AIRA
AMERICAN IMMUNIZATION REGISTRY ASSOCIATION

Clinical Decision Support Assessment

Aggregate Report

2022 – Quarter 3

M&I
MEASUREMENT & IMPROVEMENT

Background

In 2015, AIRA launched a testing and discovery project to determine the level of alignment between current immunization information systems (IIS) and the community's alignment with community vetted standards and recommendations. This Measurement and Improvement (M&I) Initiative is an ongoing project that connects with IIS pre-production systems directly and submits sample messages to these IIS development platforms.

Testing and Discovery (T&D) is the first stage of the overall IIS M&I process. The next stage is IIS Assessment. The results from T&D are used to design the final measures and tests for the IIS Assessment process, which also relies on IIS Functional Standards and Operational Guidance Statements. The final stage following IIS Assessment is Validation.

In early 2016, the Measurement for Assessment and Certification Advisory Workgroup (MACAW) was initiated to systematically research and formulate key IIS assessment components, develop measures, and implement the IIS assessment and validation process. MACAW utilizes T&D results to identify and develop assessment measures for specific IIS components. Those measures are then vetted and approved by the IIS community. **Clinical Decision Support (CDS)** is the fourth content area of the M&I Initiative, and this report contains the aggregate results of the IIS Assessment completed in **Quarter 3 of 2022**. This process will be repeated in Quarter 4 of 2022 to measure progress within the community.

In addition to this aggregate report, a detailed individual report is provided to each jurisdiction for use within their own projects. AIRA does not redistribute any individual IIS results outside of their respective jurisdiction and self-selected sharing settings within the Aggregate Analysis Reporting Tool (AART).

The CDS Assessment process utilizes the National Institute of Standards and Technology (NIST) Forecasting for Immunization Test Suite (FITS). This tool provides consistent results for all measured IIS. In addition, the requirements for accurate immunization based CDS are documented as part of the Centers for Disease Control and Prevention (CDC) Clinical Decision Support for Immunization (CDSi) project.

It is important to note that immunization recommendations are updated and changed regularly throughout the year by the Advisory Committee for Immunization Practices (ACIP).

This report represents a quarterly snapshot of standards alignment and, in conjunction with each jurisdiction's individual report, can provide valuable information to guide ongoing and upcoming enhancements.

CDS Measures

The CDS Assessment spans 12 measures in all; these measures are guided by the following Functional Standards. Visit the AIRA repository to review the detailed measures and tests.

Functional Standard 10.0: The IIS forecasts pediatric, adolescent, and adult immunizations in a manner consistent with the Advisory Committee on Immunization Practices (ACIP) recommendations.

> **10.1:** The IIS uses Clinical Decision Support (CDS) functionality that can be updated to reflect new or revised ACIP recommendations.
>
> **10.2:** The IIS displays and sends an evaluated immunization history that adheres to ACIP recommendations for each vaccination event.
>
> **10.3:** The IIS displays and sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family.
>
> **10.4:** The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC Clinical Decision Support for immunization (CDSi) resources published on the CDC website.

The measures focus on three CDS concepts that can be returned in a Health Level 7 (HL7) message as defined in the CDSi resources and the Functional Guide Volume on Query and Response. The concepts—defined below—are the Evaluation Status, Earliest Date, and Recommended Date. Each IIS is assessed on capability to return a concept and on accuracy, if the concept is returned.

This results in a total of four measures for each CDS concept:

- One capability measure to measure if the concept is returned
- Three accuracy measures to measure the content returned, one each for pediatric, adolescent, and adult

Evaluation Status

Definition: The determination if the vaccine event "counted" (e.g., valid, not valid).

1. The IIS HL7 interface returns an Evaluation Status (e.g., dose validity) for each vaccination event.
2. The Evaluation Status returned by the IIS matches the CDC CDSi expected value for routine age-based pediatric recommendations.
3. The Evaluation Status returned by the IIS matches the CDC CDSi expected value for routine age-based adolescent recommendations.

