AIRA
AMERICAN IMMUNIZATION REGISTRY ASSOCIATION

Measures and Tests for Assessment

Clinical Decision Support

February 28, 2020

Background and Context

Immunization information systems (IIS) supply health care providers with immunization clinical decision support (CDS) tools designed to automatically determine the recommended immunizations needed when a patient presents for vaccination. These recommendations are developed by the Advisory Committee on Immunization Practices (ACIP). In an effort to harmonize the outcomes of existing CDS tools, the Immunization Information Systems Support Branch (IISSB) at the CDC funded the Clinical Decision Support for Immunization (CDSi) Project to develop new clinical decision support resources for each vaccine-preventable disease in accordance with ACIP recommendations.[1]

In 2016, AIRA convened the Measurement for Assessment and Certification Advisory Workgroup (MACAW) to develop and propose measures for IIS Assessment. CDS measures and tests are the fourth content area of the Measurement and Improvement Initiative (M&I) to be developed. These measures and tests are shared with the AIRA board of directors and the full AIRA community to ensure broad community input and agreement.

The purpose of the assessment stage is to provide IIS with information to more fully align with IIS Functional Standards[2] (FS), while also developing a summary of where IIS are as an overall network in meeting standards and best practices.

Functional Standards

The use of standardized CDS tools are referenced throughout the IIS Functional Standards v4.0, updated in 2018[3] and Operational Guidance Statements (OGS). The revised IIS FS were developed by the IISSB through a consensus-based process involving input from a variety of IIS managers and technical experts from across the United States. They are intended to reflect the functionality an IIS should strive to attain to fully support program and stakeholder immunization-related goals. The OGS provide further guidance to the IIS community about how to achieve the FS and inform the development of measures for achievement. The following FS and OGS are included—at some level—in the MACAW measures and tests defined in this document.

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

> OGS 10.1: The IIS uses Clinical Decision Support (CDS) functionality that can be updated to reflect new or revised ACIP recommendations.
>
> OGS 10.2: The IIS displays and sends an evaluated immunization history that adheres to ACIP recommendations for each vaccination event.
>
> OGS 10.3: The IIS displays and sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family.
>
> OGS 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.

[1] https://www.cdc.gov/vaccines/programs/iis/interop-proj/downloads/logic-spec-acip-rec.pdf version 3.0 - pp. 8
[2] https://www.cdc.gov/vaccines/programs/iis/func-stds.html
[3] https://www.cdc.gov/vaccines/programs/iis/func-stds.html

Measures and Tests

MACAW defined the scope, measures, high-level test case strategies, measurement outcomes, and testing methods for measuring the accuracy of CDS engines. These recommendations will be shared with the community for input and presented to the AIRA board of directors for approval.

Scope

The scope includes routine age-based recommendations for pediatric, adolescent, and adult. The scope does not include contraindications, immunities, or increased risk schedules.

Birth through 6 years
DTaP, HepA, HepB, Hib, MMR, Pneumo (PCV), Polio, Rotavirus, Varicella, Influenza

7 years through 18 years
HPV, Meningococcal, Tdap/Td, Influenza, HepB, MMR, Polio, Varicella

19 years and older
Tdap/Td, Zoster, Pneumo (PCV, PPSV), Influenza, HPV, Varicella, Meningococcal

CDS Assessment Scope

Measures

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. (Please See Appendix B for discussion on Past Due Date and Series Status inclusion.)

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

The following CDS measures were consented to and are further defined in the remainder of this document. Key terms and phrases have been defined in Appendix A.

Key Notes

- 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.
- If an IIS does not return a concept (e.g., Evaluation Status), the IIS will not meet the capability measure since it is not returned, but the IIS will not be assessed on the three accuracy measures for that concept (e.g., they will neither pass nor fail the accuracy measures).

- This testing focuses on age groups and specific vaccine groups within those age groups. It does not focus on entire patient forecasts across all age groups. The Functional Guide Volume on Query and Response does address this issue and should be reviewed by all implementers outside of this CDS Assessment effort.

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.

5) The IIS HL7 interface returns an Earliest Date for each forecasted dose.
6) The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based pediatric recommendations.
7) The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based adolescent recommendations.
8) The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based adult recommendations.

