outcomes Research

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Foreword

This white paper was developed by Venesco LLC, the Office of the National Coordinator (ONC) contractor that facilitated the Patient Matching Community of Practice (CoP) during 2014-2015 and worked closely with the CoP membership to derive best practices and useful insights and suggestions that will hopefully be valuable in improving the accuracy of patient matching. The content provided in this white paper is the responsibility of Venesco LLC and is a requirement of ONC Contract # 14-233-SOL-00533.

1   Introduction and Background

As we move toward an interoperable health system featuring widespread use of electronic medical records and electronic exchange of healthcare information among organizations, patients, and caregivers, it becomes increasingly important yet complex to ensure the accuracy of each person's identity and reduce the frequency of identity errors in matching patient records. There are currently a number of issues in patient matching that must be addressed to protect patient safety, improve population health, and lower costs through care coordination:

- Multiplicity of different patient matching approaches/algorithms used by different developers and Health Information Exchange (HIE) organizations and thus lack of uniformity in patient matching methods across the healthcare industry.

- Insufficient evaluation of the accuracy of these diverse methods, especially in real-world use; thus, there is no gold standard for patient matching.

- High rates of unmatched and mismatched records, due in part to inadequate data quality in health systems, resulting in duplicate or mismatched records within a system.

- Lack of national data standards for validation of data quality for patient matching.

Previous Efforts to Improve Patient Matching. The Office of the National Coordinator (ONC) for Health Information Technology has long been aware of the critical importance of accurately linking and matching a patient's electronic healthcare records to ensure a reliable comprehensive longitudinal healthcare record. ONC began work in this area in 2009, with a whitepaper developed by RTI[1]. In 2011, the HIT Policy Committee made an initial set of recommendations that included standardization of data elements and other best practices[2]. Healthcare Information and Management Systems Society (HIMSS) and the Bipartisan Policy Center (BPC) developed publications on patient matching in 2011 and 2012[3,4] In late 2012 and 2013, a number of industry groups began work to improve patient matching, including the Care Connectivity Consortium, CHIME, HIMSS, HealtheWay, BPC, and CommonWell. In 2014, ONC published a report with its contractor, Audacious Inquiry, to identify issues and make recommendations related to patient matching. As stated in the 2014 ONC Patient Identification and Matching Final Report:

"Matching records to the correct person becomes increasingly complicated as organizations share records electronically using different systems, and in a mobile society where patients seek care in many healthcare settings. Many healthcare organizations use multiple systems for

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clinical, administrative, and specialty services, which leads to an increased chance of identity errors when matching patient records. Additionally, many regions experience a high number of individuals who share the exact name and birthdate, leading to the need for additional identifying attributes to be used when matching a patient to their record."[5]

Based on these reports, ONC has grown increasingly concerned about the reported lack of consistent patient matching standards among health systems and various health information technology (health IT) developers. Reports from other federal agencies and industry organizations such as American Health Information Management Association (AHIMA) and HIMSS have emphasized similar concerns about the lack of patient matching standards and insufficient matching accuracy.[6,7]

For these reasons, in October, 2014, the Office of the National Coordinator for Health Information Technology (ONC) identified a need to create a Patient Matching Community of Practice (CoP) workgroup to address these issues. The objective of this white paper is to describe the goals and evolution of the Patient Matching CoP's work and its creation of a Data Management Model (DMM) designed to provide a data quality standard for patient matching. The CoP also created guidelines for pilot testing of implementation of the DMM and its subsequent impact on matching accuracy.

2   Initiation of ONC-HIMSS Patient Matching Community of Practice

CoP Launch and Goal. Officially launched in December, 2014, the Patient Matching Community of Practice was initially a joint initiative of the Office of the National Coordinator and HIMSS (the Healthcare Information and Management Systems Society), a leading trade association for professionals working or interested in the field of Health Information Technology. ONC provided a Champion for the CoP and HIMSS provided its own champion, so the two organizations could partner in the improvement of patient matching.   The overarching goal of the CoP was: *To define the framework and guidelines needed to recommend a standardized core set of matching data elements, attributes, and measures to be used by technology developers and service providers and in turn ensure providers and networks have the means to match patient records with a high degree of accuracy.*   (Note: The HIMSS Champion focused his efforts on algorithm improvement and testing, while the ONC Champion and the CoP concentrated on other aspects influencing matching accuracy, such as data quality and processes and relevant regulations. This white paper describes primarily the ONC part of the joint patient matching mission.)

