



M&I Patient Matching – HL7 Pulse Check

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Session 2C / Using Measurement & Improvement to Advance IIS

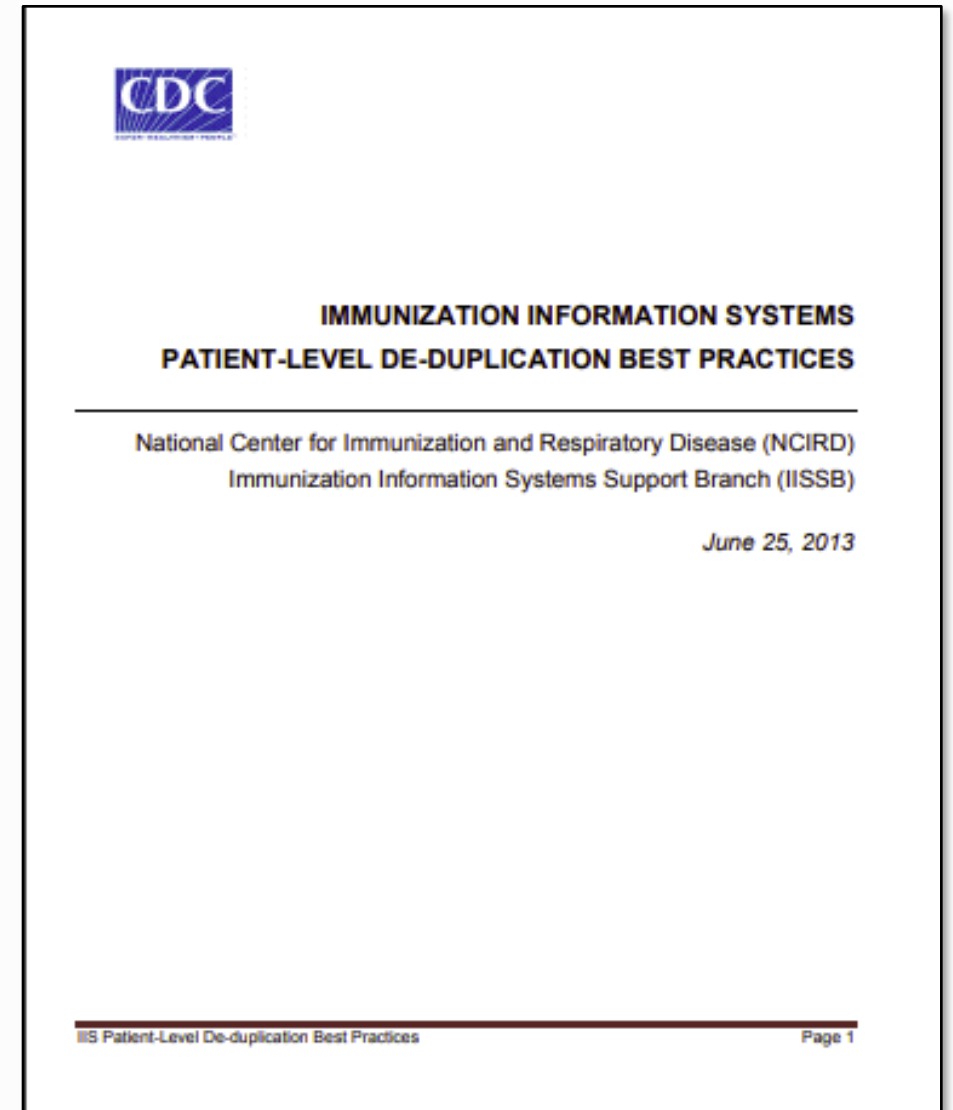
Patient Matching

Identification and linking of one patient's data within and across health systems in order to obtain a comprehensive view of that patient's health care record



Published Material

- Immunization Information Systems Patient-Level Deduplication Best Practices
 - June 25, 2013



Scope

In Scope

- Patients that likely should have matched through
 - HL7 Testing
 - Data at Rest (not discussed today)

Out of Scope

- Patients that likely should NOT have matched
- Complex scenarios, such as:
 - Marriage with new last name and address for an existing patient
 - “Baby Girl” from birthing hospital matched to “Penelope”
 - Twins with identical first names
- Traditional scoring calculations for patient matching, such as:
 - Sensitivity, Specificity, F-Score, Positive Predictive Value
- Record consolidation rules

