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PREFACE

The Measure Authoring Tool (MAT) is a web application which allows measure developers to author electronic Clinical Quality Measures (eCQMs) using Clinical Quality Language (CQL) and the Quality Data Model (QDM). The MAT provides the capability to express complex measure logic and export measures in several formats, including a human-readable document which can be viewed in a web browser, a CQL file containing the CQL library in its entirety, and for integration into Electronic Health Records (EHRs), the MAT provides an eCQM HQMF XML document, an Expression Logical Model (ELM) XML document, and a JavaScript Object Notation (JSON) file.

The purpose of this document is to provide a description of the functionality of the MAT, and to provide MAT users with step-by-step instructions for authoring an eCQM using the MAT.

The Centers for Medicare & Medicaid Services (CMS) has ownership of the MAT. Health Care Innovation Services (HCIS), a joint venture between Telligen and Net-Integrated Consulting (NIC), is currently under contract with CMS for the ongoing development, maintenance, and support of the MAT.

For additional information, contact:

The MAT Support Desk
1776 West Lakes Parkway
West Des Moines, IA 50266
Phone: 1-800-673-0655
Support@emeasuretool.org
CHAPTER 1: ACCESSIBILITY

The Measure Authoring Tool (MAT) and associated functions is accessible via assistive technology. For an alternative means of accessing information about the MAT, please contact the MAT Support Desk at support@emeasuretool.org. When submitting an email request, provide details about the issue, the web address of the requested information, and your contact information.

SECTION 508 EIT ACCESSIBILITY

CMS is committed to making website and electronic information technology (EIT) accessible. In keeping with this goal, CMS implements the regulations of Section 508 of the Rehabilitation Act.

SYNOPSIS OF SECTION 508 ACCESSIBILITY REQUIREMENTS

Section 508 of the Rehabilitation Act of 1973, as amended by the Workforce Investment Act of 1998, requires Federal agencies ensure Federal employees and members of the public with disabilities have access to and use of information and data that is comparable to individuals without disabilities.

The first regulation implementing Section 508 was issued by the Architectural and Transportation Barriers Compliance Board (the "Access Board"), an independent Federal agency whose primary mission is to promote accessibility for individuals with disabilities. This regulation is referred to as the Access Board’s EIT Accessibility Standards, enforceable on June 21, 2001. In January 2005, the Secretary of the Department of Health and Human Services (HHS) signed the HHS Policy for Section 508 Electronic and Information Technology (EIT). This policy establishes guidance for implementing Section 508 compliance throughout the department.

Although Federal agencies have an explicit statutory obligation to make all EIT that they develop, procure, maintain, or use compliant with Section 508, individuals may only file complaints or lawsuits to enforce Section 508’s requirements with respect to EIT systems procured or deployed on or after June 21, 2001. The Section 508 requirements do not apply retroactively to pre-existing EIT. However, as agencies upgrade and change their EIT, they must comply with the standards. Specifically, the Electronic and Information Technology Accessibility Standards: Economic Assessment states: "The standards are to be applied prospectively and do not require Federal agencies to retrofit existing electronic and information technology. As agencies upgrade and change their electronic and information technology, they must comply with the standards."

Federal agencies, however, have additional responsibilities under Section 501 and Section 504 of the Rehabilitation Act. These sections require that agencies provide reasonable accommodation to employees with disabilities and program access to members of the public with disabilities and take other actions necessary to prevent discrimination on the basis of disability in their programs.
MEASURE COMPOSER ACCESSIBILITY

For users of screen reader or other accessibility tools who require an alternate method to use the MAT, contact the MAT Support Desk to arrange a time for a representative to assist you. The phone number for the MAT Support Desk is 1-800-673-0655, and the email address is, support@emeasuretool.org.

ADOBE PDF

Some of our documents are available in PDF format. The current version of Adobe Reader, formerly called Acrobat Reader, now includes a built-in Read Out Loud option. If your current version of Adobe Reader does not have this feature, the updated version is available free from Adobe. To install the latest version of the Adobe Reader, go to: http://www.get.adobe.com/reader.

Adobe Reader synthesizes the text in Adobe PDF files into speech, using the default speech engine in a regular Windows or Macintosh computer, so anyone can read basic Adobe PDF text files aloud, even without a screen reader. For more information about this new feature, please visit the Adobe Reader Help Accessibility Features web page, http://helpx.adobe.com/reader/using/accessibility-features.html.

You can access the Adobe Reader Read Out Loud option in the MAT User Guide by using the following keyboard shortcuts (toggle on and off with the same command):

- Activate / deactivate the Read Out Loud Option: Shift + Ctrl + Y
- Read / stop reading the current page only: Shift + Ctrl + V
- Read / stop reading the entire document: Shift + Ctrl + B

If you use screen reader software that is not compatible with Adobe Reader (for example, an audio-enabled web browser), Adobe provides a free online tool which converts the content of PDF files to a format most screen reader applications can understand. If you need assistance converting PDF documents, Adobe offers conversion tools at its Accessibility Resource Center at http://www.adobe.com/accessibility/index.html.

MEASURE AUTHORING TOOL ACCESSIBILITY POLICY

The MAT Accessibility Policy link is located at the bottom of each page in the Measure Authoring Tool, under the Helpful Links heading, and opens the Accessibility Policy in a new window.

Figure 1: Location of Accessibility Policy
CHAPTER 2: SYSTEM REQUIREMENTS

Chapter Overview: This chapter lists the minimum hardware and software requirements to access the MAT effectively.

HARDWARE

Processing speed: 2GHz (recommended). Less than the recommended processing speed will affect the time it takes to load information or save data.

Memory: 2 GB RAM (minimum requirements).

Screen resolution: 1024 x 768 pixels.

SOFTWARE

Internet browsers: Microsoft® Internet Explorer Version 11.0 or above, or Mozilla Firefox 36 or higher. Users may open the MAT with other browsers, but they are not supported at this time.

Operating systems: Microsoft Windows 7 or above. Users may open the MAT in other operating systems, but they are not supported at this time.

INTERNET CONNECTION

The MAT is accessible via any high-speed internet connection (minimum of a 56k modem).

SYSTEM AVAILABILITY

The MAT is available 24 hours a day, 7 days a week at https://www.emeasuretool.cms.gov or emeasuretool.cms.gov. MAT users are notified by email about scheduled and unscheduled system maintenance. Scheduled maintenance occurs on the second weekend of each month from approximately 9:00 PM Eastern Time (ET) on Friday through approximately 9:00 PM ET on Saturday. The MAT may not be available during those times.

APPLICATION TIMEOUT

Users will be automatically logged out of the MAT after 30 minutes of inactivity. Users will receive a warning message after 25 minutes of inactivity, which will prompt them to continue their MAT session.

MAT PUBLIC WEBSITE

The MAT public website can be found at https://www.emeasuretool.cms.gov or emeasuretool.cms.gov. This site contains information about the Measure Authoring Tool, a link to log into the MAT, News & Alerts, Training & Resources, our Open Source Community, and the Contact Us information and form.
Users can also find links to recorded training sessions, the MAT User Guide, and other helpful documents and videos.

**TECHNICAL / USER SUPPORT**

MAT Support is available Monday through Friday from 7:30AM to 5:00PM Central Time. MAT Support is closed on the following holidays: New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving, and Christmas Day.

There are multiple ways users can contact MAT Support for assistance:

1. The Contact Us form on the Contact Us page of the public website will directly open a ticket with MAT Support.
2. Users can contact 1-800-673-0655 during MAT Support business hours.
3. Users can email MAT Support directly at support@emeasuretool.org.

Whichever method is chosen, users should provide as detailed a description of the issue as they can to assist in resolution. Including items such as what part of the tool they are using, what error messages are included, etc. can speed up the resolution of the ticket.
CHAPTER 3: LOGGING IN AND ACCOUNT MANAGEMENT

Chapter Overview: This chapter outlines information on how to become a MAT user, log into the system for the first time, subsequent logins, and user account management.

BECOMING A NEW MAT USER

There are several required steps to becoming a Measure Authoring Tool (MAT) user. All new MAT users are required to submit a notarized New User Registration Form, obtain UMLS license credentials, and register up to three Symantec™ VIP Access Credential IDs.