CoP Membership. The CoP membership was composed of a group of representatives from 17 health-related organizations who were recruited based on their involvement and central interest in patient matching standards, including hospitals, HIEs, integrated health systems, public health organizations, and research organizations located in geographically diverse areas of the U.S. Some of these representatives were members of the HIMSS patient identity and integrity workgroup, AHIMA workgroups, and the PCOR patient match team. (See Appendix A. for a list of the CoP member organizations). The CoP was supported and facilitated by ONC contractors provided by Venesco LLC. The timeline for the CoP was approximately 8 months, beginning in

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December, 2014, and ending in August, 2015. Weekly webinar meetings were scheduled for the first four months with the intended objective of researching the current patient matching environment, identifying best practices and potential standards, and presenting a "call to action" regarding patient matching for presentation at the HIMSS15 meeting in April, 2015.

Deliverables and Challenges. The expected deliverable was to provide a framework and plan to create guidelines for the selection and operation of "virtual" innovation centers in which patient matching solutions can be tested in an iterative manner. This in turn would help educate the healthcare industry, raise awareness, and support the efforts needed to establish standards that will support increased patient match accuracy. Challenges to be addressed included:

- Inconsistent stakeholder understanding of patient matching measures across the health system
- Matching performance varies depending on the quality of data available
- Improving/standardizing data quality is a complex effort
- There are few experienced patient-matching algorithm developers
- Policy issues and constraints limit consideration of a unique national patient identifier
- Potential sensitivity of HIEs and provider organizations concerning transparency in addressing patient matching problems (e.g., concerns about resulting negative perceptions of their organizations)
- Patient privacy issues surrounding using personal health information in real-world testing

3 Identification of Effective Approaches to Improving Matching Accuracy in Various Use Cases

In the first month of its existence, the Patient Matching CoP made significant progress, establishing work teams for each of four subtask areas, including: (1) the scope of work for the CoP, (2) the value proposition of patient matching for different stakeholder groups, (3) best practices for data quality and registration processes, and (4) specifics of the current and proposed federal regulations governing patient matching. Over the first two months, CoP representatives from hospitals, public health agencies, HIEs, and quality improvement organizations shared their insights with the CoP members through presentations concerning approaches in different use case environments to identifying and implementing standards, establishing data quality policies and procedures, measuring and monitoring matching rates and duplication rates, and other techniques to improve matching accuracy. These presentations were made by the following organizations:

- Children's Medical Center of Dallas (hospital setting, registration desk)
- Dallas-Fort Worth Regional Hospital Council Foundation (multi-organization retrospective database, regional quality improvement)
- New York City Department of Health Immunization Registry (public health application, provider real-time interface)
- Medication Reconciliation Use Case (Michigan Health Information Network)

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The important take-home messages from these presentations included:

- The estimated national duplication rate is approximately 8 percent, which is considered to be significantly too high for appropriate patient safety, especially as cross-organization exchange becomes more prevalent. It is also very costly due to the estimated $60 cost to facilities for manual correction of a duplicate error.