4. The Evaluation Status returned by the IIS matches the CDC CDSi expected value for routine age-based adult recommendations.

Earliest Date

Definition: The date at which point the patient could receive the next dose if the patient was likely not to return or has other reasons to accelerate the schedule more quickly than the recommended date.

1. The IIS HL7 interface returns an Earliest Date for each forecasted dose.
2. The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based pediatric recommendations.
3. The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based adolescent recommendations.
4. The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based adult recommendations.

Recommended Date

Definition: The date at which point the patient should receive the next dose.

1. The IIS HL7 interface returns a Recommended Date for each forecasted dose.
2. The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based pediatric recommendations.
3. The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based adolescent recommendations.
4. The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based adult recommendations.

Test Cases

The MACAW members developed high-level strategies for establishing detailed test cases for each measure. Test cases were developed with the following guiding principles in mind:

- **Isolate the test case to the measure:** Each test case should be isolated to the measure to ensure consistent measurement across all IIS.
- **Expectations for a test case should be few, not many:** Multiple expectations—either in number or variation—lead to inconsistencies in assessment across all IIS. For example, IIS “A” could fail for one reason while IIS “B” could fail for a different reason. When results are aggregated across all IIS, it becomes difficult to discern variations and develop actionable improvement strategies.
- **Leverage current CDC CDSi test cases:** Test cases created and vetted by the community should be reused, when possible. CDS Assessment will use the CDSi

published test cases as soon as they are available. With each published version of CDSi test cases, the CDS Assessment will test, but not score, new or changed CDSi test cases during their first quarterly assessment. They will be included in scoring during subsequent quarters. This approach will allow IIS to see the new or changed test cases and address them prior to the next quarterly assessment.

- **Also measure the middle:** CDSi test cases focus on the edge—or boundary—between valid and invalid doses. This is an interesting area and much needed, but many vaccines are administered at the recommended time and forecasting should be tested in these cases as well. Additional test cases have been added by AIRA to test typical administration patterns.

Test Outcomes

Each test case has a defined Test Case Expectation. The test cases and test case expectations are used during testing to determine how well a CDS engine aligns with the CDC CDSi expectations. Each test is marked as either "Meets" or "Does Not Meet" based on the CDC CDSi expectations.

Measure Outcomes

Each measure is given a "degree of alignment" score by dividing the number of test cases passed by the number of total tests within a measure.

The degree of alignment score is used to determine a Measure Outcome defined as follows[1]:

- **Meets:** The IIS has a degree of alignment score of at least 90% or more.
- **Deviates:** The IIS has a degree of alignment score of at least 89% but less than 80%.
- **Does Not Meet:** The IIS has a degree of alignment score of less than 80%.
- **Vaccine Family Threshold:** The IIS will be downgraded one measure outcome level (e.g., from Meets to Deviates) if any individual vaccine family has a degree of alignment below 65%, provided at least 10 test cases exist within the vaccine family.

Given there are several hundred test cases, a tool has been developed to help the IIS community determine which test cases are associated with each measure. This interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.

[1] Note that thresholds for Deviates and Does Not Meet changed in Q1 2021. In 2019 & 2020, the threshold for Deviates was 65-89%. In 2019 & 2020, the threshold for Does Not Meet was less than 65%.

Testing Method

Each test case will be first submitted to the IIS via an HL7 VXU submission. A query (QBP) will then be issued for the patient, and the response (RSP) will be analyzed. The query (QBP) will be either the Z34 (Complete History) or the Z44 (Evaluated History and Forecast), based on IIS preference. Both of those query responses can contain clinical decision support.

Results

Sixty-one[2] IIS were encouraged to be measured to be measured in the CDS Assessment. Of the 61 participating IIS[3], **48 (79%)** could be measured and are included in this report.

IIS were unable to be measured for the following reasons:

- **5** •The # of IIS unable to process the submission and respond to a query for the patient in a timely manner.
- **2** •The # of IIS that are currently unavailable for measurement or to which AIRA is not connected
- **5** •The # of IIS that either do not include CDS in its response to a query or the CDS returned is not meeting HL7 standards so it cannot be measured.
- **1** •The # IIS that do not have query capability.