MAT NEW USER REGISTRATION FORM

To access the MAT, a potential MAT user must complete the New User Registration Form, which is located on the Training & Resources tab of the MAT Public website, https://www.emeasuretool.cms.gov/web/guest/training-resources. The form should be completed according to the directions listed within the document. The form must be notarized, and the original mailed to MAT Support at the following address:

Telligen
MAT Support
1776 West Lakes Parkway
West Des Moines, IA 50266

In addition to contact information, applicants will also need to provide the organization's HL7 object identifier (OID). If the applicant’s organization has a registered OID, the applicant is to use that OID. If the organization does not have an OID, the applicant may choose to register for an OID using the HL7 OID Registry at, http://www.hl7.org/oid/index.cfm.

The organization name and OID used within the MAT must be consistent with other MAT users who are using the same organization name. For example, if an organization is called Measure Developer, Inc. and the OID for this organization is 1.2.3.4.5.6, all registration applicants who list Measure Developer, Inc. as their organization must use the OID 1.2.3.4.5.6. Otherwise a different organization name must be used.

If your organization does not have a registered HL7 OID, and a registered HL7 OID is not required for your measure development purposes, you may submit a request to MAT Support at support@emeasuretool.org to assign a universally unique identifier (UUID), specific to the MAT, for your organization in lieu of an OID.
**APPLY FOR A UMLS® LICENSE**

To integrate with the Value Set Authority Center (VSAC) through the MAT, users are required to have a Unified Medical Language System© Metathesaurus License (UMLS).

To request a license and create a UMLS account, users must access [https://uts.nlm.nih.gov/license.html](https://uts.nlm.nih.gov/license.html).

**INSTALL AND SET UP SYMANTEC™ VIP ACCESS**

The MAT uses two-factor authentication. Two-factor authentication requires that two unique identifiers be provided to access an application. The MAT uses an application produced by Symantec™ Validation & ID Protection called Symantec™ VIP Access. The Symantec™ security code is generated from an installed application to your desktop, smartphone, or tablet. Complete instructions for installing Symantec™ VIP Access and registering the corresponding Symantec™ Credential ID are located on the Training & Resources page of the public website in the document titled [Symantec™ VIP Access Setup](#).

The MAT supports up to three installations of Symantec™ VIP Access. Symantec VIP Access installation instructions for mobile devices and desktops can be accessed online at the Symantec Validation & ID Protection Center. Once the Symantec™ VIP Access application is installed, register the corresponding 12-digit alphanumeric Symantec™ Credential ID with MAT Support by completing the Contact Us form on the public website or call 1-800-673-0655.

After confirmation has been received that the Symantec™ Credential ID(s) are registered with the MAT Support Desk, the security code generated by one of the registered Symantec™ VIP Access installations may be entered to access the MAT. Symantec™ security codes are new every 30 seconds. The installed application includes a timer indicating when the security code will update. Desktop applications include a copy function to ensure the correct security code is entered into the MAT.

Note: The Symantec™ VIP Access application does not need to be installed on the same device or computer being used to access the MAT. For example, a work-issued laptop or desktop can be used to access the MAT, and the Symantec VIP Access application producing the Symantec™ Security Code may be installed on a separate device such as a smartphone.

**ACCESSING THE MEASURE AUTHORING TOOL**

**LINK TO THE MEASURE AUTHORING TOOL**

The MAT is available through a link that exists on the homepage of the MAT public Website ([https://www.emeasuretool.cms.gov](https://www.emeasuretool.cms.gov) or [emeasuretool.cms.gov](https://emeasuretool.cms.gov)). Users will find a button under the Secure Login heading along the right-hand side of the screen, titled ‘Log in to the MAT’. Clicking this button will direct users to the MAT URL.
LOGGING IN – FIRST TIME

Upon your first access to the MAT URL you will be directed to a login page. Please use the following steps to log in.

Note: It is important that you do not attempt to log into the MAT until you have received the following three items; the user name assigned to the account, a temporary password, and confirmation from MAT Support that your Symantec™ Credential ID has been successfully registered with the MAT.

1. Enter the user name you received in an email when the account was set up, to log into the MAT.
2. Enter the temporary password provided to you in an email from MATNotify.
3. Enter the security code from your Symantec™ VIP Application.
4. Click ‘Sign-In’.
5. After signing into the MAT with a temporary password, you will be prompted to create and confirm a new password. For security purposes, the system requires a strong password (defined below).
   a. Passwords may not consist of only a single dictionary word with random numbers and symbols. Users can use more than one dictionary word with the addition of numbers and symbols or construct a password that does not contain any discernable words.
   b. The last six (6) passwords cannot be reused.
   c. The password needs to be at least one-day old before it can be changed again.
   d. **Passwords must contain:**
      i. 8-16 characters only
      ii. An uppercase character
      iii. A lowercase character
      iv. A numeric character
      v. And one of the following special characters: % # * + - , : = ? _

MAT passwords expire every 60 days. The new password must continue to meet the strong password requirements. The new password must not match the previously used 6 passwords. After 60 days, MAT users are restricted from accessing the MAT until their MAT password has been changed successfully.

6. Next, select three different security questions and provide answers to those security questions. Answers may not be duplicated.
7. Select the ‘Save and Continue’ button to log into the MAT
8. Users are redirected to the UMLS Account page of the MAT and a green success message appears indicating that you have successfully logged into the MAT.
SUBSEQUENT LOGINS

Upon returning to the MAT URL a user would use the following steps to login to the system:

1. Enter your MAT User Name.
2. Enter your chosen password.
3. Enter the security code from your Symantec™ VIP Application.
4. Click ‘Sign In’.
5. Users are redirected to the UMLS Account page of the MAT and a green success message appears indicating that you have successfully logged into the MAT.

MAT USER ACCOUNT MANAGEMENT

FORGOTTEN PASSWORD/USER ID

The forgotten password function provides sign-in assistance when the password is unknown. Complete the following steps to request a password reset:

1. Select the word ‘Password’ in the ‘Forgot your User ID or Password?’ question located below the ‘Sign In’ button on the sign-in page.
2. Enter your MAT User ID and select the ‘Submit’ button.
3. Type in the answer to the Security Question and select the ‘Submit’ button.
4. If all entries are correct, a success message will display, and a temporary password will be sent to the email address on file with the MAT account.
5. If there was an error in entry a warning message will display and users can either try their entries again, or contact MAT Support through the contact us form on the Contact Us page of the public website for password assistance.

6. Upon using the new temporary password to log into the MAT the system will require the user to choose a new password and confirm it.

7. There is also an option to update the Security Questions at this point if the user wishes.

8. Select the ‘Submit’ button and the user will be logged into the MAT.

The forgotten User ID function provides sign-in assistance when the User ID is unknown. Complete the following steps to request the user ID:

1. Select the words ‘User ID’ in the “Forgot your User ID or Password?” question located below the ‘Sign-In’ button on the sign-in page.

2. Users are prompted to insert the email address associated with the MAT account and then select the ‘Submit’ button.

3. A success message will display, and the User ID associated with the email entered will be sent to that email address.

4. Once the User ID is retrieved, the user can use it to log into the MAT.

MANAGING PERSONAL INFORMATION

In the MAT Account tab of the MAT tool, the Personal Information sub-tab contains information entered when the original account was created. Here, users can update their name, title, email address, and phone number.

The user will need to enter their current MAT Password to confirm any changes made on this page.

Note: The organization and organization OID may only be changed by contacting MAT Support through the contact us form on the Contact Us page of the public website.

UPDATING PASSWORD AND SECURITY QUESTIONS

The MAT requires a user to choose new password every 60 days; however, a user’s password and security questions can be updated sooner if a user chooses.

To update their password, a user would complete the following steps:

1. Sign into the Measure Authoring Tool.

2. Click on the MAT Account Tab along the top of the tool.

3. Click on the Password sub-tab.

4. Enter the new password.

5. Confirm the new password.

6. Enter the current password to confirm the changes.

7. Click ‘Save and Continue’.
Note: Password rules are written to the right of the text fields. All passwords chosen must meet these rules before the MAT will accept them.

To update their security questions, a user would complete the following steps:

1. Sign into the Measure Authoring Tool.
2. Click on the MAT Account Tab along the top of the tool.
3. Click on the Security Questions sub-tab.
4. Make any necessary changes to the security questions.
5. Enter the current password to confirm the changes.
6. Click ‘Save and Continue’.

Figure 3: MAT Account Tab
CHAPTER 4: INTEGRATION WITH THE VSAC

Chapter Overview: This chapter discusses the integration between the Value Set Authority Center (VSAC) and the MAT. In addition, instructions for integrating with the VSAC to retrieve value set and/or code data are provided.

