Measure Authoring Development Integrated Environment (MADiE) User Guide

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1 Introduction

Measure Authoring Development Integrated Environment (MADiE) is a software tool that redefines the electronic Clinical Quality Measure (i.e., eCQM, measure) development and testing process by making it a self-contained process that includes dynamic authoring and testing within a single application. MADiE has been further designed to provide an increasingly intuitive and easy-to-use interface by leveraging modern, User Experience Research and Design philosophies. These philosophies continuously incorporate user feedback and iterative design to inform present and future development of MADiE.

1.1 Standards & Integration

MADiE has also been designed to integrate with the nationally recognized data standards that the Centers for Medicare & Medicaid Services (CMS) quality reporting programs use for expressing electronic Clinical Quality Measure (eCQM) logic for machine-to-machine interoperability. This integration provides enormous value to programs using eCQMs, federal policy leaders, and stakeholders, as it demonstrates MADiE's flexibility to facilitate evolving eCQM standards.

MADiE can generate measures following the Fast Healthcare Interoperability Resources (FHIR), [Quality Measure Implementation Guide (QMIG) STU 3.0.0](#), and [Clinical Quality Language (CQL) Normative Release](#). The QMIG specification provides direction for the metadata and framework of measures, while the CQL libraries provide the expression logic for calculating an eCQM. Additionally, MADiE can generate eCQMs containing the FHIR R4 and CQL which describe a measure and, programmatically convert both into an executable format that allows calculation of the measure directly from the specification. The currently supported models used within CQL for data interchange requirements are QI-Core and FHIR R4.

Currently, all eCQMs are written using Clinical Quality Language (CQL) and the Quality Data Model (QDM) or Fast Healthcare Interoperability Resources (FHIR). With the release of MADiE MVP, measure developers will transition their measures to QI-Core, utilizing MADiE's improved tools for constructing and testing QI-Core measures.

1.2 Overview of Measure Development & Testing

In MADiE, measure developers can build eCQMs and evaluate their performance by building out measure logic, creating synthetic patient records (referred to as test cases), and testing those synthetic patient records against a measure's logic. That process allows measure developers to understand the behavior of a measure's logic under semi-realistic scenarios and whether a measure's logic encodes their intent, through a process of iteration and testing.

1.3 Purpose of this Guide

The purpose of this document is to further describe MADiE and provide step-by-step instruction for engaging with key functionality.

2 System Requirements & Availability

MADiE is available 24 hours a day, 7 days a week and can be accessed with an internet browser. Chrome, Firefox, and Edge are recommended. MADiE may not be available during system maintenance. MADiE users will be notified by email about scheduled and unscheduled system maintenance.

3 User Account Creation

There are few steps required in creating an account and gaining access to MADiE. New MADiE users must first create a HARP account then request access to MADiE in HARP as detailed in the following sections.

3.1 Creating a HARP Account

New users must have a HARP Account to log in to MADiE. To create a new HARP account, go to https://harp.cms.gov/register and complete the registration process to create your HARP account. Registration requires users to enter profile information, account information, and successfully complete proofing (identify verification). HARP uses a third-party service provided by Experian to verify user identities.

After creating your HARP account, set up two-factor authentication if you have not already done so by following these steps:

1. After logging in to HARP, click on "Manage Two-Factor Devices."
2. Add a device and follow the prompts.

3.2 Configuring Your HARP Account for MADiE

To complete HARP account setup for use with MADiE, follow the instructions in the MADiE Access Guide found in the MADiE MVP Tab of the MAT public website.

3.3 HARP Account Management

To update your HARP Profile including your password, name, email address, and phone number log in to HARP and click on "View / Edit Profile Information."

4 Logging in to MADiE

To log in to MADiE, follow these steps:

1. In the MADiE login form, enter your HARP User ID

2. Enter your HARP password.
3. Click the "Sign In" button.
4. You will be presented with a two factor authentication, as determined by your HARP profile setting. Enter the authentication and you will be logged into MADiE.

4.1 Application Timeout

A user will automatically be logged out of MADiE after 30 minutes of inactivity. After 25 minutes of inactivity, a warning message will be displayed, indicating that their session will expire if the user remains inactive.

4.2 Long-term Account Inactivity

The MADiE-user role assigned to a MADiE user's HARP account will be deactivated if a user has not logged into MADiE for 60 days. A warning email, notifying a user of such will be sent if a user has not logged into MADiE for 30 days.

4.3 Forgotten User ID or Password

If you experience trouble logging in to MADiE, check that you are using your personal HARP User ID and password and have had the MADiE user role assigned through HARP. If you have not completed that yet, follow the instructions in the MADiE Access Guide found in the MADiE MVP Tab of the MAT public website.

If you have forgotten your HARP ID or password, go to the HARP Account Recovery page to retrieve your HARP User ID or reset a password.

4.4 UMLS® Integration

For MADiE to function properly, MADiE must connect to the Value Set Authority Center (VSAC). VSAC is provided by the U.S. National Library of Medicine (NLM) in collaboration with the Office of the National Coordinator (ONC) for Health Information Technology and CMS. The VSAC provides downloadable access to previously created value sets and direct referenced codes and is actively incorporating new value sets for other use cases, new measures, and for updating existing measures.

4.4.1 Requesting License

To integrate with the Value Set Authority Center (VSAC) through MADiE, users are required to have a Unified Medical Language System© (UMLS) Metathesaurus License. To request a license and create a UMLS account, go to UMLS Terminology Services Sign Up Page.