- Major improvements in patient matching rates have been achieved through the introduction of the following:
  - ➢ Increase the number of data attributes used in linking
  - ➢ Institute nationally recognized data and data-linking standards
  - ➢ Decrease free text data entry
  - ➢ Standardize naming conventions
  - ➢ Use of secondary data elements
  - ➢ Analysis of the impact of the addition of specific data elements on the improvement of matching rates (for example, the addition of "mother's maiden name" was found to dramatically decrease duplicate record rates)
  - ➢ Use of auto-linking algorithms to improve match rates in very large retrospective data bases in which extensive manual correction is not feasible

- Children's Medical Center of Dallas used the above approaches plus improved training for registration desk personnel, new data quality policies and procedures, daily reconciliation, and regular monitoring of their duplication rate to decrease their duplication rate from about 22 percent to a remarkable 0.14 percent. The duplication rate is calculated by dividing the number of duplicate records by the total number of patient records considered for matching. This in turn has improved patient safety and outcomes and has helped the medical center recognize considerable cost savings associated with manual correction of patient matching errors.

- AHIMA's recommendation is for incremental adoption of the following recommendations: adopt standard naming conventions, increase the data attributes included in the algorithm, and adopt standard definitions.

4   Creation of Data Quality Maturity Scale Model

4.1   CoP Decision to Target its Focus on Data Quality

<u>Feasibility and Centrality of Data Integrity</u>. As the CoP met over the first 2-3 months, it became increasingly apparent that the original focus on developing a multi-faceted patient matching model addressing three components—Data Quality, Process, and Algorithm—was likely too broad and comprehensive to be achievable in the brief 6-8 month time frame available for the CoP development, and especially to be completed in time for the anticipated ONC presentation at the HIMSS15 Conference in April, 2015. It had also become increasingly apparent to the CoP membership that the nation has a major data integrity issue that underlies its variable and insufficient patient matching success rates. Specifically, a key issue is that people (e.g.,

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registration clerks) are not entering data according to standards nor using a standard approach. That is, issues surrounding data quality and data quality assurance at the time of registration are fundamental to any effort to improve patient matching at either the single-facility level or at the multi-site level (e.g., HIEs). If the data are flawed at the institutional registration desk level and patients are mismatched, this will have a serious negative impact on patient safety, HIE sustainability, public health applications, research accuracy, and most use cases depending on accurate patient matching.

CoP Site Visit at Children's Medical Center of Dallas—the Catalyst. As the CoP increasingly recognized the importance of data elements and related processes to matching accuracy in the delivery system, a site visit was arranged for the ONC Champion and other CoP members at the Children's Medical Center of Dallas to allow the CoP members to be able to personally observe the registration desk data quality processes and to examine firsthand the registration desk policies and quality assurance processes that have had such a positive impact in decreasing Dallas Children's duplication rate. The CoP subgroup who attended included a number of the most experienced and involved members of the CoP, who spent hours together in Dallas seeking a targeted focus for a feasible and useful CoP deliverable. The CoP representative of the North Texas Regional Extension Center came up with the innovative idea of a Data Quality Maturity Scale for measuring the level of maturity of the data aspects that are critical to accurate patient matching. His inspiration for this 5-level scale came from two concepts: (1) the centrality of data quality as the foundation for accurate patient matching and (2) the model provided by the analogous 7-level EHR development scale that HIMSS had designed for measuring the maturity of an organization's EHR implementation.

Based on their experience in improving matching accuracy in real-world healthcare settings, the Dallas workgroup devised certain guidelines that shaped the design of the Maturity Scale, including the collection of specific data elements that had been demonstrated to contribute significantly to matching accuracy and the insight that some data elements must be collected using a drop-down menu to avoid the entry errors associated with free text entry (e.g., use of the U.S. Postal Service drop-down menu for addresses). The Dallas subgroup developed a graphical depiction of the Data Quality Maturity Scale and shared it with the entire CoP membership at the next webinar. Multiple meetings of workgroups and the entire CoP were devoted to refining the Maturity Scale.