The Value Set Authority Center (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 already created value sets and directly referenced codes and is actively incorporating new value sets for other use cases, new measures, and for updating existing measures.

UMLS LICENSE

A Unified Medical Language System® (UMLS) Metathesaurus License is required to access value sets contained within the VSAC. To request a UMLS license, submit a request at, https://uts.nlm.nih.gov/license.html.

The UMLS user name and password is used to establish an active connection to the VSAC allowing MAT users to retrieve the VSAC value set data.

CONNECTING TO VSAC FOR VALUE SET DATA

After Logging into the MAT, Users are directed to the Unified Medical Language System® (UMLS) Account Login page. Users with a UMLS license can enter their UMLS User Name and Password to connect to VSAC.

Users that do not have a UMLS license, but would like one can click on the ‘Need a UMLS License?’ Link that will navigate you out of the MAT and to the UMLS page where you will find a link that allows you to request an UMLS License/account.

Figure 4: UMLS Login Page
CHAPTER 5: MEASURE LIBRARY

Chapter Overview: This chapter highlights the features of the Measure Library. Users will learn how to create a new measure, create a major or minor version of an existing measure, create a draft of an existing measure, and create a clone of an existing measure.

The Measure Library contains two tables, a search box, and a number of icons to perform the above-referenced functions. Refer to Figure 6: Measure Library at the end of this section.

RECENT ACTIVITY

In the upper left-hand corner is a small table that contains the two most recent measures that were accessed by the user. If this is the first time the user has accessed the system, this table will be blank until a measure is created or opened.

To open a measure from the Recent Activity table, click on the measure name in the list.

MEASURE TABLE

The bottom half of the screen contains a table of the measures that have been created within the MAT. The list is automatically filtered by the measures owned by or shared with the user. To view all measures currently in the Measure Authoring Tool, a user would uncheck the box titled ‘Filter by My Measures’ located under the search box and click ‘Search’.

To open a measure from the Measure Table, click on the measure name in the list.

SEARCH BOX

The upper right-hand corner contains a search box with a check box that states Filter by My Measures. To see all measures, uncheck the ‘Filter by My Measures’ checkbox and click ‘Search’. Text can be typed into the search box to further narrow down the list.

ICONS

The Measure Library tab contains a number of icons. Below is a list of the icons found on this tab and their functions.

NEW MEASURE

The New Measure icon, found in the upper right-hand corner of the screen, above the search box, and is represented by a lightbulb and the words, New Measure. Clicking on this icon will open a screen that will allow you to give the new measure a name, assign an abbreviated name, choose a measure scoring type, and select the Patient-based Measure indicator. Once these fields are complete, clicking on ‘Save
and Continue’ will present the user with a success message and take the user to the Measure Composer tab to begin writing their measure.

Note: The options for the Patient-based Measure indicator are driven by which measure scoring type is selected.

CREATE DRAFT

The Draft icon, found on the measure table in-line with the individual measure names, under the Create Version/Draft column, is represented by a sheet of paper with a pencil in the corner. This icon is used to create a draft of a measure that is currently in a versioned state. Upon clicking this icon, a new draft of that measure is created, and the user is presented with a confirmation message. Clicking on the ‘Continue’ button just below the message will take the user directly to the Measure Details of the Measure Composer tab where they can begin the process of making the desired changes.

CREATE VERSION

The Version icon, found on the measure table in-line with the individual measure names, under the Create Version/Draft column, is represented by a gold star. This icon is used to create a version of a measure that is currently in a draft state. Upon clicking on this icon, the user will be taken to a screen that allows the choice of a major or minor version. After this selection, clicking on ‘Save and Continue’ will take the user back to the Measure Library tab of the tool.

HISTORY

The History icon, found in-line with the measure name on the measure table under the History column, is represented by a clock. Clicking on this icon will give the user information about the creation and activities performed on that measure that will include the person responsible for the action and the date and time of the action. Actions represented include, but are not limited to, measure creation, creation of a draft of that measure, a measure package being created, a measure being exported, ownership changes, and any time a measure is shared with another user.

EDIT

The Edit icon, found on both the recent activity table and the measure table in-line with the individual measure names, under the Edit column, is represented by a pencil. Clicking this icon will open the edit measure screen which will allow a user to change that measure’s name, the abbreviated name, the measure scoring, or the Patient-based Measure indicator. Once these fields are complete, clicking on Save and Continue will take the user back to the Measure Library tab.

Note: The options for the Patient-based Measure indicator are driven by which measure scoring type is selected.
READ-ONLY

The Read-only icon, found on both the recent activity table and the measure table in-line with the individual measure names, under the Edit column, is represented by a newspaper. This icon indicates that the current state of the measure is only allowing for users to open and read the contents of the measure, but they are currently unable to edit it. This icon will appear for a measure that is in a versioned state in place of the edit icon or on any measure for which the user does not have editing rights.

LOCK

The Lock icon, found on both the recent activity table and the measure table in-line with the individual measure names, under the Edit column, is represented by a padlock. This icon indicates that the measure is currently in use and locked by another MAT user. Hovering over the lock symbol will show the user the name of the MAT user that is currently accessing that measure. In this state, the measure can still be opened, but will be in a read-only state until the other user has finished with and exited out of the measure.

EXPORT

The Export icon, found on both the recent activity table and the measure table in-line with the individual measure names, under the Export column, is represented by a download symbol (downward pointing arrow, into a computer system unit). This icon appears in line with any measure that has had a measure package created and allows users to export the measure artifacts out of the MAT.

There is also a check box next to the Export Icon which allows users to export more than one measure at a time. To do this, the user would select the checkboxes in line with the measures they wish to export and then Select the ‘Export Selected’ button at the bottom. This check box will only show on measures that have been previously packaged.

SHARE

The Share icon, found on the measure table in-line with the individual measure names, under the Share column, is represented by a green box with a curved arrow.

Sharing a measure with another measure developer will give them the rights to edit that measure and create measure packages. For measures the user does not own, the Share icon is gray and disabled. Only the measure owner can assign permission for others to edit the measure.

The presence of an active Share icon indicates the measure is owned by the user.

Clicking on the Share icon will take the user to the Measure Sharing screen where the user can search for and will choose a person to share editing privileges with for that particular measure.
There is also a Private Measure checkbox on this page. Checking this box will make the measure in question only available to be seen by the owner and any persons it is shared with. Unchecking the Private Measure checkbox and clicking on ‘Save and Continue’ will make a private measure public again.

A user would perform a search if desired, check the boxes of the people they would like to share the measure with, check the Private Measure box if desired, and then click on ‘Save and Continue’.

To remove sharing privilege, the owner would click on the share icon again, deselect the checkbox next to the user’s name and click ‘Save and Continue’.

**CLONE**

The Clone icon, found on the measure table in-line with the individual measure names, under the Clone column, is represented by two sheets of paper. Cloning is a function that allows users to copy a measure, modify it, and save it as a new measure. The function helps users create measures with identical populations and/or denominators without the need to rebuild logic.

An active Clone icon appears for measures owned by the signed-in user. If the user accessing the measure is not the measure owner, the Clone icon is gray and disabled. It’s important to note that measures written prior to the transition to CQL are not available for cloning.

Cloned measures do not carry connection to the original measure. When a measure is cloned, users are prompted to give the measure a new name, abbreviated name, choose a measure scoring type and indicate whether or not the measure is patient-based. Changes made to the original measure after cloning are not automatically updated in the cloned measure.
Figure 5: Measure Library

- Recent Activity Table
- New Measure Icon
- Search box
- My Measures Filter
- Measure Table with Icons
Chapter Overview: The Measure Details section allows users to define the metadata about their measures. This includes, but is not limited to, information such as the measure steward, author, measurement period, clinical rationale, references, and guidance. These details will comprise the header of the human-readable measure.

The allowed measure populations display dynamically in the Measure Details based on the measure scoring type selected for the measure. In other words, only description fields for eligible populations for a measure scoring type are viewed on the Measure Details page.

As the information entered into the MAT is included in an HTML file in the measure exports, all characters used should be HTML compatible. Any character that can be created using a keyboard function and therefore directly entered into these fields will be compatible. However, use caution copying and pasting items from other sources because they could contain superscripts, subscripts or other non-HTML compatible characters (for example: ©, ®, and ™). Using non-HTML compatible characters will cause an error upon export.