4.4.2 Connecting to UMLS/VSAC for Value Set Data

Once logged into MADiE, you can establish an active connection to the VSAC and retrieve value set data. Click on the 'Connect to UMLS' link in the upper right of the header on any MADiE page to connect. Upon clicking, a "Please sign in to UMLS" modal will appear. Enter the API key associated with your UMLS account to connect. If you do not know your API key, follow the "WHERE'S MY KEY?" instructions. Once connected, the Connect to UMLS link will now read "UMLS Active," and the dot indicator will change from red to green.

5 Primary Navigation Header (White Header Bar)

The Primary Navigation Header is found at the top of every area MADiE. It provides access to the following navigation and functionality that are always accessible:

1. **MADiE Logo:** The MADiE Logo (in the far left of the Primary Navigation Header) provides navigation to the Measures page (the initial landing page upon logging in), where both a user's eCQMs and all other eCQMs entered into MADiE can be accessed.
2. **Measures:** The Measures link (the first link in the right half of the Primary Navigation Header) provides navigation to the Measures overview page (the initial landing page upon logging in), where both a user's eCQMs and all other eCQMs entered into MADiE can be accessed.
3. **Libraries:** The Libraries link (the second link from the left in the right half of the Primary Navigation Header) provides navigation to the Libraries page, where both a user's standalone CQL Libraries and all other CQL Libraries entered into MADiE can be accessed.
4. **Help:** The Help link (the third link from the left in the right half of the Primary Navigation Header) provides navigation to help and troubleshooting resources.
5. **Connect to UMLS / UMLS Active:** When a user is not connected to the UMLS and thus not connected to the VSAC, the Connect to UMLS link (fourth link from the left in the right half of the Primary Navigation Header) is displayed. Clicking on the link opens a modal to connect as described in 4.4.2. Connecting to UMLS/VSAC for Value Set Data. When connected, "UMLS Active" is displayed instead.
6. **User Profile Dropdown / Sign Out:** The User Profile Dropdown (on the far right of the Primary Navigation Header) provides a link for a user to "Sign Out."

6 Measures Overview Page (Initial Landing Page)

The Measures overview page is where users land after logging in to MADiE. This page displays all measures that have been added to MADiE and further organizes the measures into two areas: My Measures and All Measures. The My Measures table displays measures that you own or that

have been shared with you. measures found in My Measures are measures that can be edited by you. The All Measures table displays all eCQMs entered into MADiE by all users. Most of the measures listed in All measures are likely to be view-only, since most measures are only editable by a limited number of users.

6.1 My Measures / All Measures Tables

My Measures and All Measures list measures in tables that also display the following information and interactive controls for each measure.

1. **Measure Name:** The Measure Name column displays the name of a measure.
    a. **In-Use:** If a measure which you have editing privileges for (i.e., A measure you own or a measure shared with you) is being edited by someone else, the measure is in a "view-only" state until the other user navigates away from editing. A yellow "In-Use" tag appears next to the Measure Name when in that state.
2. **Version:** The Version column displays the version # of the measure listed. Measures that are currently in a draft state will show a blue tag 'Draft' beside the version number.
3. **Model:** The "Model" column displays the assigned model and version of the measure.
4. **Actions:**
    a. View: Allows the user to navigate to the selected measure.
    b. Version: Allows a measure currently in a draft state to be versioned (see section 6.2).
    c. Draft: Allows a measure currently in a version state to be drafted (see section 6.3).
    d. Export: Allows a measure to be exported from MADiE (see Section 9).
5. **Filter measures / Search:** Allows the user to search for a specific measure by typing in a measure's name or eCQM Abbreviated Title.

6.2 Versioning a Measure

A Measure in a Draft state can be versioned by selecting "Version" from the "Actions" drop down. A pop up will appear where a user can select Major, Minor, or Patch version. After this selection, click "Continue." MADiE will now attempt to version the Measure. Measures that do not contain valid CQL, Population Criteria, or contain test cases with errors cannot be versioned. If the measure cannot be versioned an error message will appear, and the measure will not be versioned. If a measure can be versioned, then clicking "Continue" will take the user back to the My Measures tab where the versioned measure can be viewed.

6.3 Draft a Measure

A Measure in a versioned state can be versioned if no other versions of that measure are currently in a Draft state. A user can draft a measure by selecting "Draft" from the "Actions"

drop down. A pop up will appear where a user can change the Measures Name. This field is auto populated to the current versioned Measure Name. Users do not need to change the name; however, Measure Name is required before continuing. Once a user decides on the Measure Name, click "Continue." A draft will now be created, and the user will be directed back to the My Measures tab where the new draft will be visible. From there a user can edit the measure.

7 Adding Measures in MADiE

There are two options for adding measures into MADiE. A new measure can be created by using the "+ New Measure" button, or a measure can be transferred from the MAT into MADiE.

7.1 Transferring Existing Measures from the Measure Authoring Tool (MAT) into MADiE

Before initiating a transfer from the MAT, verify:

1. That **you are the measure owner** in MAT and the intended measure owner upon transferring to MADiE. If you want another user to be the measure owner, transfer measure ownership to that user in MAT first, then have them initiate the transfer.
2. That the measure being transferred is a **FHIR measure** and not QDM measure.
3. That the measure being transferred is **not a Composite measure.**
4. That the measure being transferred has been **successfully packaged.**
    a. Validation errors must be addressed in order to successfully package.
5. **Whether the measure needs a CMS ID**. If needed and assign one to the measure in MAT before initiating the transfer to MADiE. MADiE MVP does not support the creation of CMS IDs.