Recommended Date

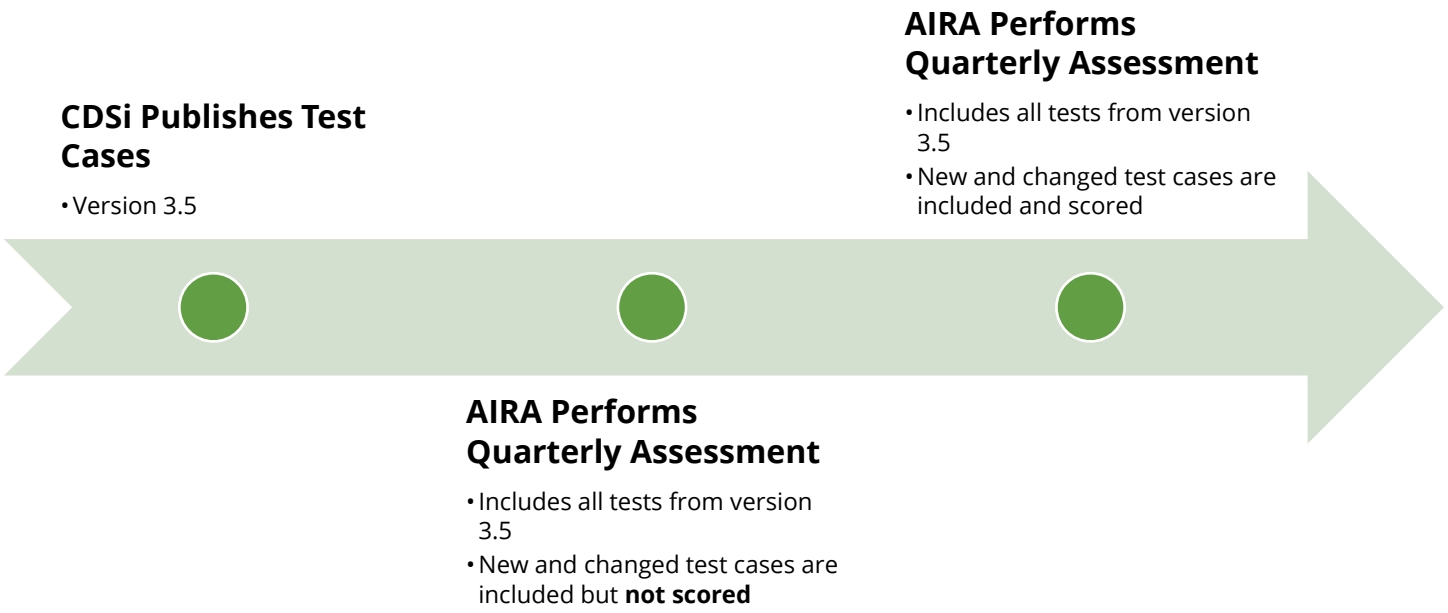
Definition: The date at which point the patient should receive the next dose.

9) The IIS HL7 interface returns a Recommended Date for each forecasted dose.
10) The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based pediatric recommendations.
11) The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based adolescent recommendations.
12) The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based adult recommendations.

Tests

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 tease apart the variation and develop actionable improvement strategies.
- **Leverage current CDC CDSi test cases:** Test cases created and vetted by the community should be reused if at all 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 the 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 should be added to test typical administration patterns.

Measure and 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.

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 must be at or above the defined thresholds set within each measure to meet the measure. When CDS assessment was initially rolled out, it was designed in a way to allow thresholds to change over time as the community made progress. Starting in January 2021, the deviates threshold will be moved from 65%-90% to 80%-90%.

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.

Testing Method

Several methods were discussed to carry out the testing, ranging from leveraging existing HL7 interfaces to User Interface reviews. MACAW recommended leveraging the HL7 interface for several reasons including:

- Fully testing a CDS engine requires a considerable number of test cases, so automation is critical.
- User interface testing (and any other hybrid approach) was too time consuming and resource intensive given current resources.
- At the time of this decision, AIRA had connections to 25 IIS that return CDS within their HL7 engine, with more building the capability in preparation for Meaningful Use Stage 3.
- No alternative national standard exists for direct communication to a CDS engine, and very few CDS engines have explicit external communication endpoints. MACAW will revisit this if or when a national CDS standard is developed.
- Testing via HL7 continues to build on existing areas of assessment (e.g., transport, HL7). This reduces the effort needed by IIS programs to participate and continues to build on the real-world relationship between a provider and an IIS.

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.

Evaluation Status Measures

Measure 1:

The IIS HL7 interface returns an Evaluation Status (e.g., dose validity) for each vaccination event.

Purpose	**Supports**
The purpose of this measure is to identify if an IIS returns Evaluation Status. The accuracy of the evaluation status is not measured within this measure.	**FS 10.0:** The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. **OGS 10.2:** The IIS displays and/or sends an evaluated immunization history that adheres to ACIP recommendations for each vaccination event.