For images of this page, please refer the Figure 7: Measure Details Tab Part 1, Figure 8: Measure Details Tab Part 2, Figure 9: Measure Details Tab Part 3, and Figure 10: Measure Details Tab Part 4 within this chapter.

General Measure Information

The General Measure Information section contains a number of fields that are auto-populated with information that was either entered or obtained during the creation of the measure. All fields in this section are read-only and can not be edited. This section is defaulted to a collapsed state. To view the information contained in the General Measure Information section, a user would click on the heading to expand the fields. Clicking on the heading again, will return the section to its collapsed state. The fields in this section are as follows:

Measure Scoring

The Measure Scoring field automatically displays the type of measure scoring which was entered at the time the measure was created. This can not be changed on the Measure Details page. To change the type of measure scoring, select the edit icon for the measure on the Measure Library page.

Patient-Based Measure

The Patient-based Measure field will show what option was chosen in the Patient-based indicator when the measure was first created. This field can not be changed on the Measure Details page. To change the Patient-based indicator, select the edit icon for the measure on the Measure Library page.
ECQM ABBREVIATED TITLE
The eCQM Abbreviated Title field automatically displays the abbreviated title that was chosen by the measure developer at the time the measure was created. This cannot be changed on the Measure Details page. To change the eCQM Abbreviated Title, select the edit icon for the measure on the Measure Library page.

FINALIZED DATE
The MAT assigns a date and time representing the Finalized Date of the measure upon versioning. No date displays for measures currently in draft mode.

GUID (GLOBALLY UNIQUE IDENTIFIER)
A GUID is assigned to the measure at creation. This identifier remains consistent throughout all versions and drafts of a measure. It is a unique identifier assigned by the MAT and required by the HL7 HQMF standard.

ECQM VERSION NUMBER
The eCQM Version Number field is assigned by the Measure Authoring Tool. The Measure Version Number has three components: The major version, minor version, followed by the number of times the measure version has been packaged. The number of times the selected measure has been packaged is called the revision number.

If the measure is currently in a draft state, this field will show which version the draft was created from in the following format: “Draft based on vX.X.XXX”

Note: In the unlikely circumstance that a measure draft or version is packaged 999 times, then the revision counter resets to zero.

SAVE BUTTON
The ‘Save’ button is located both just below the General Measure Information, and again at the bottom of the Measure Details page. Clicking this button will save any changes made to the Measure Details page.

DELETE MEASURE BUTTON
The ‘Delete Measure’ button is located both just below the General Measure Information, and again at the bottom of the Measure Details page, next to the ‘Save’ button. Clicking this button will open a message indicating that the user needs to enter their MAT account password to confirm the deletion of the measure. Only the owner of the measure can delete it. Once a measure, or version of a measure is deleted, it can not be retrieved.
ECQM IDENTIFIER (MEASURE AUTHORING TOOL)

The eCQM Identifier (Measure Authoring Tool) field is optional. When ready to assign a Measure Identifier, the user can select the ‘Generate Identifier’ button. This identifier will remain consistent throughout all versions and drafts of a measure. Once a Measure Identifier has been generated, the user will not be able to modify or remove it from any draft or version. The Measure Identifier will be unique to that measure (and its versions or drafts); it will not be assigned by the MAT to any other measure.

ENDORSED BY NQF

Select the appropriate selection from the dropdown menu to indicate whether or not the measure is currently endorsed by NQF.

NATIONAL QUALITY FORUM (NQF) NUMBER

Enter the assigned NQF ID if the measure is NQF endorsed.

For measures that do not have an NQF Number, enter “Not Applicable”.

MEASUREMENT PERIOD

The Measurement Period for all measures defaults to the calendar year and is represented as January 1, 20XX through December 31, 20XX in the HTML human readable.

A measurement period other than the calendar year may be designated. To do so, complete the following steps.

1) Uncheck the Calendar Year checkbox.

2) Select the calendar icon to the right of the ‘From’ input field and select the desired date. Or click in the ‘From’ box and type in the date for the Measurement Period in the format – “MM/DD/YYYY”

3) Next, select the calendar icon to the right of the ‘To’ input field and select the desired date. Or click in the ’To’ box and type in the date for the measurement period in the format – “MM/DD/YYYY”

4) Select the Save to retain changes.

MEASURE STEWARD

The Measure Steward is the organization responsible for the measure content and maintenance. Choose the desired Measure Steward by selecting organization from the dropdown menu. To save the selected Measure Steward, select the ‘Save’ button.
Note: If the desired organization does not appear in the Measure Steward list, submit a request to MAT Support to have the organization added. The request should include the full name of the organization and the organization’s OID. An organization OID may be obtained from and registered on the HL7 OID registry, https://www.hl7.org/oid/index.cfm. If an organization OID is not available, a UUID, specific to the MAT, will be assigned by MAT Support.

**Figure 6: Measure Details Tab Part 1**

**MEASURE DEVELOPER**

The Measure Developer represents the organization(s) that authored the measure. Choose the desired organization(s) by selecting the checkbox positioned to the left of the organization name.

The organization OID can be verified by hovering over the organization name in the alphabetical Measure Developer list. The selected Measure Developer(s) appears at the top of the alphabetical list after the selection has been saved. To save the selected Measure Developer(s), select the ‘Save’ button.
Note: If the desired organization does not appear in the Measure Developer list, submit a request to MAT Support to have the organization added. The request should include the full name of the organization and the organization’s OID. An organization OID may be obtained from and registered on the HL7 OID registry, https://www.hl7.org/oid/index.cfm. If an organization OID is not available, a UUID will be assigned by the MAT Help Desk.

**DESCRIPTION**
Enter a general description of the measure intent.

Note: Users are encouraged to view the published measures stored on the eCQI Resources Page to view examples of descriptions.

**COPYRIGHT**
Enter the organization(s) who own the intellectual property represented by the measure.

For measures that do not have copyright information, enter “None”.

**DISCLAIMER**
Enter disclaimer information for the measure.

For measures that do not have disclaimer information, enter “None”.

**MEASURE TYPE**
Select the appropriate Measure Type by selecting the checkbox to the right of one or more of the following measure types included in the Measure Type List on the Measure Details page:
- Appropriate use Process
- Composite
- Cost/Resource Use
- Efficiency
- Intermediate Clinical Outcome
- Outcome
- Patient Engagement/Experience
- Patient Reported Outcome Performance
- Process
- Structure

To deselect a previously added Measure Type, uncheck the box to the left of the Measure Type to be removed then select the ‘Save’ button to retain changes.
COMPONENT MEASURES LIST

The Component Measures List within the Measure Details page allows users the option to add one or more component measures for the selected measure.

Measures constructed in the MAT may be composite measures. For composite measures, MAT users may add one or more component measures. Component measures serve as a reference point for understanding what comprises a composite measure.

Users are able to select component measures from a list of all measures accessible from the Component Measures List input field on the Measure Details page. All measures are listed in a table with the measure name, full version number, and finalized date, if applicable.

To select component measures, select the ‘Add/Edit Component Measure’ button located just below the Component Measures list. Clicking this button will navigate the user to a new page where all measures within the Measure Authoring Tool are listed. Twenty-file measures display at a time and users may page through the measures using the pagination tool at the bottom of the measures list or use the Search tool in the upper, right corner of the page to refine the search with keyword(s). Select the checkbox next to the measure(s) to be added and click the ‘Add to Component Measures List’ button just below the pagination tool.

Once component measures have been added, a success message will display. Select the ‘Return to Previous’ button at the bottom-left of the screen to return to the Measure Details page.
STRATIFICATION
Enter information that describes the strata for which the measure is to be evaluated.

For measures that do not have stratification information, enter “None”.

RISK ADJUSTMENT
Enter a description of the risk adjustment for the measure. Risk adjustment is the method of adjusting for clinical severity and conditions present at the start of care that can influence patient outcomes for making valid comparisons of outcome measures across providers. This field indicates whether an Measure is subject to the statistical process for reducing, removing, or clarifying the influences of confounding factors to allow more useful comparisons.

For Measures that do not have risk adjustment information, enter “None”.
**RATE AGGREGATION**
Enter a description of the rate aggregation for the measure. Rate aggregation describes how to combine information calculated based on logic in each of several populations into one summarized result. It can also be used to describe how to risk adjust the data based on supplemental data elements described in the measure.