After completing the transfer, the vast majority of measure content will be transferred, but please note that:

1. Data and selections for fields that no longer exist in MADiE and are not part of any future development plans will not be transferred (e.g., Transmission Format, Measure Set, etc.).
2. Any stratifications within a measure group will not be transferred.
3. Any population criteria that contain measure observations will not be transferred.
4. Some measure metadata (e.g., References) will not be immediately available but will be transferred and stored in MADiE until the containing areas are fully developed.
5. MADiE accepts measure types that are present in the HL7 measure type list. These types include Outcome, Patient Reported Outcome, Process and Structure. Measures that are transferred from MAT to MADiE that are not one of the above types will automatically

be mapped to one of the supported types. Users can update the measure type after it has been transferred to MADiE.

MAT	MADiE
Appropriate Use Process	Process
Cost/Resource Use	Structure
Efficiency	Structure
Intermediate Clinical Outcome	Outcome
Outcome	Outcome
Patient Engagement/Experience	Patient Reported Outcome
Patient Reported Outcome Performance	Patient Reported Outcome
Structure	Structure

After confirming the items above, follow the steps below to initiate the transfer.

1. Find the measure you want to transfer.
   a. It can be in "Draft" and does not need to be versioned.
2. Select/Highlight the measure in the measure list page.
3. Click "Export."
4. Select the "Transfer to MADiE" option.
5. Click "Save," and the measure will become available in My Measures within MADiE.
   a. **Note:** Contact the MADiE Helpdesk if your measure does not appear after transferring.

7.1.1 Disabled "Transfer to MADiE" Option

The Transfer to MADiE option may be disabled in the Measure Authoring Tool (MAT) because:

1. You are not the owner of the measure.
2. You have already transferred the measure.
3. You have already transferred another version of the measure.
4. The measure is a QDM measure.
5. The measure is a composite measure.

7.1.2 Unintentional Transfer of an Incorrect measure Version

If you unintentionally transfer the incorrect version of a measure, follow these steps to remove and replace it, as only one version of the measure is allowed to be transferred using the "Transfer to MADiE" option.

1. Find the version of the measure that you wish to remove in the Measures overview page within MADiE.

2. Open the measure by clicking "View" in the "Action" column corresponding to the measure.
3. Once opened, click the "Delete Measure" button in the header. That will delete the measure and all test cases.
4. Submit a helpdesk ticket, indicating that you unintentionally transferred the incorrect measure version, and we will remove the flag blocking multiple transfers from the same measure version family.
5. You will be notified when the flag has been removed, and you can proceed with transferring the desired version of your measure from the MAT.

7.2 Creating a New Measure

Before initiating creation of a new measure in MADiE, consider whether you want your new measure to have a CMS ID.

7.2.1 Creating a New Measure with a CMS ID

If your new measure needs a CMS ID:

1. Create the new measure in the MAT first.
2. Generate and add a CMS ID for the new measure.
3. Create a measure package.
4. Transfer the newly created measure into MADiE using the instructions in 7.1. Transferring Existing Measure from the Measure Authoring Tool (MAT) into MADiE.
5. Continue building the transferred measure in MADiE.

Note: CMS ID generation in MADiE is not currently supported to prevent creation of duplicate CMS IDs and gaps in CMS ID #s. As a result, CMS ID generation is relegated to the MAT until those risks can be addressed.

7.2.2 Creating a New Measure without a CMS ID

To create a new measure without a CMS ID in MADiE, initiate the process by clicking on the + New Measure button in the upper right of the screen while on the Measures overview page. The New Measure creation modal will appear, prompting you to enter the following information:

1. **Measure Name:** The Measure Name is used to identify and refer to a measure. It is often descriptive of what the measure assesses.
2. **Measure CQL Library Name:** The Measure CQL Library Name is used to identify and refer to a CQL Library within a measure. When creating the Measure CQL Library Name, it must adhere to the following requirements:

a. The name must be unique and not match any other CQL Library Name in MADiE.
b. The first character must be a capitalized letter.
c. Other valid characters include alphanumeric characters and underscores.
d. Spaces are not allowed.

3. **eCQM Abbreviated Title:** The eCQM Abbreviated Title must be 32 characters or less.
4. **Model:** The Model dropdown displays all available models and model versions that can be assigned to a measure currently supported by MADiE.
5. **Measurement Period - Start Date/End Date:** The Measurement Period - Start Date/End Date fields establish the measurement period for the measure. Start and end dates must be entered in "mm/dd/yyyy" format.

Once the information above has been entered you have the option to:

1. **Cancel:** The Cancel button discontinues the creation of the new measure and closes the modal.
2. **Continue:** The Continue button saves the initial information entered in the New Measure creation modal and brings the user to the next screen, where the rest of the measure content can be populated.

8 Viewing & Editing a Measure

Upon opening an existing measure or continuing from the New Measure creation modal, the measure content viewing/editing area is displayed. The viewing/editing area displays key content and functionality for the opened/newly created measure and additional areas to further view/edit the rest of a measure.

8.1 Measure Header

In the blue header area, the following information and functionality about the measure is displayed:

1. **Measure Name:** The Measure Name field displays the current name of the measure. The Measure Name is typically a brief description of the measure's focus and target population, providing an intuitive way to identify and refer to the measure. The measure name maybe truncated if needed to fit the available space followed by ellipses. A tooltip will provide the full measure name if the user mouses over the ellipses.
2. **Model & Version:** The model and model version can be found below the Measure Name.

3. **Measurement Period:** The measurement period can be found under the measure Name and to the right of the model and model version.
4. **Navigation Breadcrumbs:** Above the measure name are navigation breadcrumbs, indicating what area of MADiE is currently displayed and providing a way to navigate back to the measures page.
5. **Delete Measure Button:** On the right side of the blue header area, the Delete Measure functionality is available. Engaging Delete Measure will display a modal confirming if you would like to remove the measure and all its test cases.