Test Case	**Test Case Expectation**
A patient with one valid dose and one invalid dose will be sent to the IIS and subsequently queried for.	The response explicitly includes an evaluation status for each dose administered through the use of the HL7 standard LOINC for dose validity (59781-5).

Measure Outcome	
Meets	The IIS will meet this measure if the test case expectation is met.
Deviates	Deviation is not a possible measure outcome for this measure.
Does Not Meet	The IIS will not meet this measure if the test case expectation is not met.

Measure 2:

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

Purpose	**Supports**
The purpose of this measure is to measure the degree of alignment when an IIS returns Evaluation Status. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.2: The IIS displays and/or sends an evaluated immunization history that adheres to ACIP recommendations for each vaccination event. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	**Test Case Expectation**
CDSi Test Cases: As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Evaluation Status returned by the IIS will match the published CDSi test case expectations. One limitation in using HL7 for this measurement is the HL7 response message is able to message only two outcomes of the vaccination event while the CDSi project has the potential for four outcomes. For the most part, this works well, as nearly all CDSi test cases result in either valid or not valid. A limited number have other expectations. To accommodate for this, test cases with an Evaluation Status expectation of either Extraneous or Substandard will be excluded from assessment until clear interfacing guidance can be set by the Standards and Interoperability Steering Committee (SISC).
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Evaluation Status returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification.

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.

Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Measure 3:

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

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Evaluation Status. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.2: The IIS displays and/or sends an evaluated immunization history that adheres to ACIP recommendations for each vaccination event. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
CDSi Test Cases: As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Evaluation Status returned by the IIS will match the published CDSi test case expectations. One limitation in using HL7 for this measurement is the HL7 response message is able to message only two outcomes of the vaccination event while the CDSi project has the potential for four outcomes. For the most part, this works well, as nearly all CDSi test cases result in either valid or not valid. A limited number have other expectations. To accommodate for this difference, the following CDSi Evaluation Statuses will map to the following HL7 dose validity values.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Evaluation Status returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification. The same mapping between CDSi Evaluation Status and HL7 Dose Validity will be used.

CDSi Expected Evaluation Status	HL7 Dose Validity Value
Valid	Yes
Not Valid	No
Extraneous	Yes/No
Substandard	No

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Measure 4:

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

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Evaluation Status. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.2: The IIS displays and/or sends an evaluated immunization history that adheres to ACIP recommendations for each vaccination event. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
CDSi Test Cases: As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Evaluation Status returned by the IIS will match the published CDSi test case expectations. One limitation in using HL7 for this measurement is the HL7 response message is able to message only two outcomes of the vaccination event while the CDSi project has the potential for four outcomes. For the most part, this works well, as nearly all CDSi test cases result in either valid or not valid. A limited number have other expectations. To accommodate for this difference, the following CDSi Evaluation Statuses will map to following HL7 dose validity values.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Evaluation Status returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification. The same mapping between CDSi Evaluation Status and HL7 Dose Validity will be used.

CDSi Expected Evaluation Status	HL7 Dose Validity Value
Valid	Yes
Not Valid	No
Extraneous	Yes/No
Substandard	No

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Earliest Date Measures

Measure 5:

The IIS HL7 interface returns an Earliest Date for each forecasted dose.

Purpose	**Supports**
The purpose of this measure is to identify if an IIS returns Earliest Date. The accuracy of the earliest date is not measured within this measure.	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family.

Test Case	**Test Case Expectation**
A patient with an at-birth HepB will be sent to the IIS and subsequently queried for.	The response explicitly includes an earliest date for each forecasted dose through the use of the HL7 standard LOINC for Earliest Date (30981-5).

Measure Outcome	
Meets	The IIS will meet this measure if the test case expectation is met.
Deviates	Deviation is not a possible measure outcome for this measure.
Does Not Meet	The IIS will not meet this measure if the test case expectation is not met.

Measure 6:

The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based pediatric recommendations.

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Earliest Date. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Earliest Date returned by the IIS will match the published CDSi test case expectations.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Earliest Date returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification.

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Measure 7:

The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based adolescent recommendations.

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Earliest Date. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
CDSi Test Cases: As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Earliest Date returned by the IIS will match the published CDSi test case expectations.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Earliest Date returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification.

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Measure 8:

The Earliest Date returned by the IIS matches the CDC CDSi expected value for routine age-based adult recommendations.

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Earliest Date. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
CDSi Test Cases: As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Earliest Date returned by the IIS will match the published CDSi test case expectations.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Earliest Date returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification.

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Recommended Date Measures

Measure 9:

The IIS HL7 interface returns a Recommended Date for each forecasted dose.