For measures that do not have rate aggregation, enter “None”.

**RATIONALE**
Enter a general description of the evidence used to create the measure. The Rationale should be a succinct statement of the need for the measure. This usually includes statements pertaining to importance criterion such as impact, gap in care and evidence.

Examples of rationale statements can be reviewed in the human readable of published measures by accessing the eCQI Resource Center.

**CLINICAL RECOMMENDATION STATEMENT**
Enter a Clinical Recommendation Statement or general advice regarding the measure and its content developed by the expert panel that created the measure. The Clinical Recommendation Statement is a summary of relevant clinical guidelines or other clinical recommendations supporting the measure.

**IMPROVEMENT NOTATION**
Enter information that indicates whether an increase or decrease in the score is the preferred result (e.g., higher score indicates better quality).

**REFERENCE(S)**
Enter information that identifies bibliographic citations or references to clinical practice guidelines, sources of evidence, or other relevant materials supporting the measure’s intent and rationale.

To add more than one reference, select the ‘Add Reference’ button to the right of the reference box. To remove a reference, select the ‘Remove’ button to the right of the reference to be deleted.

For measures that do not have reference information, enter “None”.

Note: Please keep in mind, each reference should be added separately for references to appear as separate rows in the measure output.

**DEFINITION**
Enter a definition or description of individual terms, if needed. For measures that do not have definition information, enter “None”.
GUIDANCE

Enter important information about how to interpret or implement certain components of the measure. Implementers can reference the guidance section for additional information about the data elements, logic, and timing of the measure’s specifications.

Note: It is recommended that use of the Guidance section is limited, as this information must be manually interpreted before implementation.

For Measures that do not have guidance information, enter “None”.

TRANSMISSION FORMAT

Enter URLs that provide the transmission formats that are specified for a particular reporting program.

For measures that do not have Transmission Format information enter “None”.

Figure 8: Measure Details Tab Part 3
INITIAL POPULATION

Enter a description of the initial population for the measure.

The initial population refers to all patients to be evaluated by a specific performance measure. The initial population shares a common set of specified characteristics within a specific measurement set to which a given measure belongs. Details often include information based upon specific age groups, diagnoses, diagnostic and procedure codes, and enrollment periods. Initial population is a population type included in all four measure scoring types: proportion, ratio, continuous variable, and cohort.

DENOMINATOR

Enter a description of the denominator for the measure.

It can be the same as the initial population or a subset of the initial population, serving as a method to further constrain the population for the purpose of the measure. Different measures within a measure set may have different denominators. Measures with the measure scoring types of proportion or ratio have denominator(s). Continuous variable measures do not have a denominator, but instead define a measure population.

DENOMINATOR EXCLUSIONS

Enter a description of the denominator exclusions for the measure.

Denominator Exclusions are patients who should be removed from the measure population and denominator before determining if numerator criteria are met. Denominator exclusions are used in proportion and ratio measures to help narrow the denominator.

NUMERATOR

Enter a description of the numerator(s) for the measure.

Numerators are used in proportion and ratio measures. In proportion measures the numerator criteria are the processes or outcomes expected for each patient, procedure, or other unit of measurement defined in the denominator. In ratio measures the numerator is related, but not directly derived from the denominator.

NUMERATOR EXCLUSIONS

Enter a description of the numerator exclusions for the measure.

Numerator Exclusions are used in ratio and proportion measures to define instances that should not be included in the numerator data.
DENOMINATOR EXCEPTIONS

Enter a description of the denominator exceptions for the measure.

Denominator exceptions are those conditions that should remove a patient, procedure, or unit of measurement from the denominator only if the numerator criteria are not met. Denominator exceptions allow for adjustment of the calculated score for those providers with higher risk populations. Denominator exceptions are used only in proportion measures. They are not appropriate for ratio, continuous variable, or cohort measures.

Denominator exceptions allow for the exercise of clinical judgment and should be specifically defined where capturing the information in a structured manner fits the clinical workflow. Generic denominator exception reasons used in proportion measures fall into three general categories: medical reasons, patients’ reasons, and system reasons.

For proportion measures that do not have denominator exceptions, enter “None”.

MEASURE POPULATION

Enter a description of the measure population for the measure.

Measure population is used only in continuous variable measures. It is a narrative description of the measure population (e.g., all patients seen in the Emergency Department during the measurement period).

MEASURE POPULATION EXCLUSIONS

Enter a description of the measure population exclusion for the measure.

Measure population exclusions are used only in continuous variable measures. It is a narrative description of the measure population to exclude.

MEASURE OBSERVATIONS

Enter a description of the measure observations for the measure.

Measure observations are used only in continuous variable and ratio measures. They provide the description of how to evaluate performance. Measure observations are generally described using a statistical methodology such as: count, etc.

SUPPLEMENTAL DATA ELEMENTS

Enter a description of the supplemental data elements for the measure.
CMS defines four required supplemental data elements (payer, ethnicity, race, and ONC Administrative Sex), which are used to aggregate data into various subgroups. Comparison of results across strata can be used to show where disparities exist or where there is a need to expose differences in results.

Additional supplemental data elements required for risk adjustment or other purposes of data aggregation can be included in the Supplemental Data Element section.

For measures that do not have supplemental data elements, enter “None”.

**MEASURE SET**

A measure set is a unique grouping of measures that, when viewed together, provide a robust picture of the care within a given domain (e.g., cardiovascular care, pregnancy).

For measures that do not have a measure set, enter “None” or “Not applicable”.

Upon saving information entered in the Measure Details page successfully, select ‘Go To CQL Workspace’ to proceed with building the measure.

*Figure 9: Measure Details Tab Part 4*
CHAPTER 7: MEASURE COMPOSER/CQL WORKSPACE

Chapter Overview: This chapter demonstrates the CQL Workspace added to the MAT with the implementation of Clinical Quality Language as the means to express eCQMs. The CQL Workspace is where a Measure Developer will enter the logic that will make up their measure.

POSITION AND LAYOUT OF THE CQL WORKSPACE

LOCATION OF THE CQL WORKSPACE WITHIN THE MAT TOOL

The CQL Workspace is part of the Measure Composer within the Measure Authoring Tool (MAT). A user will find the tab for the CQL Workspace after the Measure Details tab.

PARTS OF THE CQL WORKSPACE

1. General Information
   The General Information section contains the CQL Library Name, the Library version number, the declaration of the Model the MAT is using, and the Model version number. These fields are auto-populated and un-editable.

2. Includes
   The Includes section is used to include additional CQL libraries into a measure. Only CQL libraries that are in a versioned state are available for inclusion into the measure.

3. Value Sets
   The Value Sets section is used to retrieve value set OIDs from the Value Set Authority Center (VSAC) for use within the measure.

4. Codes
   The Codes Section is used to retrieve the code identifier (REST API URL) from the Value Set Authority Center (VSAC) in order to utilize directly referenced codes within the measure.

5. Parameter
   The Parameter section is pre-populated with the Measurement Period the user specified on the Measure Details tab. There is also a CQL editor space in which users may define additional parameters.

6. Definition
   The Definition section is where most of the logic in CQL is constructed. The four default Standard Data Element (SDE) definitions are already populated for use within the measures. The CQL editor is where users construct the remaining logic for the measures.
7. Function
The CQL version of the MAT has a number of pre-defined functions already in place for use in definitions; however, if users find they need additional functions, the Function section is the place to create them. In addition to the CQL editor, users have a section to add arguments to their functions.

8. View CQL
The View CQL section is there to allow users to see all of the CQL logic from beginning to end as it currently stands. This view will also show users if there are errors within the logic and on which lines those errors are occurring. This section is for reference only and is un-editable; therefore, if there is an error, users will need to return to where the problem expression was created and fix any errors there.

Figure 10: Parts of the CQL Workspace

USING THE INCLUDES SECTION
To include another library within a measure, assign an alias that will be used later to call out expressions from that library into the measure. A user could then use the search box to narrow down the list of
available libraries and then check the box next to the desired library. Upon selecting the library, the CQL file of that library will be displayed in the View CQL file here section at the bottom of the screen to allow users to ensure that they have the correct library and to remind them of the content of that library. Once the correct library has been selected, a user would click the ‘Save’ icon in the upper right-hand corner of the screen. The assigned alias will be moved into the list box on the left-hand side of the screen. Up to ten libraries can be included in a single measure.