8.2 Details Tab

Also displayed upon opening an existing measure or continuing on from the New Measure creation modal, is a measure's Details tab, similar to the Measure Details tab in the MAT. The Details tab consists of the eight subareas, described below.

8.2.1 General Information

The Information subarea of the Details tab contains mostly identifying information related to a measure. Content in this subarea includes:

8.2.1.1 Name, Version, & ID

1. **Measure Name:** The Measure Name field displays the current name of the measure. The Measure Name is typically a brief description of the measure's focus and target population, providing an intuitive way to identify and refer to the measure.
2. **Measure CQL Library Name:** The Measure CQL Library Name field displays the current name of measure CQL library within the measure. Users often specify a name similar to that of the measure Name.
3. **Measure ID:** The Measure ID provides a unique identifier to reference the measure from which its versions and drafts originated. It is shared between all versions and drafts of the same measure, but unique between different measures. The Measure ID cannot be edited and is automatically generated by MAT/MADiE.
4. **Version ID:** The Version ID provides a unique identifier to reference a specific version of a measure. Every time a new version of a measure is created, a new, unique identifier is assigned. The Version ID cannot be edited and is automatically generated by MADiE.
5. **eCQM Abbreviated Title:** The eCQM Abbreviated Title must be 32 characters or less.
6. **CMS ID:** The CMS ID is assigned to a measure by the MAT, as CMS ID generation is currently not available in MADiE. See for more details.

7. **Experimental:** The 'Experimental' field defaults to "No" for new measures, indicated by an unchecked checkbox. To state that it is experimental, check the checkbox.
8. **Program Use Context:** The Program Use Context field defaults to blank and allows users to select the program or project of work the measure is applicable to. he drop down contains the following options:

Code	Display	Definition
mips	MIPS	Merit-Based Incentive Payments System (MIPS)
ep-ec	EP/EC	CMS Promoting Interoperability Eligible Professionals/Eligible Clinicians.
eh-cah	EH/CAH	CMS Promoting Interoperability Eligible Hospitals or Critical Access Hospitals.
qpp	QPP	Quality Payment Program.
aapm	AAPM	Advanced Alternative Payment Models.
cpcp	CPC+	Comprehensive Primary Care Plus (CPC+)

9. **Endorsing Organization:** The Endorsing Organization consists of two fields. One field to select the organization that endorses the measures and one to enter the endorsing number. Endorsing Organization is not required. If no Endorsing Organization is selected, then Endorsing Number must be blank. If an Endorsing Organization is selected Endorsing Number is required. Currently these fields correlate to Endorsed by NQF and NQF number in the MAT.

8.2.1.2   Model & Measurement Period

1. **Model: The model used to create the measure is created. Currently QI-Core v4.1.1 is the only supported model.**
2. **Measurement Period - Start Date/End Date:** The Measurement Period - Start Date/End Date fields establish the measurement period for a measure.

8.2.1.3   Steward & Developers

The Steward & Developers subarea indicates those organizations responsible for maintaining and contributing to the measure. Content in this subarea includes:

1. **Steward:** The Steward dropdown allows selection of the organization responsible for a measure's content and maintenance. The Steward is also commonly referred to as the measure publisher.
2. **Developers:** The Developers dropdown allows selection of the organization(s) that is/are responsible for authoring a measure. Choose the desired organization(s) from the dropdown menu.

Note: Organizations not included in the Steward/Developers dropdowns can be added by making a request to the MADiE Helpdesk.

8.2.2   Measure Overview

8.2.2.1   Description

The Description subarea communicates the measure intent. Examples of Description content is available in the human readable files of published measures within the eCQI Resources Center.

8.2.2.2   Rationale

The Rationale subarea describes why a measure is needed and includes content related to importance criteria such as impact, gap in care and evidence. Example Rationale content is available in the human readable files of published measures within the eCQI Resource Center.

8.2.2.3   Guidance (Usage)

The Guidance (Usage) subarea describes how to interpret or implement certain components of a measure. Implementers can reference Guidance (Usage) for additional information about the measure's data elements, logic, and timing. If Guidance (Usage) information is not being included for a measure, enter "None" into this field.

8.2.2.4   Clinical Recommendation

The Clinical Recommendation subarea includes a clinical recommendation statement or general advice regarding the measure and its content from the expert panel that created the measure. The clinical recommendation statement is a summary of relevant clinical guidelines or recommendations supporting the measure.

8.2.3   Legal

8.2.3.1   Copyright

The Copyright subarea includes the organization(s) who own the intellectual property represented by the measure. For measures that do not have copyright information, enter "None" into this field.

8.2.3.2   Disclaimer

The Disclaimer subarea includes disclaimer information for a measure. For measures that do not have disclaimer information, enter "None" into this field.

8.3   CQL Editor Tab

A measure's CQL, including Parameters, Definitions, and Functions can be viewed and edited in the CQL Editor tab (second tab from the left, next to Details, after opening a measure). All

information except for the measure CQL Library Name and Version can be added, edited, and deleted.

All CQL must be entered in correct CQL syntax. When saving, any errors in the CQL will be displayed. CQL containing errors can be saved but may prevent dependent functionality from working properly (e.g., population criteria configuration, test case calculation, etc.). Make sure that the CQL is fully completed, and errors are resolved to ensure proper functionality of areas dependent on the CQL.