Distinctive Maturity Scale Characteristics. The Data Quality Scale, like the HIMSS EHR Scale, was designed by the CoP to have the following two characteristics that reflect its neutrality and broad applicability: (1) intentional independence of specific developers and (2) neutral application across developers, health systems, public health registries, and other settings where patient matching is required. Because a variety of data-related characteristics, including data elements, standard formats, and data quality assurance processes, are essential to high-accuracy patient matching, the CoP designed the Data Quality Maturity Scale to have the following additional features:

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- Necessary data elements that are important to high-accuracy matching

- Use of standard data formats and collection methods

- Use of data quality assurance processes, including personnel training, policies and procedures, daily reconciliation, correction processes, and regular monitoring of duplication rates

More specifically, the data quality scale includes a defined set of data elements specifically used at registration to match patients with their electronic health records. The levels within the scale are determined in part by the required data elements identified, with Level one (1), the lowest level, including the most basic level of data elements used in matching (e.g., the first and last name, date of birth, gender, phone number, and street address). As the levels progress from one (1) to five (5), additional data elements are available to further reduce duplicate records (e.g., middle name, cell phone number, mother's maiden name). The highest data quality level (5) includes various identifiers (e.g., biometrics, insurance plan ID, Medicaid ID, and Medicare ID).

See **Figure 1** for the Maturity Scale (also provided in Appendix B for printing ease). Please note the supporting quality assurance processes and the requirement for structured data capture for some data elements, such as the standard USPS address format. Levels three (3) and above required daily reconciliation and/or other quality assurance processes. All Levels from one (1) to five (5) require duplication rate reporting.

Figure 1. Data Quality Maturity Level Scale*†

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 #* Address* Street* State* Zip*	Middle Name Mother's Maiden Name Prefix† Marital Status†	Alias or Previous Name USPS Address† Identifier Last 4 SSN* DL Passport Alien ID#	Multi Birth† Birth Order† Birth Place E-mail* Previous Address† Previous Cell Phone(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 % captured	-	-	-	-

*Data Elements in green with asterisk (*) are in the proposed rule
†Data Elements in blue with dagger (†) require structured data capture

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While these data elements, standards, policies, and quality assurance processes influence the accuracy of patient matching across use cases, the Maturity Scale is tailored most specifically for patient matching at the registration desk in hospital and clinic settings, since this work is foundational to the accuracy of patient matching in multi-site operations and other use cases, including HIEs, public health registries, research databases, and quality improvement organizations.

5   Patient Matching Stakeholder Value Proposition Matrix

The CoP recognized from its inception that it was highly important to identify the value proposition associated with improved patient matching for each of the key stakeholders. This is true because both time and expense are associated with improving data quality and the associated processes in order to improve patient matching accuracy, so it is important to recognize the cost savings and other incentives as well as the barriers involved in achieving high-accuracy patient matching. The CoP members realized that even if one develops excellent standards, they likely will not be implemented broadly unless a strong case can be made for the incentives and advantages associated with their implementation across a spectrum of stakeholders. Accordingly, the CoP created a subgroup to develop and refine a Patient Match Stakeholder Value Proposition Matrix. The Matrix highlights the value propositions and the barriers associated with improved patient matching for each stakeholder group defined in the ONC Interoperability Roadmap, including patients and family caregivers, providers, payers, public health entities, research and quality improvement organizations, health IT developers, and certification and standards organizations.

Value Propositions for Specific Stakeholder Groups. Examples of patient matching value propositions specific to particular stakeholder groups include:

- For patients and care givers: increased patient safety and an accurate longitudinal medical record

- For healthcare providers and systems: easier access to more comprehensive patient information, reduced costs associated with manual corrections, and improved quality of care

- For payers: reduced payments associated with improved patient safety and better care and outcomes

- For public health organizations: improved public health surveillance and registry data quality

- For organizations that generate new knowledge, such as research organizations: easier access to accurate data for research and more accurate research results

Common barriers for a number of stakeholder groups include implementation costs and resources associated with improving matching accuracy.   The Matrix also describes the general barriers associated with improved patient matching for all stakeholder groups, which include the lack of a national patient identifier, limited effectiveness of current technical solutions, and insufficient access to needed data elements that could improve patient matching accuracy. (See Appendix C. for the Patient Matching Stakeholder Value Proposition Matrix).