Figure 11: The Includes Section in the CQL Workspace

To open an included library alias that was previously added, double-click on the alias listed in the list box on the left-hand side of the screen. This will open a new window which will allow a user to view the CQL file of the selected library. From here you can close the screen using the “X” icon or you can replace the included library with a different version of that same library. To do this you click on the Edit icon in the upper-right of the screen. Clicking this edit icon will open up a box with a list of all of the available versions of that library. To change versions, simply click on the checkbox next to the version you would like to include and click Apply.

Note: When replacing an included library using the Edit icon, the only versions of the library that will be available for inclusion are libraries that are versioned with no CQL validation errors, and that use the same version of the QDM that the measure is using.
To remove an included library from a measure, go to the Includes section, open the alias to be removed by double-clicking on it and then choose the delete (trashcan) icon to remove the library. A message will be offered to double check the intent to remove the library from the measure, and upon clicking ‘Yes’, the library will be removed from the included list in the measure.

If logic from the library is currently being used in the measure, the delete icon will be disabled. All references to the included library must be removed from measure logic in order to be able to remove the library.

**USING THE VALUE SETS SECTION**

To add a value set to the measure, you have a couple of options. You can simply enter the value set object identifier (OID) into the text box to the left of the ‘Retrieve OID’ button and then click the ‘Retrieve OID’ button. Verify the name populated in the name field matches the value set desired. Choose a version for the value set if desired and then click the ‘Apply’ button under the Version dropdown. The name and OID of the newly added value set will now display in the Applied Value Sets/Codes table at the bottom of the screen.

The second option is to choose a program and a release prior to retrieving an OID. To do this, you enter the OID into the retrieve box, use the program dropdown to choose which program is associated with the release for which you wish to use. Then choose that release from the Release dropdown and click Retrieve OID.

Note: If the value set does not exist within the program and release chosen, you will receive an error message stating that it was not found. In addition, choosing a program and a release for your value set will disable the version dropdown, as you can not have both a release and a version.
If the value set you are attempting to add into your measure is named the same as another value set already contained within the measure, you will need to add a suffix to it in order for the identifiers to be unique. To do this you put your cursor into the suffix box and enter a numerical suffix to the second value set and click Apply. This suffix (shown in parentheses after the value set name) will show whenever this value set is used within your logic.

To modify a value set already applied, click on the Edit icon (pencil) next to the value set to be modified. The information from that value set will, once again, populate the boxes in the upper portion of the screen. The Retrieve OID button must be pressed, which will retrieve the most current information from the value set, and then a new version may be chosen, or a suffix added or changed. Click the ‘Apply’ button below the Version dropdown to save the changes.

Note: If the name of the value set has changed, all references to that value set within the logic will need to be changed as well to reflect the new name.

To remove a value set from a measure, click the trashcan icon next to the value set to be removed. A message will display to verify the intent to remove, and upon clicking ‘Yes’ the value set will be removed from the Applied Value Sets list at the bottom of the screen.

Note: If a value set is used within a measure that contains a CQL file with no validation errors, the delete icon (trashcan) will be disabled. All references to the value set must be removed from the logic before the value set can be removed.

To check to see if previously added value sets are still valid, click the Update From VSAC button located just above the copy buttons. This will make a new call to VSAC and will check to make sure that the value sets still exists with the information that was previously added into the MAT. If, after this fresh call to VSAC is completed, there is an issue with any of the value sets in the applied value sets table, you will see a triangle with an exclamation point in it next to the problem value set. The recommendation is to double check your problem entries in VSAC directly.

The MAT also lets users copy value sets out of one measure and paste them into another measure or a stand-alone CQL library. To do this you would click on the checkbox under the copy heading in line with the value set(s) you wish to copy. Click on the Copy icon (paper) just above the Applied Value Sets table, then navigate to another measure, go to the Value Sets Section of the CQL Composer, and click on the Paste icon (paper with a clipboard) above the Applied Value Sets table. Any value sets that do not already exist in the second measure will be pasted into the Applied Value Sets table and ready for use. The Clear icon (eraser) next to the Paste icon will clear any checks in the copy checkboxes if you feel the need to start over.
USING THE CODES SECTION

To add a directly referenced code to the measure, enter the code identifier (REST API URL) for the code into the text box to the left of the Retrieve button and then click the Retrieve button. Verify the name populated in the name field matches the code desired and then click the Apply button. The name, code number, code system, and code system version will now display in the Applied Codes table at the bottom of the screen. Code system versions will not be shown in any of the exports unless the measure developer chooses to include them. To include a code system version for the code in your measure exports, click on the Include Code System checkbox before you click the Apply button. You will see a green checkmark in the Applied Codes table under the heading Version Included.
If the code you are entering into your measure has the same code descriptor as a code that is already in the Applied Codes table, you will need to add a suffix to make the identifier unique. To do this you fill in a numerical value in the suffix field before clicking on the Apply button. The suffix will show in parentheses directly following the code descriptor for any code to which it has been added.

To edit a code that has previously been applied to the measure, click on the Edit icon (pencil) in-line with the code you wish to edit. This will populate the top half of the screen with the information from that code. In edit mode you can add or change a suffix, or check/uncheck the Include Code System Version checkbox. You must click the Apply button to have your changes saved and shown in the Applied Codes table.

To remove a code from a measure, click the trashcan icon next to the code to be removed. A message will display to verify the intent to remove, and upon clicking ‘yes’ the code will be removed from the Applied Codes list at the bottom of the screen.

Note: If a code is used within a measure that contains a CQL file with no validation errors, the delete icon (trashcan) will be disabled. All references to the code must be removed from the logic before the code can be removed.

The MAT also lets users copy codes out of one measure and paste them into another measure or a stand-alone CQL library. To do this you would click on the checkbox under the copy heading in line with the code(s) you wish to copy. Click on the Copy icon (paper) just above the Applied Codes table, then navigate to another measure, go to the Codes Section of the CQL Composer, and click on the Paste icon (paper with a clipboard) above the Applied Codes Table. Any codes that do not already exist in the second measure will be pasted into the Applied Codes Table and ready for use. The Clear icon (eraser) next to the Paste icon will clear any checks in the copy checkboxes if you feel the need to start over.
USING THE PARAMETER SECTION

To create a new Parameter, enter a name for the parameter then use the CQL Editor to enter the logic for the parameter. Clicking the Save icon will initiate the validation of the logic. The following icons are available in the parameter section above the CQL Editor: Information, Save, Erase, and Delete. Please see the CQL Editor description for information on the function of each of these Icons.

To open a parameter that was previously added, double click on the name of the parameter in the list box on the left-hand side of the screen. Once open, the parameter can be modified and saved again.

Note: If the name of the parameter is changed, any logic containing the name of that parameter will need to be changed to the new parameter name.

To clear the workspace before creating a new parameter, click on the ‘+Add New’ link above the Parameter Name.

The Parameter Section also contains a comment box. This box allows users the ability to type a comment that is directly connected to the parameter being worked on. These comments will appear on
the View CQL Section of the MAT and in the CQL Export of the measure. To add a comment a user would simply type in their comment and save their parameter.

To remove a comment from a parameter, open the parameter by double-clicking on the parameter name in the box on the left-hand side of the screen. Delete the comment out of the comment box by either highlighting it and pressing the delete key on your keyboard or backspacing over the text until it is removed and then save the parameter by clicking on the save icon.

A user can also view the current CQL file while writing their parameter logic by clicking on the ‘Click to View CQL’ button below the CQL Editor. This will show the CQL file as it currently stands. This section will collapse upon save, which will require a user to re-open it to refresh the data.

**USING THE DEFINITION SECTION**

The definition section contains the following fields:

- Definition Name
- Context
- Comment
- Return Type

To create a new Definition, enter a name for the definition, chose whether the definition is patient-based or population-based in the context field, and then use the CQL Editor to enter the logic for the definition. Clicking the save icon will initiate the validation of the logic. If all of the logic in the current CQL file is without validation errors, the system will show what the current definition is returning in the return type field above the CQL Editor.

The following icons are available in the definition section above the CQL Editor: Save, Erase, Insert, Information, and Delete. Please see the CQL Editor description for information on the function of each of these Icons.

To open a definition that was previously added, double click on the name of the definition in the list box on the left-hand side of the screen. Once open the definition can be modified and saved again.

Note: If the name of the definition is changed, any logic containing the name of that definition will need to be changed to the new definition name.