8.4 Population Criteria Tab

8.4.1 Criteria Sub Tab(s)

Population criteria for a measure can be added, configured, and managed in the Population Criteria tab (third tab from the left, next to CQL Editor, after opening a measure). In MADiE, measures may have multiple sets of population criteria (represented by Population Criteria 1, Population Criteria 2, etc.). To add additional population criteria, click the "Add Population Criteria" button below existing Criteria. Each population criteria can potentially have its own configuration for the following fields and subareas:

1. **Description:** The Description field describes a population criteria's intent.
2. **Type:** The Type dropdown indicates whether the measure and population criteria configuration are used to examine a process, an outcome over time, a patient-reported outcome, or a structure measure such as utilization.
3. **Population Basis:** The Population Basis dropdown specifies the type of elements in the populations. Note: If a user changes the Population Basis for a specific Population, a warning will appear and if a user continues, Test Case expected values for that Population will be cleared.
4. **Scoring:** The Scoring dropdown indicates how calculation is performed for the measure.
5. **Scoring Unit:** The Scoring Unit field defines the expected units of measure for the measure score.
6. **Populations:** The Populations subarea within a set of population criteria display configurable populations corresponding to the Scoring selected. Populations that may be displayed include:
   a. Initial Population
   b. Measure Population
   c. Measure Population Exclusion
   d. Denominator
   e. Denominator Exclusion
   f. Numerator

    g.   Numerator Exclusion

    h.   Denominator Exception

    i.   Observation

Note: If changes are made to any populations that have previously been included in the test cases they will be removed.

7. **Population Description:** For each population that is displayed a description field is also provided. They allow narrative about what the populations are measuring to be added.

8. **Stratifications:** The Stratifications subarea within a set of population criteria allows stratifications to be added, configured, and managed. Description fields are also included to communicate details about each stratification.

9. **Reporting:** The Reporting subarea includes the following:

    a.   **Rate Aggregation:** The Rate Aggregation field describes how to combine calculated information based on logic in each of several populations into one summarized result. For measures that do not have rate aggregation, enter "None" into this field.

    b.   **Improvement Notation:** The Improvement Notation dropdown provides direction for whether an increase or decrease in score is the preferred result.

8.4.2 Supplemental Data Tab

Supplemental data elements (SDE) are those that should be identified for each patient for whom the measure is applicable. This additional data can be used to evaluate for disparities in care.

The CMS defines four supplemental data elements for each measure (payer, ethnicity, race and ONC Administrative Sex). These are defined in the SupplementalDataElements standalone library. To include them in your measure, include the SupplementalDataElements library and in your measure CQL create definitions that reference the definitions in the library.

Any definitions created in the CQL workspace are available to be included in the measure as supplemental data elements if desired and can be viewed in the Definition multi select drop down. Select all definitions that should become supplemental data elements.

For each definition selected, a description will appear for users to provide meta data explaining each SDE. Enter all meta data and hit save to set SDEs.

8.4.3 Risk Adjustment Tab

Risk adjustment is the method of adjusting for clinical severity and conditions present at the start of care that can influence patient outcomes, making it difficult to make valid comparisons of outcome measures across providers.

Any definitions created in the CQL workspace are available to be included in the measure to be Risk Adjustment Variables (RAV) if desired and can be viewed in the Definition multi select drop down. Select all definitions that should become Risk Adjustment Variables.

For each definition selected, a description field will appear for users to provide meta data explaining each RAV. Enter all meta data and hit save to set RAVs.

8.5 Test Cases Tab

Test cases for a measure can be added, edited, and managed in the Test Cases tab (fourth tab from the left, next to Population Criteria, when a measure is open). The Test Cases tab displays a table of all test cases that have been created along with Pass/Fail and coverage results. Above the table in the Test Cases tab, the following are displayed:

1. **Test Cases Passing Indicator:** The Test Cases Passing Indicator displays the percentage of test cases that are passing (i.e., have matching expected and actual values) as it relates to measure logic relevant to a measure's first set of population criteria. The indicator also shows the percentage as a fraction, displaying the number of passing test cases to the total number of test cases. Click the Run All Tests button to calculate results.
2. **Coverage Indicator:** The Coverage Indicator displays the percentage of the measure logic that has been evaluated by the test cases as it relates to a measure's first set of population criteria. Click the Run All Tests button to calculate results.
3. **Execute Test Cases Button**: The Execute Test Cases button initiates calculation of all test cases against measure logic related to the population criteria selected. The Test Cases Passing Indicator, Coverage Indicator, and individual test case, Pass/Fail results are updated. The Run All Tests Button must be clicked each time to calculate new results.
4. **+ New Test Case Button:** The + New Test Case button initiates creation of a new Test Case.

The Test Cases table lists all the measure's test cases and displays additional information about each test case including:

1. **Pass/Fail:** When the Run All Tests button has been clicked, the Pass/Fail column displays Pass or Fail for a test case, indicating if the test case's expected values match actual values calculated. Pass/Fail results are no longer automatically calculated after opening a measure. The Run All Tests button must be clicked each time to calculate new results.
2. **Title:** The Title column displays the title of a test case.
3. **Test Case Group:** The Test Case Group column displays the name of the test case group to which a test case may be assigned.
4. **Description:** The Description column displays the description given to a test case.

5. **Actions:** The Actions column displays the View/Edit button, which opens a test case to view and/or edit its content.

8.5.1 Using Existing Test Cases from Bonnie FHIR to Create New Test Cases in MADiE

Test cases from Bonnie FHIR can be exported into JSON files, allowing a user to import an individual test case (see section 8.5.3) or "Copy-and-paste" the content within the JSON files and into new test cases in MADiE. In order to carry out the process, follow these steps:

1. Log in to Bonnie FHIR and open the measure containing the test cases that are to be transferred.
2. Click on the gear icon to the right of "Test Patients" and select "Export" in the bar that appears.
3. A zip file will be downloaded containing:
   a. All test cases consolidated into a single JSON file.
   b. All test cases separated into individual JSON files.
   c. **Note:** Downloaded JSON files will not contain Expected and Actual values.
4. Info from the individual JSON files can then be imported (section 8.5.3) or copied + pasted to construct new test cases for a measure in MADiE.
5. Test cases that are imported will have some QI-Core default values added, but both imported and copied will need to be updated to use complete QI-Core profiles.