Concepts

IIS ability to match records with:

- First, Middle, and Last Name Variations
 - Alias (e.g., Robert -> Bob)
 - Special Characters (e.g., Rae'Lyn -> Raelyn)
 - Spelling Variation (e.g., Sara -> Sarah)
 - Name Order (e.g., Abdur-Rahman -> Rahman-Abdur)
 - First/Middle Name Concatenation
 - Middle Name/Initial Variation
- Address Standardization
- Other Key Fields
 - Date of Birth
 - Gender
 - Email
 - Phone
- Etc...



IMMUNIZATION INFORMATION SYSTEMS PATIENT-LEVEL DE-DUPLICATION BEST PRACTICES

National Center for Immunization and Respiratory Disease (NCIRD)
Immunization Information Systems Support Branch (IISSB)

Methods

HL7 Method

- Submit demographic changes between 1st and 2nd VXU
 - Then query to validate match
- Test from different perspectives
 - Single Provider (same MRN)
 - Two Unrelated Providers (different MRNs)
- Measures
 - n=306 for Testing & Discovery
 - n=212 for Assessment
 - Field of interest
 - Scenario

Testing Steps

Test Case Execution

1. VXU A- First name = "Harold" + hep. A vaccine
2. VXU B- First name = "Harry" + hep. B vaccine
- ...
- <wait for matching to finish>
- ...
3. QBP A- with demographics from VXU A
4. QBP B- with demographics from VXU B

Expected Outcome

Single patient found with both hep. A and hep. B vaccination events

Patient Matching Single Org. – HL7

- Initial Patient Matching – HL7 content area
 - Assessment Stage
- Tests scenario of a patient obtaining vaccines from the same organization with slightly different demographics (e.g. “Dave” for shot #1, “David” for shot #2)
- MRNs are identical
- All other fields (besides first name) are identical

Single Organization Testing Methodology

Field	AART VXU 1	Transformation Procedure
First Name	John	FIRST_NAME_ ALTERNATIVE_SPELLINGS
Last Name	Jones	
Medical Record	1234	
Sending Provider	North Hospital	
Date of Birth	20201101	
Address Line 1	100 Main St.	
Vaccine Doses	hepatitis A	

Single Organization Testing Methodology

Field	AART VXU 1	Transformation Procedure	AART VXU 2
First Name	John	FIRST_NAME_ ALTERNATIVE_SPELLINGS	Jon
Last Name	Jones		Jones
Medical Record	1234		1234
Sending Provider	North Hospital		North Hospital
Date of Birth	20201101		20201101
Address Line 1	100 Main St.		100 Main St.
Vaccine Doses	hepatitis A		hepatitis B

Single Organization Testing Methodology

Field	AART VXU 1	Transformation Procedure	AART VXU 2	IIS Consolidated Record
First Name	John	FIRST_NAME_ ALTERNATIVE_SPELLINGS	Jon	Jon <u>or</u> John
Last Name	Jones		Jones	Jones
Medical Record	1234		1234	1234
Sending Provider	North Hospital		North Hospital	North Hospital
Date of Birth	20201101		20201101	20201101
Address Line 1	100 Main St.		100 Main St.	100 Main St.
Vaccine Doses	hepatitis A		hepatitis B	hepatitis A & B

Example VXU 1

```
MSH|^~\&||ORG1|||20230108140619-0400||VXU^V04^VXU V04|2SLG-MPAT-  
SO-FN-Nickname-01.1|P|2.5.1|||ER|AL|||Z22^CDCPHINVS  
PID|1||E82L191781^^^AIRA-TEST^MR  
||FitzpatrickAIRA^Harold^Afton^^^L|CarterAIRA^MadgeAIRA^^^M|  
20181108|F||2106-3^White^CDCREC|1046 Nam St^^Grand  
Blanc^MI^48480^USA^P|^NET^example@example.com|||||2186-5^not  
Hispanic or Latino^CDCREC  
PD1|||||||02^Reminder/Recall - any  
method^HL70215|||||A|20230108|20230108  
NK1|1|FitzpatrickAIRA^CarterAIRA^^^L|MTH^Mother^HL70063|1046 Nam  
St^^Grand Blanc^MI^48480^USA^P|^PRN^PH^^^810^9094343  
ORC|RE||BE82L191781.1^AIRA|||||I-23432^Burden^Donna^A^^^NIST-  
AA-1  
RXA|0|1|20221108||83^Hep A Peds^CVX|999|||01^Historical  
information - source unspecified^NIP001|||||CP|A
```