To clear the workspace before creating a new definition, a user would click on the ‘+Add New’ link above the definition name.

The comment box allows users the ability to type a comment that is directly connected to the definition being worked on. These comments will appear on the View CQL Section of the MAT and in the CQL Export of the measure. To add a comment a user would simply type in their comment and save their definition.
To remove a comment from a definition, open the definition by double-clicking on the definition name in the box on the left-hand side of the screen. Delete the comment out of the comment box by either highlighting it and pressing the delete key on your keyboard or backspacing over the text until it is removed and then save the definition by clicking on the save icon.

A user can also view the current CQL file while writing their definition logic by clicking on the ‘Click to View CQL’ button below the CQL Editor. This will show the CQL file as it currently stands. This section will collapse upon save, which will require a user to re-open it to refresh the data.

**USING THE FUNCTION SECTION**

The Function Section contains the following fields:

- Function Name
- Context
- Comment
- Return Type
- +Add Argument

To create a new Function, enter a name for the function, chose whether the function is patient-based or population-based, add any arguments needed by clicking on ‘+Add Argument’ above the arguments list, give your argument a name, select the datatype for your argument, and the QDM Datatype if necessary, and click add, and then, use the CQL Editor to enter the logic for the function. Clicking the save icon will initiate the validation of the logic. If all of the logic in the current CQL file is without validation errors, the system will show what the current function is returning in the return type field above the CQL Editor.

Arguments added into the function will show in the Arguments List just above the CQL Editor. This list contains two icons that will allow you to edit (yellow pencil) or delete (blue trashcan) the argument within the function.

The following icons are available in the function space for use: Save, Erase, Insert, Information, and Delete. Please see the CQL Editor description for information on the function of each of these Icons.

To open a function that was already added, double click on the name of the function in the list box on the left-hand side of the screen. Once open the function can be modified and saved again.

Note: If the name of the function is changed, any logic containing the name of that function will need to be changed to the new function name.

To clear the workspace before creating a new function, a user would click on the ‘+Add New’ link above the definition name.
The comment box allows users the ability to type a comment that is directly connected to the function being worked on. These comments will appear on the View CQL Section of the MAT and in the CQL Export of the measure. To add a comment a user would simply type in their comment and save their function.

To remove a comment from a function, open the function by double-clicking on the function name in the box on the left-hand side of the screen. Delete the comment out of the comment box by either highlighting it and pressing the delete key on your keyboard or backspacing over the text until it is removed and then save the function by clicking on the save icon.

A user can also view the current CQL file while writing their function logic by clicking on the ‘Click to View CQL’ button below the CQL Editor. This will show the CQL file as it currently stands. This section will collapse upon save, which will require a user to re-open it to refresh the data.

**USING THE CQL EDITOR**

The CQL Editor is the space provided in the center of the section for users to enter their measure logic in Clinical Quality Language (CQL). The CQL Editor has been enhanced with a few options to assist measure developers in creating CQL logic.

1. **Information Icon**
   
   The information Icon, represented by a lowercase ‘i’ in a blue circle, is there to remind users of the shortcut keys available for use within the CQL Editor.
   
   a. Ctrl-alt-a = A list of all attributes available
   b. Ctrl-alt-d = A list of all definitions currently created within the measure
   c. Ctrl-alt-f = A list of all available functions, both pre-defined and user-defined.
   d. Ctrl-alt-k = A list of keywords as defined by CQL
   e. Ctrl-alt-p = A list of all available parameters
   f. Ctrl-alt-t = A list of all available timings
   g. Ctrl-alt-u = A list of UCUM units available for insert
   h. Ctrl-alt-v = A list of all value sets and codes added to the measure
   i. Ctrl-alt-y = A list of all available datatypes
   j. Ctrl-space = A complete list of all of the above

2. **Save Icon**
   
   The Save Icon, represented by the floppy disk icon, is there to save a user’s current work. A number of things occur when using the Save Icon. First, upon clicking the save icon, the system validates the logic being saved. If there are errors, the user will see a red box with a white X to the left of the line number. Hold your cursor over the icon to read the error message in the tool tip. Second, the system will save the work the user has as it currently stands in one of two ways. It will save it with or without errors. If the logic has errors, in addition to the error messages, the user will see a message that says, “Successfully saved (expression name) with errors” or “Successfully modified (expression name) with errors”. Third, the user will notice that the name of the new expression will appear in the list in the box on the left-hand side of the screen.
3. **Erase Icon**

The Erase Icon, represented by a blue and white picture of an eraser, will clear all logic out of the CQL Editor for the item currently being worked on in the measure composer. This is useful if a user feels the need to start again.

4. **Insert Icon**

The Insert Icon, represented by a white plus sign in a blue box, has been populated with a number of items measure developers may find useful when building CQL logic. This icon is here to assist users in inserting pieces into their CQL logic in the correct CQL syntax. Options of items available to be inserted through the insert icon are listed below along with instructions for their use.

   a. **Parameters** – Clicking on the Parameters option in the Item Type dropdown within the insert icon will populate the Item Name dropdown with a list of the parameters that are available within this measure. This includes the default parameter of “Measurement Period” along with any others the user may have created.

   b. **Definitions** – Clicking on the Definitions option in the Item Type dropdown within the insert icon, will populate the Item Name dropdown with a list of the definitions currently available within this measure.

   c. **Functions** - Clicking on the Functions option in the Item Type dropdown within the insert icon, will populate the Item Name dropdown with a list of any functions the user has defined on the function section of the CQL workspace.

   d. **Timing** - Clicking on the Timing option in the Item Type dropdown within the insert icon, will present the user with a list of common simple timings. Users can add text around the timings within the CQL Editor if more complex timing calculations are needed.

   e. **Pre-Defined Functions** - Clicking on the Pre-Defined Functions option in the Item Type dropdown within the insert icon, will populate the Item Name dropdown list with a number of functions that are loaded into the MAT for measure developer use.

   f. **Applied Value Sets/Codes** - Clicking on the Applied Value Sets/Codes option in the Item Type dropdown within the insert icon, will populate the Item Name dropdown list with all of the value sets or codes that were defined by the user in the measure, as well as any value sets or codes associated with an included library, and some hardcoded elements such as Birthdate, or Dead.

   g. **Attributes** - Clicking on the Attributes option in the Item Type dropdown within the insert icon, will open the Attribute Builder within the MAT. The Attribute Builder has a number of fields that will change or become enabled based on the choices made within the builder. The fields available are as follows:

      i. The first field is the Attributes by Datatype field. This field is optional in the Attribute Builder but making a selection here will filter the list of Attributes in the next field based on the datatype with which the user will be associating that attribute.

      ii. The Attribute field is where a user will choose the attribute to be used in the expression being built. The choice made here will help to determine what fields are available throughout the rest of the builder.
iii. The Mode field has four possible selections: Comparison, Computative, Nullable, and Value sets. However, this field is filtered based on which attribute was selected to only include the options that make sense with the chosen attribute.

iv. The Mode Details tab is filtered based on what was chosen is the Mode field. For example, if the mode chosen was nullable, the options in the Mode field would be ‘Is Null’ or ‘Is Not Null’. However, if the mode chosen was Computative, the items in Mode Details would be things like =, -, div, or mod.

v. The Date/Time field is only enabled when an attribute and/or mode is chosen for which entering a date/time makes sense. For example, if a user chooses the attribute ‘refills’ with a ‘comparison’ mode and <= for the mode details, then adding a date/time does not make sense; therefore, the field will be disabled. When entering a date, the user must state the items in this order: Year, Month, Day. For example, a user could enter only a year, but if they wanted a certain month, they would need both the month and the year. Similarly, if they wanted a specific day, they would need the month and year as well. The time fields work the same way. In order to have minutes, a user must enter hours, and so on. A user can enter only a date, or only a time, or both a date and time together.

vi. The Quantity and Units fields go hand-in-hand. Again, these fields will be enabled or disabled based on the choices made for attribute and mode. For example, if the attribute is authorDatetime and the mode is comparison with a mode detail of <=, then entering a quantity and a unit does not make sense, so the fields will be disabled. However, if the user chose the computative mode with a + for the mode detail then a user could enter a quantity, for example 2, months, and that would be correct.

vii. Once all choices are made as necessary the user would click on the ‘Insert’ button to enter the selections into the CQL workspace in the correct CQL Syntax.
5. Delete

The Delete Icon, represented by a blue trash can, is there to completely remove a previously saved expression from a measure. It is important to note that once an expression is deleted it can not be retrieved. Expressions that are currently in use, either within another expression or in the measure population, are not available to be deleted.