8.5.2 Creating a New Test Case

To create a new test case, initiate the process by clicking on the + New Test Case button in the upper right, below the blue header area. The Create New Test Case modal will appear, prompting you to enter the following information:

1. **Title:** The Title field is the name of your test case.
2. **Description:** The Description field communicates what the test case is testing.
3. **Group:** Group field assigns a test case to a group that can be used to sort and organize the test case table according to your preferences.

Once the information above has been entered you have the option to:

1. **Cancel:** The Cancel button discontinues the creation of a new test case and closes the modal.
2. **Save:** The Save button saves the test case using the information entered into the Create New Test Case modal.

8.5.3 Import Single Test Case JSON

MADiE allows users to import test case JSON that was exported from Bonnie, see section 8.5.1 to learn how to export JSON test cases from Bonnie FHIR. In order to import this JSON, follow these steps:

1. Log in to MADiE and open the measure you wish to import the test case to.
2. Create (see section 8.5.2) a new test case or open an existing test case to edit (see section 8.5.4).
3. Click "Import" in the button bar on the left side.
4. MADiE will prompt you to select a file using the browsers default selector. Select and open the individual test case JSON file that corresponds to the test case you are trying to create.
5. The JSON contained in the file will now be placed in the JSON editor on the left side of the screen, overwriting any JSON previously there.
6. As the JSON is added to the editor, QI-Core defaults are automatically added (see Section 10 for QI-Core defaults that are added).
7. Set any other elements in the test case as needed.
8. Click "Save" to finalize importing the test case JSON and added defaults. Note: MADiE does not automatically add all required QI-Core elements, users may still need to add additional elements to be QI-Core compliant.

8.5.4 Viewing & Editing a Test Case

Once a test case has been created, it can be opened for viewing/editing by clicking on the test case's select button in the test case table. Once opened, the test case shows two panels on each side of the screen. The left panel displays the JSON Editor while the right panel displays supporting test case resources and content.

8.5.4.1 JSON Editor

The left panel displays the JSON Editor, where the JSON logic of a test case can be viewed and edited. All information can be added, edited, deleted, and must be in correct JSON syntax. When saving, any errors in the JSON will be displayed. JSON files may contain errors and warnings. JSON containing errors can be saved but may prevent dependent functionality from working properly (e.g., test case calculation). JSON files containing just warnings can be saved and calculated. Verify the JSON is complete, and errors are resolved to ensure proper functionality of areas dependent on it.

8.5.4.2   Measure CQL (View Only)

The right panel initially displays the measure CQL to aid in building the test case JSON. However, the measure CQL is view-only and cannot be edited in this area. CQL edits can only be made in the CQL Editor tab.

8.5.4.3   Highlighting

The Highlighting subarea [second link from the left in the right panel, next to the Measure CQL (View Only) link] displays a test case's highlighting results calculated against the measure CQL. Upon clicking the "Run Test" button, green and/or red highlighting is generated. Green highlighting indicates a passing result for any applicable lines of measure CQL, while red highlighting indicates a failing result for any applicable lines of measure CQL. The "Run Test" button must be clicked each time a user would like to calculate new results.

8.5.4.4   Expected/Actual

The Expected/Actual subarea (third link from the left, next to the Highlighting link, in the right panel) displays population criteria tables, where expected values for populations, stratifications, and observations within each set of population criteria can be configured. Upon clicking the "Run Test" button, Actual values are displayed along with pass/fail results for the test case across each set of population criteria. The "Run Test" button must be clicked each time a user would like to calculate new results.

8.5.4.5   Details

The Details subarea (last link the right panel, next to the Expected/Actual link) displays:

1. **Title:** The Title field is the current name of a test case.
2. **Description:** The Description field communicates what a test case is testing and is auto populated with any Description field content entered during the creation of the test case.
3. **Test Case Group:** The Test Case Group field assigns a test case to a group that can be used to sort and organize the test case table according to a user's preferences. It is auto populated with any Test Case Group assignments entered during the creation of the test case.

8.5.5   Deleting a Test Case

After a test case has been created, it can be deleted by clicking on the test case's select button in the test case table. Then select "Delete." A confirmation Dialog is shown. Select "Cancel" to continue editing and "Delete" to permanently remove the test case. Please note, deleting test cases cannot be undone.

8.6 Review Tab

Certain Measure data is related only to the Measure Review process. This Measure data can be found and edited on the Review Tab. The Measure Review process will also take place on this tab in the future.

8.6.1 Review Info

The Review info subarea displays:
1. **Approval Date**: Corresponds to the date the measure was approved. In a draft measure this will be blank. Once versioned Approval Date will be set to the date the measure was versioned.
2. **Last Review Date**: Corresponds to the date the measure was Last Reviewed. In a draft measure this will be blank. Once versioned Last Review Date will be set to the date the measure was versioned.

9 Measure Export

MADiE allows for most measures to be exported by any user. To export a measure, navigate to the Measure List Page, and use the search function to find the measure you want to export. Open the measure action drop down and select "Export." A loading message will appear as MADiE generates the Export files. Measures do not need to be versioned to export but the measure needs to have the Measure Description, Measure Developers and Measure Steward set, no errors in the CQL and the population criteria must be filled out. Test cases do not factor into the ability to export a measure. If a measure can't be exported an error message explaining the issue will display. If a measure is successfully exported a success message will display and a zip file containing the measure package will be downloaded to the user's computer.