CDS Concepts Supported

Measures 1, 5, and 9 assess which CDS concepts are supported as part of an IIS HL7 interface. Of the 48 IIS that were assessed, the following table shows how many IIS support the CDS concepts.

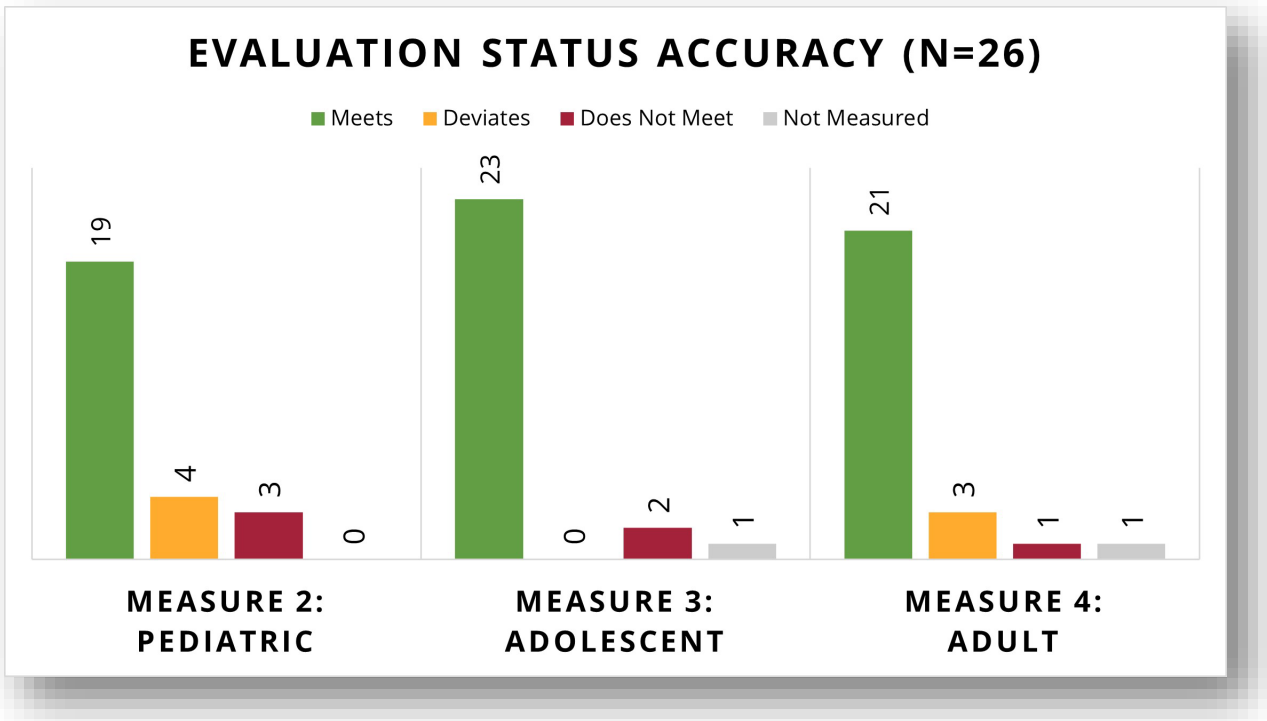
[2] The denominator for M&I participation decreased from 62 to 61 in Q2 2022, due to San Diego IIS merge with CA's state IIS.

[3] Includes all 50 states, American Samoa, the Commonwealth of the Northern Mariana Islands, the District of Columbia, the Federated States of Micronesia, Guam, New York City, Philadelphia, Puerto Rico, the Republic of the Marshall Islands, the Republic of Palau, and the Virgin Islands.

CDS Concept	Supports (N=48)
Measure 1: Evaluation Status *Did the dose count?*	**26**
Measure 5: Earliest Date *When could the next dose be given?*	**45**
Measure 9: Recommended Date *When should the next dose be given?*	**48**

Evaluation Status Accuracy Results

Measures 2 (Pediatric), 3 (Adolescent), and 4 (Adult) measure the accuracy of the Evaluation Status when it is returned by the IIS. Twenty-six IIS (see Measure 1 above) supported Evaluation Status and were measured for their alignment with the CDSi expectations.