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6 Decision to Conduct Pilot Testing of Data Maturity Model in Real-world Delivery Settings

From the inception of the Patient Matching CoP, a central objective has been the desire to develop tools and standards to foster improvement in patient matching accuracy and to identify real-world settings willing to implement them and test their effectiveness. Accordingly, the CoP leaders and members worked with ONC to develop Guidelines for a Pilot Scope of Work that would implement a refined version of the Data Quality Maturity Model in one or more pilot settings, assess the extent to which the pilot organization improved its maturity level, and evaluate the impact of any level improvement on key performance measures, as the duplication rate is measured before and after the intervention. The Venesco contractor who was hired to facilitate the Patient Matching CoP and other CoPs developed draft guidelines for the Pilot Testing of the Data Maturity Model.

AHIMA Critique and Resulting Creation of the Data Management Model. As the guidelines for the pilot were being developed, the CoP asked a knowledgeable expert at AHIMA (not a CoP member) to bring a fresh eye to the review and critique of the Data Quality Maturity Model so it would be sufficiently refined to be implemented as the key intervention in the Pilot Guidelines. Her critique of the overview slide presentation version of the Data Quality Maturity Scale suggested the need for more detail and clarity for the reader and for further examination of the literature to identify other Data Quality Models being used in health and other industries that could be applicable to patient matching and could expand and refine the CoP's maturity level model.   The ONC Champion accordingly reviewed the literature further and identified a promising Data Management Model that had been developed by the CMMI Institute at Carnegie-Mellon University in Pittsburgh, so she followed up with the Carnegie-Mellon leads to better understand their CMMI approach and its applicability to the patient matching use case. This proved to be effective in helping the CoP flesh out the overall design to expand the Maturity Level model into a full-scale Data Management Model tailored to the improvement of data quality and the processes associated with improvement of patient matching.

Design and Anticipated Benefits of the DMM. The Data Management Model is comprised of 6 areas:

- Data Management Strategy
- Data Standards Adherence
- Data Quality
- Operations
- Platform and Architecture
- Support Processes

The expected benefits of implementing a Data Management Model in a healthcare setting are that it will: be health IT developer-agnostic; decrease the administrative burden and cost of healthcare delivery; and establish performance measures, standards, terminology, and best practices that are recognized and utilized nationwide. It is not intended to evaluate matching

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algorithms or analytic tools, nor compare the benefits of deterministic vs. probabilistic matching approaches, nor evaluate developer products.

Defining the Performance and Other Measures to Assess Data Management Model Impact. Discussions of standard measures for assessing and monitoring patient matching accuracy had pervaded the CoP since its inception, since there were no clearly defined standard measures available to help organizations monitor the accuracy of their patient matching nor to provide meaningful and accurate comparisons across organizations. This was also a significant issue in evaluating the impact of the Pilot interventions. The primary measure that had been discussed was the duplication rate, which the CoP calculates as follows: **the # of actual duplications divided by the # of registrations (patient records) = the actual duplication rate.** The definition of a Duplicate Record is: more than one entry or file for the same person in a single facility (database) level Master Person Index (MPI). This causes one patient to have two or more different medical records within the same facility.[6]

Although the CoP considered other important measures, including clinical outcome measures, it was the consensus of the CoP that such measures were not realistic to measure during the 9-month Pilot period. Accordingly, the decision was made to restrict the measurement of before and after pilot intervention impact to the duplication rate. The duplication rate is also attractive because it is relevant to other use cases as well, including multi-organization patient matching in such entities as HIEs, public health registries, quality improvement organizations, and research databases. Despite its potential wider use, the CoP decided that the Pilot sites should be limited to single health care organizations and their registration data quality activities, given the limited time frame for the pilot and the central role of the registration staff and processes as the foundation of accurate patient matching.

7   Overview of Pilot Guidelines and Data Management Model/Maturity Model

Although the Pilot SOW Guidelines are described in more detail elsewhere[8], a brief description of the guidelines for the Pilot is presented below.