9.1 Files In Export

At this time MADiE only exports Measure and included library data. No Test case data is exported. The following files are included in the export zip file:
1. **Measure HTML**: This is the human readable representation of the measure.
2. **Measure JSON**: The JSON representation of the measure.
3. **Measure XML**: The XML representation of the measure.
4. **CQL Folder**
   a. **Measure CQL**: The CQL the user entered for the measure.
   b. **CQL for all Included Libraries**: The CQL for any library that was included in the measure.

5. **Resource Folder**
   a. **JSON File for All Included Libraries**: The JSON representation of any included library.
   b. **XML File for All Included Libraries**: The XML representation of any included library.

9.2 File Naming Convention

The following naming convention is how MADiE names the export files:

- Zip File: {eCQM Abbreviated Title}-v{MeasureVersion}-{Modelfamily}V{ModelMajorVersion}.zip
- HTML File: {eCQM Abbreviated Title}-v{MeasureVersion}-{Modelfamily}.html
- JSON File: {eCQM Abbreviated Title}-v{MeasureVersion}-{Modelfamily}.json
- XML File: {eCQM Abbreviated Title}-v{MeasureVersion}-{Modelfamily}.xml
- Measure CQL: {eCQM Abbreviated Title}-{MeasureVersion}.cql
- Included Library CQL: {libraryName}-{libraryVersion}.cql
- Included Library JSON: {libraryName}-{libraryVersion}.json
- Included Library XML: {libraryName}-{libraryVersion}.xml

10 QI-Core Defaults

QI-Core requires many attributes when a user includes a given resource into their test case JSON. Many of these required elements are not commonly included in a measure, resulting in the measure developers having to manually add the attributes. To alleviate some of the additional time that would require MADiE now adds some required QI-Core elements as default values on import of the individual test cases. See section 8.5.3 for instructions in how to import an individual test case. Coverage and Practitioner are resources that are always added, the rest of the attributes are added only if the resource is present in the JSON file and the attribute is not. No existing attributes will be overwritten.

10.1 Added Default Values

Resource	Attribute	Default Value
QICoreCondition	Condition.subject	Reference to current test case
QICoreCondition	Condition.category	- Encounter Diagnosis if condition is referenced by encounter - Problem List otherwise
QICoreCoverage	Coverage.beneficiary	Reference to current test case

Resource	Attribute	Default Value
QICoreCoverage	Coverage.payor	Reference to Default Organization
QICoreCoverage	Coverage.status	active
QICoreDevice	Device.patient	Reference to current test case
QICoreEncounter	Encounter.status	finished
QICoreEncounter	Encounter.subject	Reference to current test case
QICoreMedicationAdministration	MedicationAdministration.subject	Reference to current test case
QICoreMedicationRequest	MedicationRequest.intent	order
QICoreMedicationRequest	MedicationRequest.status	active
QICoreMedicationRequest	MedicationRequest.subject	Reference to current test case
QICoreMedicationRequest	MedicationRequest.requester	Reference to the default Practitioner
QICoreObservation	Observation.subject	Reference to current test case
QICorePractitioner	Practitioner.identifier	123456
QICorePractitioner	Practitioner.name.family	Evil
QICorePractitioner	Practitioner.name.prefix	Dr
QICoreProcedure	Procedure.status	completed
QICoreProcedure	Procedure.subject	Reference to current test case
QICoreServiceRequest	ServiceRequest.intent	order
QICoreServiceRequest	ServiceRequest.status	active
QICoreServiceRequest	ServiceRequest.subject	Reference to current test case

10.2 Default Organization

The Default Organization in MADiE is set to Blue Cross Blue Shield of Texas. We've set the address to P.O. Box 660044, Dallas, TX 75266-0044. With the phone number 972-766-6900

11 Sharing a Measure

Currently, MADiE does not contain self-service functionality to share measures. To share a measure and all test cases for the measure, the measure owner must complete the Measure Sharing Request Form v1.1 located on the MADiE MVP tab of the MAT Public website and submit it via email to the Helpdesk at semanticbits-madie-help@icf.com. **This form must be submitted via email and NOT submitted using the Bonnie MAT MADiE Jira Issue tracker as it contains HARP IDs.

Please consider the following before submitting a request:

1. Once a measure is shared, all of its test cases are shared, since MADiE consolidates measure creation and testing functionality into a single tool.
2. Once a measure is shared, those who have access must coordinate to avoid overwriting each other's work. Overwriting prevention measures will not be immediately available and all users that the measure is shared with will have access to the measure and its test cases without restriction.
3. Once a measure and its test cases are shared, sharing cannot be reversed. Support for unsharing is currently not available.

If you want to share your measure, take the following steps:

1. Review who the measure is currently shared with by selecting the measure in the MAT and clicking the "Share" button.
2. Review previously submitted Bonnie Group Account forms to identify who has access to the measure's test cases in Bonnie FHIR.
3. Collect the HARP IDs of the users with which the measure and test cases are to be shared.
4. Transfer the measure to MADiE.
5. **IMPORTANT:** Before submitting your request to share your measure, ensure that the measure is in MADiE and all users on the form have the MADiE HARP role.

12 Libraries Overview Page

The Libraries Overview page displays all standalone CQL Libraries that have been added to MADiE and further organizes the CQL Libraries into tables in two areas: My CQL Libraries and All CQL Libraries. The My Libraries table displays a list of CQL Libraries you own or have been shared with you. The All Measures table displays all CQL Libraries in the system. Both areas also include:

1. **Search:** The Search field can be used to find a specific CQL Library by Library Name.
2. **Library Name:** The Library Name column displays the name of a CQL Library.
3. **Version:** The Version column displays the assigned version number of the library. Libraries that are in draft state will display a blue "Draft" tag beside its version number.
4. **Model:** The Model column displays the model and model version of a CQL Library.
5. **Actions:** The Actions column provides access to two options:
   a. **View/Edit:** The View option opens a selected CQL Library.
   b. **Version:** The Version option creates a version or draft of a selected CQL Library.