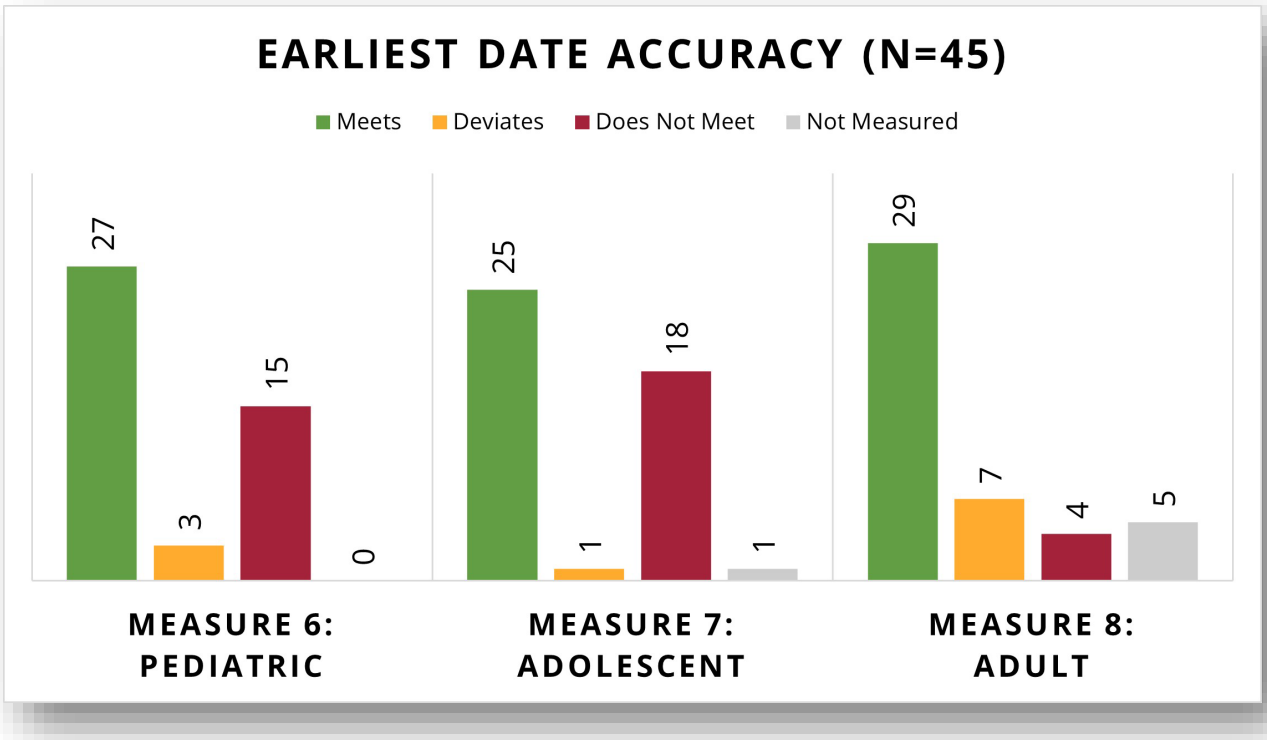


Of the **26 IIS assessed for Evaluation Status**, the following high-level observations provide additional context for reading and interpreting the aggregate results graph:

- **Pediatric Measure:**
    - **Vaccine Family Threshold:** One IIS was downgraded from Meets to Deviates because at least one vaccine family was below the vaccine family threshold. One IIS was downgraded from Deviates to Does Not Meet because at least one vaccine family was below the vaccine family threshold.
- **Adolescent Measure:**
    - **Not Measured:** One IIS showed support for Evaluation Status but did not return it consistently across all vaccine families. As such, IIS accuracy could not be measured.
- **Adult Measure:**
    - **Not Measured:** One IIS showed support for Evaluation Status but did not return it consistently across all vaccine families. As such, IIS accuracy could not be measured.