Changing fields - [PID-5.2](#), [RXA-5](#)

Example VXU 2

```
MSH|^~\&||ORG1|||20230108140619-0400||VXU^V04^VXU V04|2SLG-MPAT-  
SO-FN-Nickname-01.1|P|2.5.1|||ER|AL|||Z22^CDCPHINVS  
PID|1||E82L191781^^^AIRA-TEST^MR  
||FitzpatrickAIRA^Harry^Afton^^^L|CarterAIRA^MadgeAIRA^^^M|  
20181108|F||2106-3^White^CDCREC|1046 Nam St^^Grand  
Blanc^MI^48480^USA^P|^NET^example@example.com|||||2186-5^not  
Hispanic or Latino^CDCREC  
PD1|||||02^Reminder/Recall - any  
method^HL70215||||A|20230108|20230108  
NK1|1|FitzpatrickAIRA^CarterAIRA^^^L|MTH^Mother^HL70063|1046 Nam  
St^^Grand Blanc^MI^48480^USA^P|^PRN^PH^^^810^9094343  
ORC|RE||BE82L191781.1^AIRA|||||I-23432^Burden^Donna^A^^^NIST-  
AA-1  
RXA|0|1|20221108||08^Hepatitis B^CVX|999|||01^Historical  
information - source unspecified^NIP001|||||CP|A
```

Changing fields - [PID-5.2](#), [RXA-5](#)

Patient Matching Multiple Orgs. – HL7

- Expansion of the Patient Matching – HL7 content area
 - Testing & Discovery
- Tests common real-world scenario of a patient obtaining vaccines from multiple organizations with slightly different demographics (e.g. “Dave” at doctor’s office “David” at pharmacy)
- Testing & Discovery results are lower than for Patient Matching Single Organization - HL7
 - Potential improvement area for IIS

Multiple Organization Testing Methodology

Field	AART VXU 1	Transformation Procedure
First Name	John	FIRST_NAME_ ALTERNATIVE_SPELLINGS
Last Name	Jones	
Medical Record	1234	
Sending Provider	North Hospital	
Date of Birth	20201101	
Address Line 1	100 Main St.	
Vaccine Doses	hepatitis A	

Multiple Organization Testing Methodology

Field	AART VXU 1	Transformation Procedure	AART VXU 2
First Name	John	FIRST_NAME_ ALTERNATIVE_SPELLINGS	Jon
Last Name	Jones		Jones
Medical Record	1234		5678
Sending Provider	North Hospital		East Pharmacy
Date of Birth	20201101		20201101
Address Line 1	100 Main St.		100 Main St.
Vaccine Doses	hepatitis A		hepatitis B

Multiple Organization Testing Methodology

Field	AART VXU 1	Transformation Procedure	AART VXU 2	IIS Consolidated Record
First Name	John	FIRST_NAME_ ALTERNATIVE_SPELLINGS	Jon	Jon <u>or</u> John
Last Name	Jones		Jones	Jones
Medical Record	1234		5678	1234 <u>or</u> 5678
Sending Provider	North Hospital		East Pharmacy	--
Date of Birth	20201101		20201101	20201101
Address Line 1	100 Main St.		100 Main St.	100 Main St.
Vaccine Doses	hepatitis A		hepatitis B	hepatitis A & B

Example VXU 1

```
MSH|^~\&||ORG1|||20230108140619-0400||VXU^V04^VXU_V04|2SLG-  
MPAT-SO-FN-Nickname-01.1|P|2.5.1|||ER|AL|||Z22^CDCPHINVS  
PID|1||E82L191781^^^AIRA-  
TEST^MR||FitzpatrickAIRA^Harold^Afton^^^L|CarterAIRA^MadgeA  
IRA^^^M|20181108|F||2106-3^White^CDCREC|1046 Nam St^^Grand  
Blanc^MI^48480^USA^P|^NET^example@example.com|||||||2186  
-5^not Hispanic or Latino^CDCREC  
PD1|||||||02^Reminder/Recall - any  
method^HL70215|||||A|20230108|20230108  
NK1|1|FitzpatrickAIRA^CarterAIRA^^^L|MTH^Mother^HL70063|10  
46 Nam St^^Grand Blanc^MI^48480^USA^P|^PRN^PH^^^810^9094343  
ORC|RE||BE82L191781.1^AIRA|||||I-  
23432^Burden^Donna^A^^^NIST-AA-1  
RXA|0|1|20221108||83^Hep A Peds^CVX|999|||01^Historical  
information - source unspecified^NIP001|||||||CP|A
```