Purpose: To implement the Data Management Model and the Data Quality Maturity Model in one or more pilot sites in order to assess its impact on 1) the data quality maturity level, and on 2) the accuracy of patient matching, as measured by assessment of the duplication rate at baseline and following implementation of the Data Management Model/Maturity Scale. A secondary outcome is to further refine the Model based on feedback from the pilot site personnel.

7.1   Measures of Impact
- Assessment of expansion of the appropriate data elements collected
- Extent of improvement in the process and format of such data collection
- Degree of ease, burden, or cost/cost savings associated with the necessary training and implementation of the model in the pilot site(s)

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- Degree of change in the retrospective actual duplication rate between baseline and following full implementation,

- Specific recommendations for changes in the model and/or its implementation by Pilot Site leaders or staff

7.2   Pre-requisites for Participation

Organizations interested in being pilot sites must have the following characteristics:

- A current registration workflow that documents a wide variety of registration modes, including phone, in-person, on-line self-registration, and emergent registration (i.e., patient is not a reliable reporter) as well as eligibility process steps and reconciliation process steps

- Ability to assess its level within the data maturity/management model

- Be able to provide its baseline actual duplication rate and report their duplication rate on a monthly basis throughout the pilot

- Commit to the training and other interventions needed to increase their data quality maturity level

- Be willing to document and share any changes or tuning of their matching algorithm during the pilot

- Be able to provide information needed to demonstrate improved level within the maturity model

- The site's patient matching algorithm must already include the required data elements required at the higher levels of the maturity scale OR the site's patient matching developer must express written willingness to add these specific data elements to the algorithm prior to the start of the pilot to allow accurate assessment of pre-post differences in the duplication rates.

7.3   Sequence of Pilot Tasks over Nine-Month Pilot Period

The pilot will need to provide a Project Director to provide oversight. A Site Project Manager will need to be designated by each Pilot site. The Pilot tasks will include the following:

Task 1:   Start up Activities and Site Selection (Month 1)

Task 2:   Site Activities Preparatory to Pilot Intervention (Month 2)

Task 3:   Initiate the Pilots in Project Sites (Month 3)

Task 4:   Launch of the Full Implementation and Early Assessment of Implementation Adequacy (Month 4-5)

Task 5:   Continuation of Intervention (Month 6-7)

Task 6:   Evaluation and Impact Assessment Activities (Month 8)

Task 7:   Development of Final Report and Recommendations (Month 9).

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Appendix A: Member Organizations in Patient Matching CoP

(Note: ONC provided the Champion and Venesco LLC provided the CoP support contractors.)

Organization
Office of the National Coordinator
Venesco LLC
American Health Information Management Association (AHIMA)
Children's Medical Center of Dallas
Dartmouth University
Delaware Health Information Network (DHIN)
Healthcare Information and Management Systems Society (HIMSS)
HealthPartners Institute (MN)
HIT Impact
Kaiser Permanente Center for Health Research (Portland)
Michigan Health Information Network (MiHIN)
New Jersey HITEC
New York City Department of Health and Mental Hygiene
North Texas Regional Extension Center
University of California at San Diego (UCSD)
ONC Consultant
Oregon Community Health Information Network (OCHIN)
San Diego Health Connect (SDHC)
Sisters of Charity of Leavenworth Health System (SCLHS)

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Appendix B.   Data Quality Maturity Level Scale

Figure 1. Data Quality Maturity Level Scale*†

Item	Level 1	Level 2	Level 3	Level 4	Level 5
Data	Given Name* Last Name* Date of Birth* Gender* Middle Initial Suffix† Race Primary Phone #* Address* Street* State* Zip*	Middle Name Mother's Maiden Name Prefix† Marital Status†	Alias or Previous Name USPS Address† Identifier Last 4 SSN* DL Passport Alien ID#	Multi Birth† Birth Order† Birth Place E-mail* Previous Address† Previous Cell Phone(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 % captured	-	-	-	-

Data Elements in green with asterisk (*) are in the proposed rule
†Data Elements in blue with dagger (†) require structured data capture

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Appendix C.   Patient Match Stakeholder Value Proposition Matrix