Earliest Date Accuracy Results

Measures 6 (Pediatric), 7 (Adolescent), and 8 (Adult) measure the accuracy of the Earliest Date when it is returned by the IIS. Forty-five IIS (see Measure 5 above) supported Earliest Date and were measured for their alignment with the CDSi expectations.

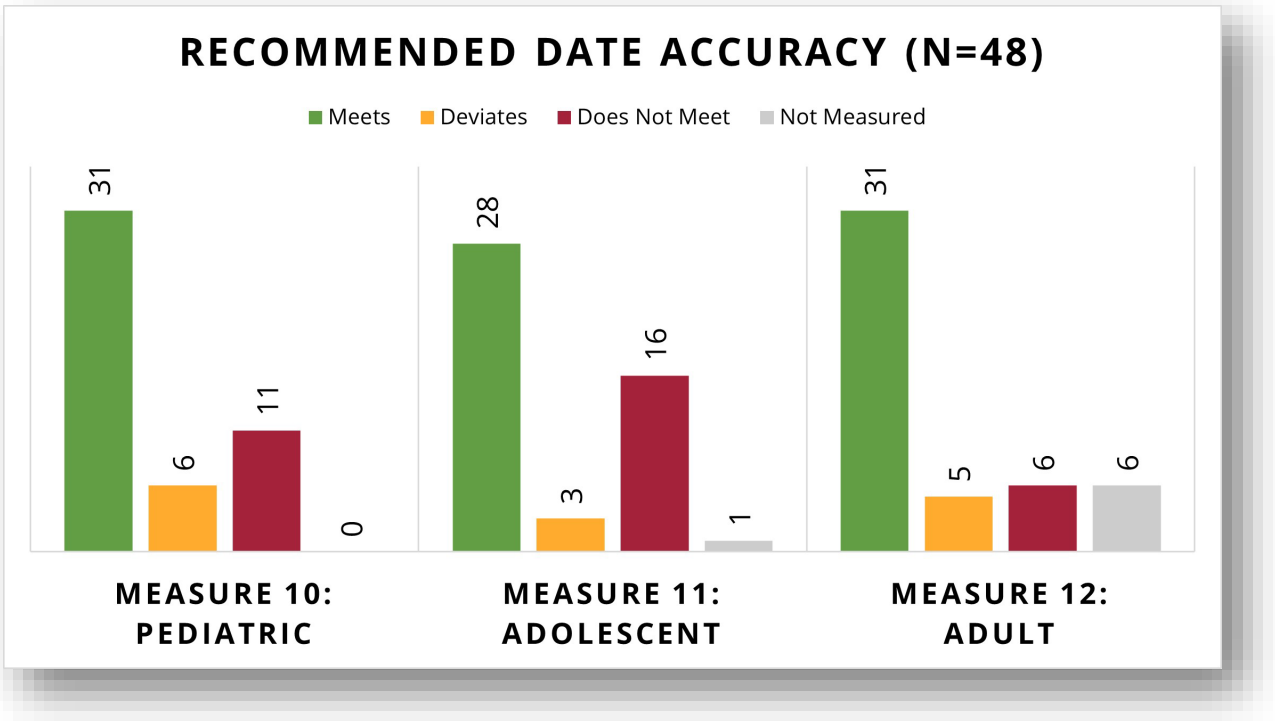


Of the 45 IIS assessed for Earliest Date, the following high-level observations provide additional context for reading and interpreting the aggregate results graph:

- **Pediatric Measure:**
    - **Vaccine Family Threshold:** Eight IIS were downgraded from Deviates to Does Not Meet because at least one vaccine family was below the vaccine family threshold.
- **Adolescent Measure:**
    - **Not Measured:** One IIS showed support for Earliest Date but did not return it consistently across all vaccine families. As such, IIS accuracy could not be measured.
    - **Vaccine Family Threshold:** Six IIS were downgraded from Deviates to Does Not Meet because at least one vaccine family was below the vaccine family threshold.
- **Adult Measure:**
    - **Not Measured:** Five IIS showed support for Earliest Date but did not return it consistently across all vaccine families. As such, IIS accuracy could not be measured.