Changing fields - MSH-4, PID-3.1, PID-3.4, PID-5.2, RXA-5

Example VXU 2

```
MSH|^~\&||ORG2|||20230108140619-0400||VXU^V04^VXU V04|2SLG-MPAT-  
SO-FN-Nickname-01.1|P|2.5.1|||ER|AL|||Z22^CDCPHINVS  
PID|1||E82L191782^^^AIRA2-  
TEST^MR||FitzpatrickAIRA^Harry^Afton^^^L|CarterAIRA^MadgeAIRA^^^  
^^M|20181108|F||2106-3^White^CDCREC|1046 Nam St^^Grand  
Blanc^MI^48480^USA^P|^NET^^example@example.com|||||||2186-5^not  
Hispanic or Latino^CDCREC  
PD1|||||||02^Reminder/Recall - any  
method^HL70215|||||A|20230108|20230108  
NK1|1|FitzpatrickAIRA^CarterAIRA^^^L|MTH^Mother^HL70063|1046 Nam  
St^^Grand Blanc^MI^48480^USA^P|^PRN^PH^^^810^9094343  
ORC|RE||BE82L191781.1^AIRA|||||I-23432^Burden^Donna^A^^^NIST-  
AA-1  
RXA|0|1|20221108||08^Hepatitis B^CVX|999|||01^Historical  
information - source unspecified^NIP001|||||||CP|A
```

Changing fields - MSH-4, PID-3.1, PID-3.4, PID-5.2, RXA-5

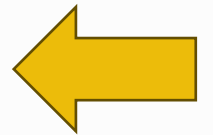
Single Org. v. Multi. Org. Performance

	Submission			Query			Total	
	Single Org.	Multi. Org.		Single Org.	Multi. Org.		Single Org.	Multi. Org.
Meets	93.77%	80.57%		91.89%	79.37%		92.83%	79.97%
Does not Meet	4.09%	17.30%		5.97%	18.53%		5.03%	17.92%
Not Measured	2.14%	2.12%		2.14%	2.10%		2.14%	2.11%

Q1 2026

Single Org. v. Multi. Org. Performance

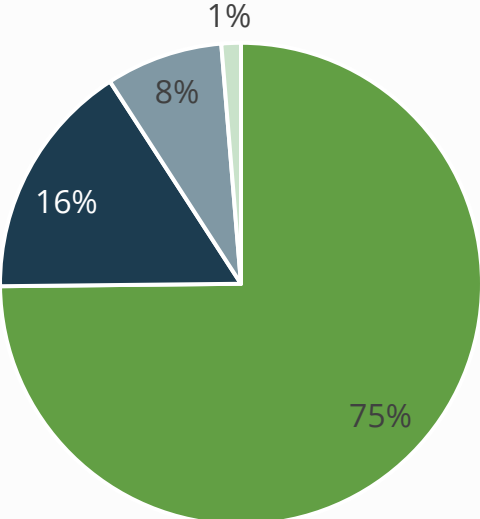
	Submission			Query			Total	
	Single Org.	Multi. Org.		Single Org.	Multi. Org.		Single Org.	Multi. Org.
Meets	93.77%	80.57%		91.89%	79.37%		92.83%	79.97%
Does not Meet	4.09%	17.30%		5.97%	18.53%		5.03%	17.92%
Not Measured	2.14%	2.12%		2.14%	2.10%		2.14%	2.11%