The following Stakeholder Value Proposition Matrix is broken down according to the stakeholder categories and definitions provided in the ONC Interoperability Roadmap.   The overall rationale of the matrix is to identify both value propositions for and barriers to improving patient matching accuracy for each stakeholder group. These positive and negative factors are key considerations in implementing any approach to establishing and disseminating patient matching standards and processes. Value propositions include incentives, ROI/cost savings, or other advantages associated with the changes needed to improve patient matching. Barriers to such changes include the perceived or actual negative factors associated with such changes for specific stakeholders. Additionally, there are General Barriers including the lack of a unique patient identifier, federal restrictions on funding the development of a unique patient identifier, limited effectiveness of current technical solutions, and insufficient access to needed data elements that could improve patient matching accuracy. These general barriers to improved patient matching affect all stakeholder groups.

Stakeholder Group	Roadmap Definition	Role	Value Proposition	Barrier
People who receive care or support the care of others	Individuals, consumers, patients, caregivers, family members serving in a non-professional role and professional organizations that represent these stakeholders' best interests	End User Decision Maker Influencer Recommender	Higher patient safety Access to correct longitudinal patient record More effective visits Reduction of patient cost Reduce multiple visits Reduced hassle of record and follow-up corrections Avoid need to carry paper record	Implementation costs and resources Lack of education concerning benefits of improved accuracy Concern about privacy and data breaches
People and organizations that deliver care and services	Professional care providers who deliver care across the continuum, not limited to but including hospitals, ambulatory providers, pharmacies, laboratories, behavioral health including mental health and substance abuse services, home and community based services, nursing homes and professional organizations that represent these stakeholders' best interests	End User Decision Maker Influencer Recommender Financer Saboteur	Easier access to more comprehensive patient information and care plan Improve quality of care Reduced costs associated with correction of manual errors Reduce multiple visits Access to correct longitudinal patient record	Implementation costs and resources Concern about their patients' privacy and data breaches

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Stakeholder Group	Roadmap Definition	Role	Value Proposition	Barrier
Organizations that pay for care	Private payers, employers and public payers that pay for programs like Medicare, Medicaid and Tricare	End User Decision Maker Influencer Recommender Financer Saboteur	Reduction of non-payment Easier claim settlement due to easier access to accurate records Reduced payments associated with improved patient safety and better care and outcomes	Implementation costs and resources Data breaches
People and organizations that support the public good (including the public health)	Federal, state, tribal and local governments	End User Decision Maker Influencer Recommender Saboteur	Improved public health surveillance and public health registries More Accurate data	Implementation costs and resources Data breaches
People and organizations that generate new knowledge, whether research or quality improvement	Researchers, population health analytics and quality improvement knowledge curators and quality measure standards	End User Decision Maker Influencer Recommender Financer Saboteur	Easier access to accurate data More accurate research knowledge Better evidence to guide quality improvement.	Implementation costs and resources Data breaches
People and organizations that provide health IT capabilities	Technology developers for EHR and other health IT, including but not limited to health information exchange (HIE) technology, laboratory information systems, personal health records, pharmacy systems, mobile technology, medical device manufacturers and other technology that provides health IT capabilities and services	Influencer Financer Saboteur	Streamlined information Reduced overall cost after implementation	Data breaches Data entry Implementation costs and resources

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Stakeholder Group	Roadmap Definition	Role	Value Proposition	Barrier
People and organizations that govern, certify and/or have oversight	Governing bodies and accreditation/certification bodies operating at local, regional, or national levels that provide a governance structure, contractual arrangements, rules of engagement, best practices, processes and/or assess compliance	End User Decision Maker Influencer Recommender Financer Saboteur	Accurate data needed for accurate standards for governance, certification, and oversight	Implementation costs and resources
People and organizations that develop and maintain standards	Standards development organizations (SDOs) and their communities of participants, such as technology developers, health systems, providers, government, associations, etc.	Decision Maker Influencer Recommender Saboteur	Accuracy of data is essential to applying standards.	Implementation costs and resources