Recommended Date Accuracy Results

Measures 10 (Pediatric), 11 (Adolescent), and 12 (Adult) measure the accuracy of the Recommended Date when it is returned by the IIS. Forty-eight IIS (see Measure 9 above) supported Recommended Date and were measured for their alignment with the CDSi expectations.



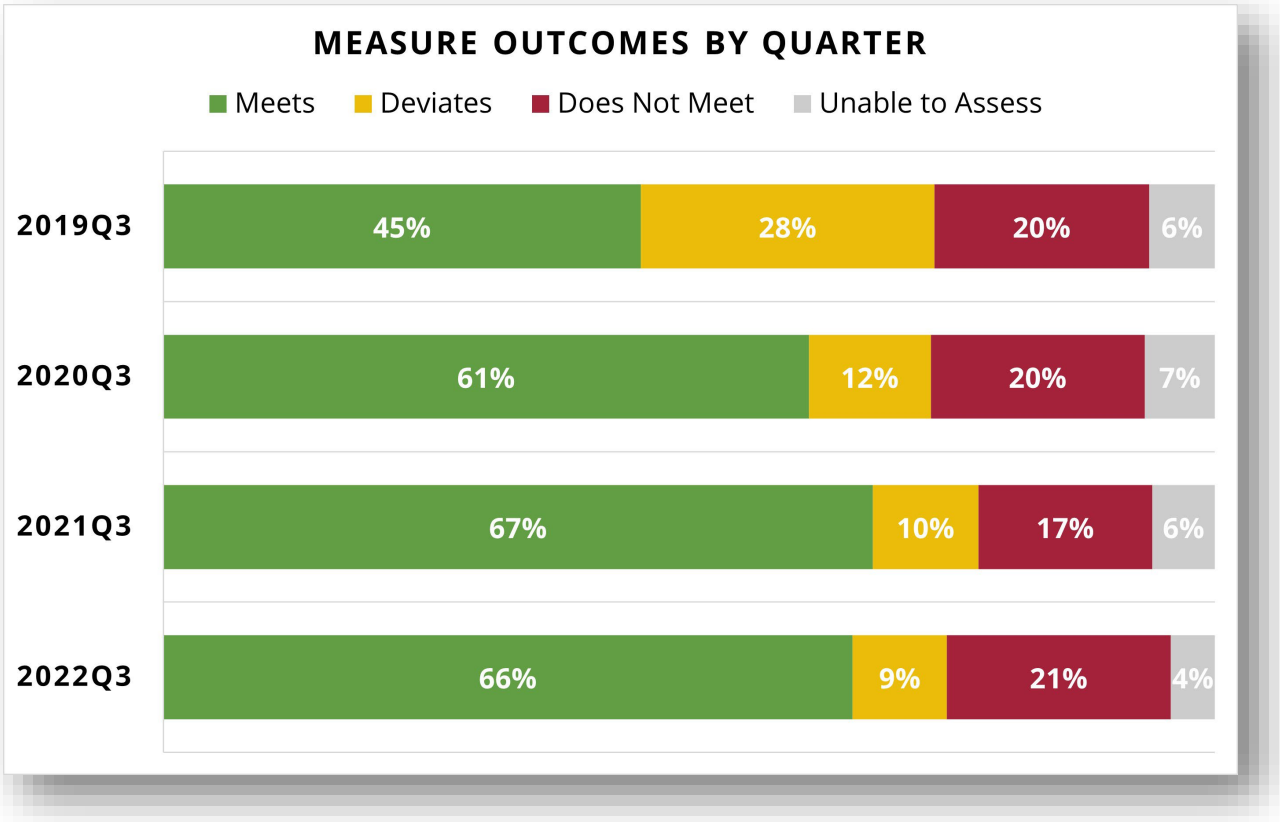
Of the 48 IIS assessed for Recommended Date, the following high-level observations provide additional context for reading and interpreting the aggregate results graph:

- **Adolescent Measure:**
  - **Vaccine Family Threshold:** Four IIS were downgraded from Deviates to Does Not Meet because at least one vaccine family was below the vaccine family threshold.
  - **Not Measured:** One IIS showed support for Recommended Date but did not return it consistently across all vaccine families. As such, IIS accuracy could not be measured.
- **Adult Measure:**
  - **Not Measured:** Six IIS showed support for Recommended Date but did not return it consistently across all vaccine families. As such, IIS accuracy could not be measured.

Summary of Progress

IIS are continuing to implement functionality to align with ACIP recommendations. Community progress will be monitored using two key indicators: 1) aggregate outcome for all measures and 2) reduction in vaccine family threshold failures.

The following graph shows quarterly outcomes for all CDS measures.

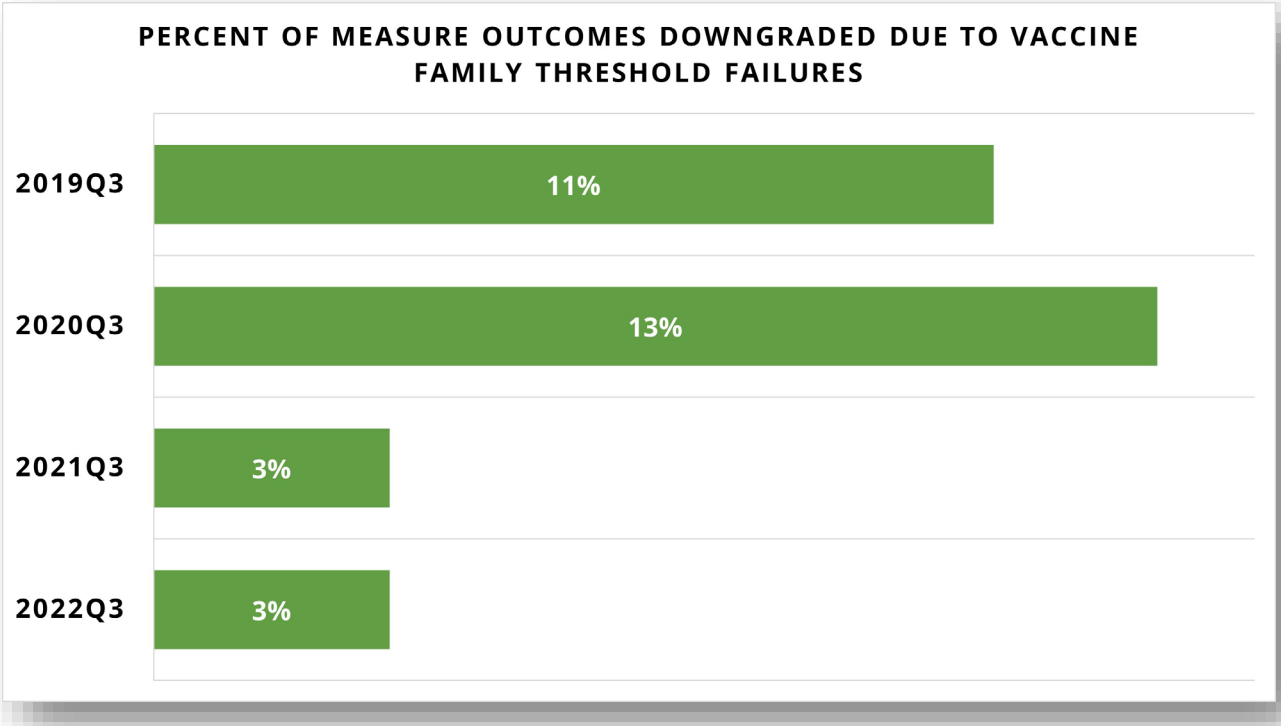


In the baseline measurement (Q2 2019), 39% of all measures had an outcome of Meets. In Quarter 3 2022, 66% of all measures had an outcome of Meets. Quarter-to-quarter comparisons will likely result in dips due to the nature of evolving and new ACIP recommendations as well as increases in the number of IIS being measured in the content area. However, long term we expect to see increases in IIS meeting all CDS measures, indicating positive progress across the community.