A standalone CQL Library cannot be included into a measure unless it is in a versioned state. However, please note that once a standalone CQL Library has been versioned, it cannot be edited. To make any changes, a new draft of that standalone CQL library must be made.

13 Creating a New CQL Library

To create a new CQL Library, initiate the process by clicking on the "+ New Library" button in the upper right of the screen while on the Measures page. The New Library creation modal will appear, prompting you to enter the following information:

1. **Library Name:** The Library Name is the name of the standalone CQL library. The CQL Library Name must be unique within MADiE, start with an alpha-character or underscore followed by an alpha-numeric character(s) or underscore(s) and must not contain spaces.
2. **Model:** The Model dropdown assigns an available Model and Model version to the CQL library.
3. **Description:** The Description field describes the intent of the CQL Library.
4. **Publisher:** This is the organization responsible for the library content and maintenance. Choose the desired organization from the dropdown menu. **Note:** Organizations not included in the Publisher dropdown can be added by making a request to the [MADiE Helpdesk](#).

Once the information above has been entered you have the option to:

1. **Cancel:** The Cancel button discontinues the creation of a new CQL library and closes the modal.
2. **Continue:** The Continue button saves the new CQL library using the information entered into the New Library creation modal and opens the newly created CQL Library for further editing.

14 Viewing & Editing a CQL Library

Upon opening an existing CQL Library or continuing from the New Library creation modal, the CQL Library content viewing/editing area is displayed. The viewing/editing area displays key content for the opened/newly created CQL Library and additional areas to further view/edit the rest of the CQL Library.

14.1 CQL Library Header

In the blue header, the following information and functionality about a CQL Library is displayed:

1. **CQL Library Name:** The CQL Library Name is displayed below the Navigation Breadcrumbs and above the Model, Model Version, and measurement period.
2. **Model & Version:** The model and model version are displayed below the CQL Library Name.

3. **Last Update Date:** The date when the CQL Library was last updated is displayed below the CQL Library Name and to the right of the model and model version.
4. **Navigation Breadcrumbs:** Above the CQL Library Name are navigation breadcrumbs, indicating what area of MADiE is currently displayed and providing a way to navigate back to the Libraries page.

14.2 CQL Editor (for Standalone CQL Libraries)

Below the blue header and in the left panel is the CQL Editor where a Standalone CQL Library logic including Parameters, Definitions, and Functions can be viewed and edited. All information except for the measure CQL Library Name and Version can be added, edited, and deleted.

All CQL must be entered in correct CQL syntax. When saving, any errors in the CQL will be displayed. CQL containing errors can be saved but may prevent dependent functionality from working properly (e.g., measures including the library). Make sure that the CQL is fully completed, and errors are resolved to ensure proper functionality.

14.3 CQL Library Details

Below the blue header and in the right panel are where the CQL Library Details can be edited, including:

1. **Library Name:** The Library Name is the name of the standalone CQL library. The Library Name displays the name entered when the CQL Library was created or last edited by anyone with access. CQL Library Names must be unique within MADiE, start with an alpha-character or underscore followed by an alpha-numeric character(s) or underscore(s) and must not contain spaces.
2. **Description:** The Description field describes the intent of the CQL Library.
3. **Experimental Checkbox:** The Experimental Checkbox can be selected if a CQL Library is Experimental.
4. **Publisher:** This is the organization responsible for the library content and maintenance. Choose the desired organization from the dropdown menu. **Note:** Organizations not included in the Publisher dropdown can be added by making a request to the MADiE Helpdesk.

5. **Program Use Context:** The Program Use Context field defaults to blank and allows users to select the program or project of work the measure is applicable to. The drop down contains the following options:

Code	Display	Definition
mips	MIPS	Merit-Based Incentive Payments System (MIPS)
ep-ec	EP/EC	CMS Promoting Interoperability Eligible Professionals/Eligible Clinicians.
eh-cah	EH/CAH	CMS Promoting Interoperability Eligible Hospitals or Critical Access Hospitals.
qpp	QPP	Quality Payment Program.
aapm	AAPM	Advanced Alternative Payment Models.
cpcp	CPC+	Comprehensive Primary Care Plus (CPC+)

15 Feedback and Support

An issue tracker and feedback email list are available to support the resolution of issues and to answer questions related to the MADiE application. The Bonnie MAT MADiE issue tracker is available on the ONC Jira system.

MADiE users should create a ticket in the issue tracker to report bugs, ask questions, or to request new features. To add an issue, users must create a login account in the Jira system. Once an issue has been entered, the MADiE team will review and prioritize it.

Acronyms

Acronym	Definition
CMS	Centers for Medicare & Medicaid Services
CQL	Clinical Quality Language
CQM	Clinical Quality Measure
eCQM	Electronic Clinical Quality Measure
FHIR	Fast Healthcare Interoperability Resources
IP	Initial Population
JSON	JavaScript Object Notation
MADiE	Measure Authoring Development Integrated Environment
MAT	Measure Authoring Tool
NLM	National Library of Medicine
ONC	Office of National Coordinator for Health Information Technology
QI-Core	Quality Improvement Core
QMIG	Quality Measure Implementation Guide
UMLS	Unified Medical Language System
VSAC	Value Set Authority Center
XML	Extensible Markup Language