Purpose	**Supports**
The purpose of this measure is to identify if an IIS returns Recommended Date. The accuracy of the recommended date is not measured within this measure.	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family.

Test Case	**Test Case Expectation**
A patient with an at-birth HepB will be sent to the IIS and subsequently queried for.	The response explicitly includes a recommended date for each forecasted dose through the use of the HL7 standard LOINC for Recommended Date (30980-7).

Measure Outcome	
Meets	The IIS will meet this measure if the test case expectation is met.
Deviates	Deviation is not a possible measure outcome for this measure.
Does Not Meet	The IIS will not meet this measure if the test case expectation is not met.

Measure 10:

The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based pediatric recommendations.

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Recommended Date. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Recommended Date returned by the IIS will match the published CDSi test case expectations.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Recommended Date returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification.

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Measure 11:

The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based adolescent recommendations.

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Recommended Date. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
CDSi Test Cases: As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Recommended Date returned by the IIS will match the published CDSi test case expectations.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Recommended Date returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification.

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Measure 12:

The Recommended Date returned by the IIS matches the CDC CDSi expected value for routine age-based adult recommendations.

Purpose	Supports
The purpose of this measure is to measure the degree of alignment when an IIS returns Recommended Date. When the CDSi project publishes new/updated test cases, they will be incorporated into the CDS Assessment 30 days after publication. This will help measure the uptake of new/changed ACIP recommendations and clarifications in a timely fashion (OGS 10.4).	FS 10.0: The IIS forecasts pediatric and adult immunizations in a manner consistent with ACIP recommendations. OGS 10.3: The IIS displays and/or sends a forecast that adheres to ACIP recommendations, with status indicators for each vaccine and vaccine family. OGS 10.4: The IIS CDS functionality is updated for the IIS in a timely fashion after new ACIP recommendations are incorporated into the CDC CDSi resources published on the CDC website.

Test Case Sets	Test Case Expectation
CDSi Test Cases: As CDSi publishes updates to its test cases, the assessment will be based on the most up-to-date version of test cases. For current specifics on CDSi test cases, an interactive drill-down has been developed in AART and can be accessed here. A username and password are not required.	The Recommended Date returned by the IIS will match the published CDSi test case expectations.
Additional Test Cases: A set of test cases will be added to focus on vaccination events occurring at the recommended age and/or intervals for vaccines in scope.	The Recommended Date returned by the IIS will match the expectation per the published CDSi Supporting Data and Logic Specification.

Measure Outcome	
Meets	The IIS will meet this measure if the IIS has a degree of alignment score at or above 90%.
Deviates	The IIS will deviate from this measure if the IIS has a degree of alignment score at or above 65% but less than 90%. Beginning on January 1, 2021 the IIS will deviate from this measure if the IIS has a degree of alignment score at or above 80% but less than 90%.
Does Not Meet	The IIS will not meet this measure if the IIS has a degree of alignment score below 65%. Beginning on January 1, 2021 the IIS will not meet this measure if the IIS has a degree of alignment score below 80%.

NOTE: The IIS will drop 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.

Appendix A: Glossary

Adolescent: 7 years through the entire 18th year of life

Adult: 19 years and older

Degree of Alignment: The percent of test cases passed within a measure of vaccine family

Matches: The IIS must produce the exact same answer as the CDSi expected value

Pediatric: Birth through the entire sixth year of life

Returns: The concept being tested must explicitly return the concept through the query/response interface in a standards-based way. For consistency across all interfaces, the assessment process will not imply or infer the results of a query/response interface.

Routine Age-Based: ACIP recommendations that are based solely on age of the patient

Appendix B: Future Considerations

Past Due Date and Series Status were originally proposed by MACAW to be part of CDS Assessment but have been deferred at this time due to comments received by the community.

Past Due Date - The date at which the patient is considered overdue for the next dose – was deferred due to lack of published standards or guidance documents that past due date must be part of an HL7 response message.

Series Status - The status of the patient towards protection against the vaccine preventable disease (e.g., complete, immune, contraindicated, not complete, too old, etc.) – was deferred due to lack of clarity within published standards or guidance documents on how series status is to be messaged consistently as part of an HL7 response message.

MACAW will continue to monitor standards development and guidance documents to determine an appropriate time to include either Past Due Date or Series Status.

Appendix C: Document History

Version	Date	Description of Change
1.0	December 20, 2018	Initial Version
1.1	February 28, 2020	1) Moved the lower bound of the Deviates threshold from 65% to 80%. This will be in effect on January 1, 2021. 2) Removed language in “Appendix B: Future Considerations” related to thresholds.