Downgrades due to vaccine family threshold failures

The following graph shows quarterly results related to vaccine family failures that resulted

in a measure outcome downgrade.[4] In the baseline measurement (Q2 2019), 22% of measure outcomes were downgraded because the IIS performed poorly on at least one vaccine family. In Q3 2022, 3% of measure outcomes were downgraded because the IIS performed poorly on at least one vaccine family. We expect to continue to see decreases in these percentages over time, indicating positive movement across the community.



Remeasurement

The next remeasurement for CDS Assessment will take place in Quarter 4 of 2022. The goal of each remeasurement is to demonstrate increases in both the number of IIS who are measured and the number that meet measures and tests for this content area.

Limitations

- **Comparison across time:** Unlike other M&I content areas, such as Transport and Query/Response Assessment, CDS Assessment is more challenging to compare across time because ACIP recommendations continually evolve. Each quarter, test

[4] The threshold for Deviates was raised from 65% to 80% in Q1 2021. The majority of IIS who had issues with vaccine family thresholds now fall into Does Not Meet. Therefore, they do not have to be downgraded.

cases are modified to match the evolving ACIP recommendations. At a high-level, trends can be seen, but it is also highly possible that any impact on measurement from quarter-to-quarter could be due to recommendation changes and not necessarily CDS engine changes. However, looking over several quarters should provide a much better view of the progress IIS are making to align with ACIP recommendations.

- **Requirements to be measured:** For an IIS to be able to be measured, the IIS must be able to do the following three things. Some IIS were able to meet some, but not all, of these requirements, so they were unable to be measured.
    1. The IIS must:
        a. be able to accept a basic HL7 VXU message with historical vaccination events, which loads the test case scenario into the IIS,
        b. fully process the VXU and make the patient available for querying within 60 seconds, and
        c. respond to the query and include well-formed CDS in the RSP.
- **Vaccine matching:** Currently, HL7 version 2 (v2) is the only standards-based way to measure CDS engines. Although an overall effective method, it doesn't entirely isolate the CDS engine. The HL7v2 processing rules sometimes interfere with testing CDS. Vaccine matching business rules may merge two vaccination events that the CDS test cases intend to be unique. When this is discovered, the test case must be left unmeasured. This is not to suggest the vaccine matching within an IIS is inaccurate, but rather some things cannot be tested until a direct interface to the CDS engine exists void of external business processing.
- **CDS engine scope:** Not all jurisdictions or IIS CDS engines provide evaluation or forecasts for all ages. In these cases, the IIS will not be assessed on measures outside of their scope of CDS.
- **Test case focus:** This testing focuses on age groups and specific vaccine families within those age groups. It does not focus on entire patient forecasts across all age groups. The Functional Guide Volume on Query and Response[5] does address this issue and should be reviewed by all implementers outside of this CDS Assessment effort.

General Recommendations

1. Continued education and direction
    a. Both are needed on CDS recommendations. ACIP recommendations change regularly, and it is imperative that IIS remain in alignment with those recommendations.

[5] https://repository.immregistries.org/resource/iis-functional-guide/

2. Evaluation Status timeliness
    a. Evaluation Status is not returned nearly as often as the Forecasted Dates. Returning the Evaluation Status and Evaluation Reason (not assessed) can help clinical staff understand why a dose may need to be repeated. From an assessment standpoint, the Evaluation Status can also help identify where misalignment exists and where corrective action is needed.
3. Targeted focus on improvement
    a. Many IIS had one or two vaccine families that were problematic and dropped their measures lower than expected. In many cases, the IIS could focus on those vaccine families to quickly move closer to alignment with ACIP recommendations.

Questions and/or Comments

Please direct questions and/or comments via AIRA's online Technical Assistance form.