Q1 2026

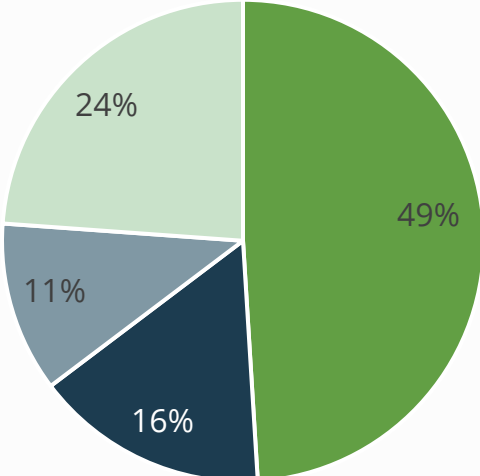
Measures Categorized by Performance

- Single



■ Well >90% ■ Fairly Well (80-89%) ■ Fair (70-79%) ■ Poor (<70%)

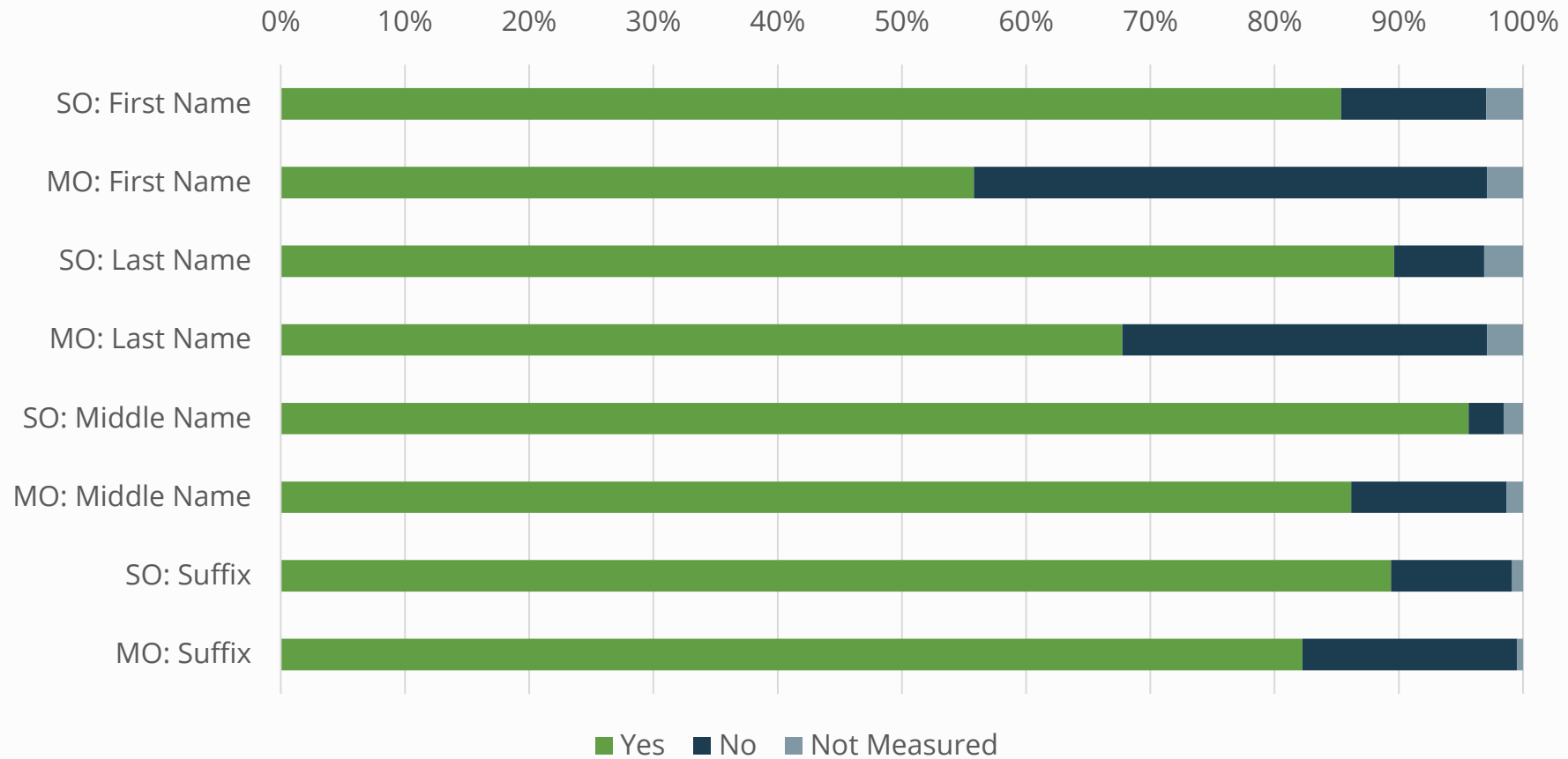
- Multiple



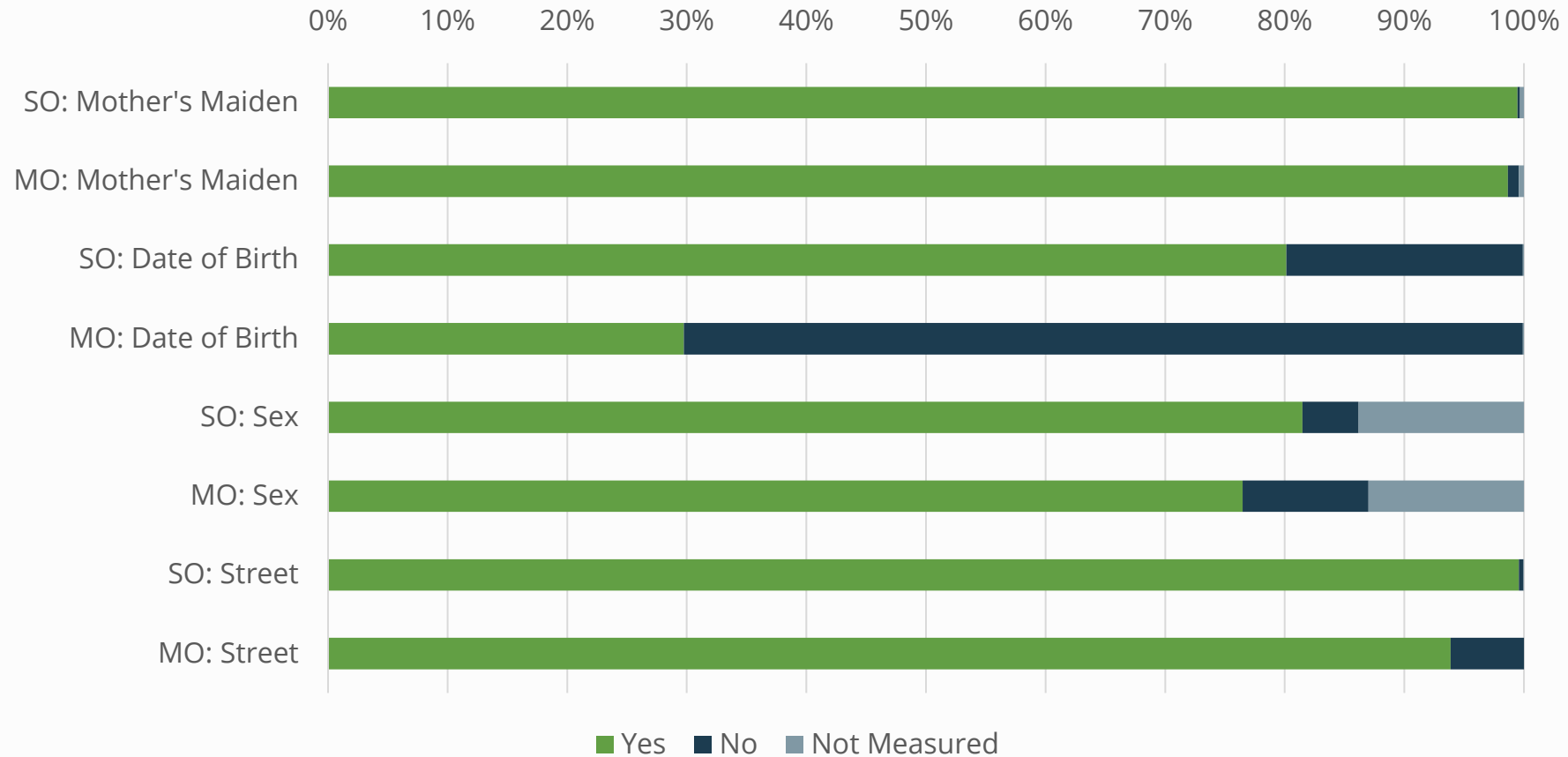
Q1 2026

■ Well >90% ■ Fairly Well (80-89%) ■ Fair (70-79%) ■ Poor (<70%)

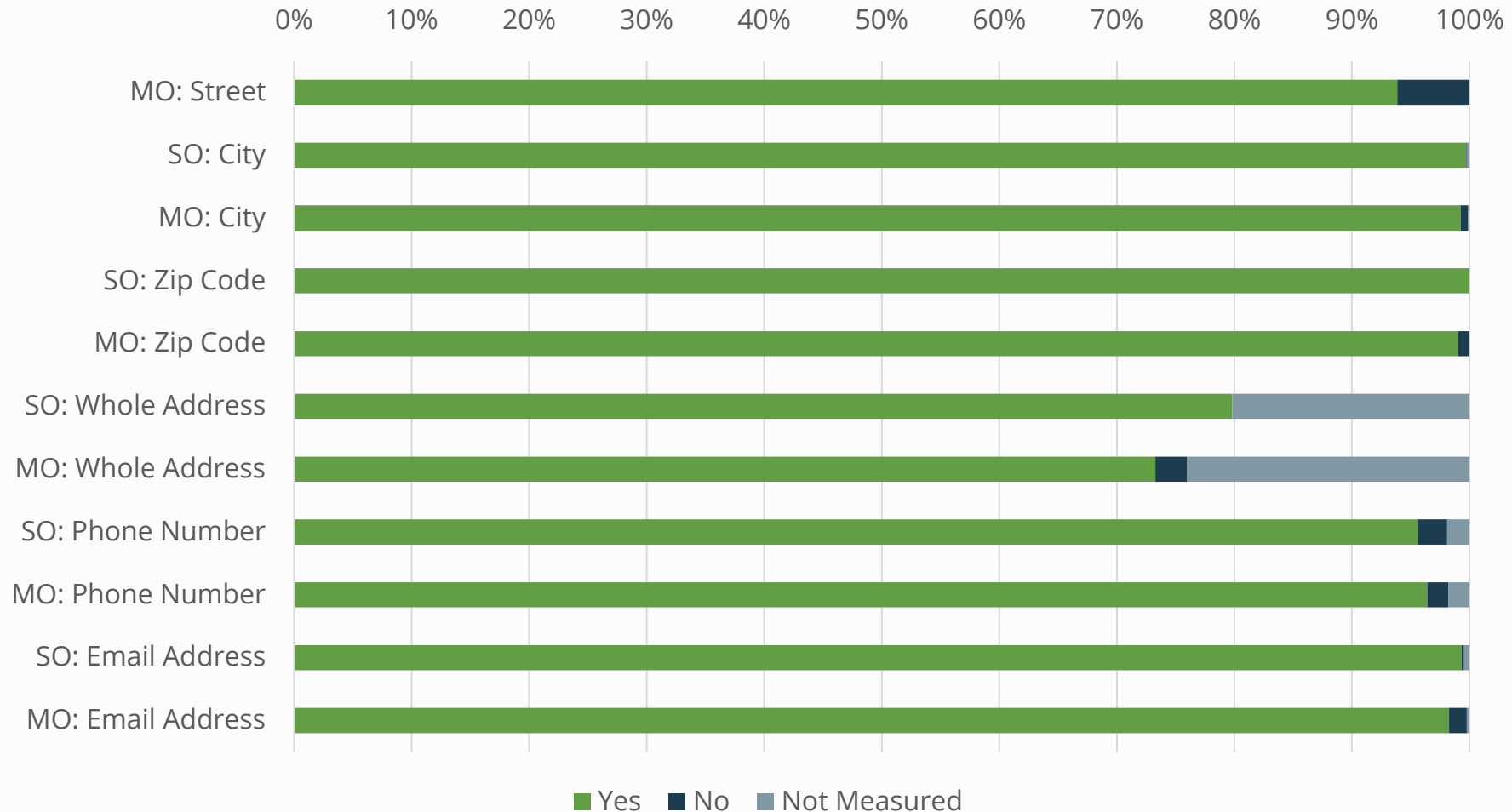
Performance by Field Group 1



Performance by Field Group 2



Performance by Field Group 3











Priorities for IIS Patient Matching Algorithms

- Multiple Organization Patient Matching as a Whole
- Align patient matching algorithms across use cases
- Less reliance on MRN
- Specific Fields
 - First Name
 - Last Name
 - Date of Birth

Patient Matching Today

Assessment

IIS Assessment involves more formal testing to measure individual IIS systems using IIS community-selected measures and tests.

Content Area	Assessment Results
Transport Assessment	2 of 3 <small>Q3 2025</small> 
Submission and Acknowledgement Assessment	16 of 16 <small>Q3 2025</small> 
Query and Response Assessment	5 of 8 <small>Q3 2025</small> 
Data Quality Incoming/Ongoing Assessment	25 of 27 <small>Q3 2025</small> 
Clinical Decision Support Assessment	5 of 12 <small>Q3 2025</small> 
DAR Assessment	35 of 45 <small>2024</small> 
Patient Matching – HL7 Submission Assessment	208 of 212 <small>Q3 2025</small> 
Patient Matching – HL7 Query Assessment	208 of 212 <small>Q3 2025</small> 

Patient Matching – HL7 Submission

This content area focuses on IIS ability to accurately match patients and merge them into a single consolidated record. The IIS will be sent a new patient's record with a hepatitis A vaccine dose. Then, a few moments later the IIS will be sent a very similar patient's records with a hepatitis B vaccine dose. Each pair of messages will be isolated to one aspect of patient matching – a single change in a demographic field being modified in a prescribed manner. After sending both patient's records, queries for each will be sent to the IIS. Ideally, an IIS will respond with a consolidated immunization record, that includes both hepatitis A and B doses.

Continues...

+1 Query

+1 Multi Org. Submission

+1 Muti Org. Query



Assessments > Patient Matching – HL7 Submission Assessment

Assessment Details

[View Assessment History](#)

Assessment

208 of 212 Q3 2025



[Compare with my peers](#)

Patient Matching Today

Background

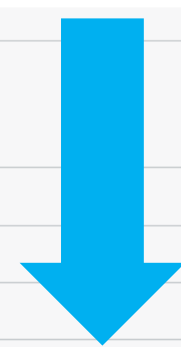
About the Assessment

Measure Outcomes

Limitations of Report & General Recommendations

Continues...

+ 205 measures



Assessment Measures

View:

Meets Doesn't Meet Deviates Not Measure

▶ S-PREQ-N-PREQ-001	Patient Matching Prerequisite Measure	✓
▶ FINM-ABEG-N-S-001	First Name - AltBeginnings - Minimum Demographics - 01	✓
▶ FINM-ABEG-X-S-001	First Name - AltBeginnings - Maximum Demographics - 01	✗
▶ FINM-AEND-N-S-001	First Name - AltEndings - Minimum Demographics - 01	✓
▶ FINM-AEND-X-S-001	First Name - AltEndings - Maximum Demographics - 01	✓
▶ FINM-AENV-N-S-001	First Name - AltEndVowels - Minimum Demographics - 01	✓

Vision for the Future

- Four reports moving to a unified content area and/or report:
 - Single v. Multiple Orgs.
 - Submission v. Query

CONCEPT	SUBMISSION OR QUERY	RESULT	PASSED	FIRST	LAST	MIDDLE	SUFFIX	ADDRESS	STREET	CITY
Multiple Org	Query - Name Fields	Does Not Meet	76%	✗	✓	✗	✓			
Multiple Org	Query - Contact Fields	Does Not Meet	76%					✗	✗	✓
Multiple Org	Query - Other Fields	Does Not Meet	74%							
Multiple Org	Submission - Name Fields	Deviates	82%	✗	✓	⚡	✓			
Multiple Org	Submission - Contact Fields	Does Not Meet	76%					✗	✗	✓
Multiple Org	Submission - Other Fields	Does Not Meet	74%							
Single Org	Query - Name Fields	Deviates	85%	⚡	✓	✗	✓			
Single Org	Query - Contact Fields	Deviates	87%					✗	✓	✓
Single Org	Query - Other Fields	Deviates	89%							
Single Org	Submission - Name Fields	Meets	92%	⚡	✓	✓	✓			
Single Org	Submission - Contact Fields	Deviates	89%					✗	✓	✓
Single Org	Submission - Other Fields	Meets	90%							