Figure 15: Icons for the CQL Editor
CHAPTER 8: MEASURE COMPOSER/POPULATION WORKSPACE

Chapter Overview: The Population Workspace is designed to allow measure developers the ability to add expressions to define specific populations. Additional features of this page include adding additional populations and viewing the human readable for a population.

The Population Workspace tab immediately follows the CQL Workspace tab within the Measure Composer. The Population Workspace tab will default to the View Populations section which shows all of the current populations in the measure in a tree structure.

The Population Workspace also contains all required and optional populations for the measure scoring type and, if applicable, Measure Observations and Stratifications listed in the navigation area along the left-hand side of the screen. If the measure being viewed is in a read-only state, the only item available for viewing is the View Populations section.

Users may add definitions constructed in the CQL Workspace into the measure populations. Additional measure populations may also be added or removed. Prior to exiting the Population Workspace, users are prompted to save changes. Changes made within the Population Workspace are saved by selecting the Save icon located in the top-right corner of each of the population sections.

DEFINING POPULATIONS

The required and optional populations for the measure scoring type will be listed within the Population Workspace. To define a measure population, users will add definitions or functions that were built within the CQL Workspace.

When you first enter the Population workspace you will be taken to the View Populations section. This section is laid out in a tree view. Just as the View CQL Section in the CQL Workspace is read-only, so is the View Populations section. There is no functionality on this page. The purpose of this view is to give you an overall look as to which expressions are currently paired to which populations. The default view for this section is to have all populations expanded so you can see everything at once; however, the collapse and expand buttons (+ and – signs) allow you to adjust the view however you would like.

If the measure you are in is in a read-only state, meaning it’s versioned or it is a measure that belongs to someone else and you do not have editing rights, the View Populations section is the only section that will appear in the Population Workspace. Again, this view allows you to see what expression is included in each population but does not allow you to make any changes.

If you are currently editing a draft measure that you do have editing rights for, you will see in the left-hand navigation all of the populations that are allowed for the measure based on the measure scoring type and the selection made for the patient-based indicator which were chosen when the measure was created.
It’s important to note that, if while in the population workspace, you make one of the populations included in your measure package grouping invalid, that measure grouping will be removed and will need to be re-created on the Measure Packager tab of the MAT.

### ADDING A DEFINITION TO A POPULATION

To add expressions to into your populations, you would click on the appropriate population heading in the left-hand navigation, pull down the dropdown menu and select the expression you would like to stand in for that population and click the save icon.

### ADDING ADDITIONAL POPULATIONS

To add more instances of that population, click on the +Add New link next to the save icon. This will add the next sequential population with another dropdown box to allow you to choose an expression.

### DELETING AN ADDED POPULATION

To delete an added population, just click the delete icon in line with the population you wish to remove.

It’s important to note the numbering of the populations. Additional populations are numbered with the next sequential integer. For Example, if you have Initial Population 1 and you add another, you will have Initial Population 2. However, if you then delete Initial Population 1, the remaining population will still be named Initial Population 2, and if another is added, it will then be Initial Population 3.

It’s also important to note that the system will not allow you to remove the last remaining population. For example, if you have added a Denominator Exclusion 1, and then determine that you don’t need it any longer, the system will not allow you to delete Denominator Exclusion 1 as it is the only one remaining in the section. To remove the expression from your populations, simply reset the dropdown menu back to Select Definition and click the save icon.

### VIEW THE HUMAN READABLE FOR A SELECTED POPULATION

The MAT gives users the ability to view the logic as it will appear in the Human Readable export by clicking on the Binoculars in line with the population. This will open in a new window, so you may need to allow pop-ups for the application before it will generate. The Human Readable view will also not generate if there are errors in the CQL file. You would need to go back to the CQL workspace and correct any errors first and then try again.
ADDING MEASURE OBSERVATIONS

In the Measure Observation section of the Population Workspace, you will be pairing functions instead of definitions.

A Measure Observation requires both an aggregate function, which is provided in the dropdown list by the MAT, and a valid user-defined function in order to be complete and able to be included in a measure package.

In the Measure Observation section of the Population Workspace, you can add additional Measure Observations, delete, and view the human readable of the Measure Observation.
ADDING STRATIFICATION

Only one stratification may be included in a single measure package grouping; however, multiple stratum may be added to a single stratification.

In the Stratifications section, you pair your definitions written in the CQL Workspace to the stratum level.

In the Stratification section, you have two Add New links. The one at the top will add additional stratifications while the one in line with the stratification heading will add additional stratum to that stratification.

In this section you can add additional stratifications, add additional stratum, delete, and view the human readable of the stratification.
Figure 18: Stratification Section
CHAPTER 9: MEASURE COMPOSER/MEASURE PACKAGER

Chapter Overview: The Measure Packager tab allows users to organize their populations to facilitate proper groupings within the exports. Creating a measure package is the final step in creating the eCQM. This chapter outlines how to create a measure package by creating measure groupings, adding associations to populations when necessary, including supplemental data elements, and including risk adjustment variables.

On the Measure Packager tab, MAT users create one or more measure groupings in preparation for exporting the measure. Groupings are combinations of populations in a single measure package. The measure package is the culmination of all created groupings and ultimately includes the contents that can be exported. Based on the type of measure scoring selected (proportion, ratio, continuous variable, or cohort), the user must observe the rules when creating groupings when it comes to which populations to include.

Note: The Measure Packager tab will not load if the user has errors within their CQL logic. The user is encouraged to go back to the CQL Workspace to correct any validation errors before proceeding.

CREATE A MEASURE GROUPING

More than one Measure Grouping, also called Package Grouping, may be included in a Measure Package.

A Measure Grouping consists of the populations (i.e. Initial Population 1, Numerator 1, Denominator 1, Stratification, and Measure Observations) that contain the CQL expressions that consist of the measure logic for the selected measure.

Follow these steps to create a measure grouping.

1. Select the desired population in the Populations box to highlight it. It is important to note that only populations with valid definitions or functions paired to them will populate in the Populations box.
2. Select the right pointing arrow to move the population from the left-hand box to the right-hand box under Package Grouping.
3. Select the next desired population in Populations and select the right pointing arrow to move it to Package Grouping.
4. Continue moving desired populations from Populations to Package Grouping until all desired populations are transferred.
5. Select the ‘Save Grouping’ button located below Populations.

When ‘Save Grouping’ is selected in the Measure Packager, a validation of the Grouping selections is performed. All populations within a measure grouping must contain valid definitions. This means a definition or function included in a population can not be blank, nor can it have any errors, and each definition connected to a population included in a Measure Grouping must return the correct type for the type of measure that the user is creating.
When creating a measure grouping, users will be restricted from including populations in the package grouping not permitted for the measure scoring type. For example, only one Stratification is permitted per Package Grouping. An error message displays when attempting to move more than one Stratification into the Package Grouping or a Package Grouping already contains more than one Stratification prior to the current version of the MAT.

If the definitions that are paired to the populations are returning the wrong type, the user will see a return-type error message that will prevent the package grouping from being saved and will direct them back to the CQL Workspace to adjust their logic.

If changes are made to the measure once packaged (i.e. value set, definitions, or measure details changes), the user should re-save their populations on the Population Workspace, must save their measure grouping again, and create a new measure package to see those changes in the export files.

Measure Packages may contain more than one measure grouping.

Follow these steps to create additional measure groupings

1. Select the ‘Create New Grouping’ button.
   a. Measure Grouping 2 displays above Populations.
2. Repeat the steps outlined above to move populations from the Populations box to the Package Grouping box.
3. When all desired populations have been moved to the Package Grouping box, select the ‘Save Grouping’ button. A success message displays if saved successfully. Measure Grouping 2 displays in the Measure Grouping List at the top of the page.
4. To view or edit a measure grouping, select the pencil icon next to the desired grouping. The populations selected for that grouping display in Package Grouping.
5. To delete a measure grouping, select the delete icon next to the desired grouping. The grouping will be deleted from the Measure Grouping List.
DESIGNATE AN ASSOCIATION

The ability to apply an association to a population is added when creating a package grouping. It is used to associate initial populations to the numerator or denominator when more than one initial population is included in a grouping for a ratio measure. Associations can also be applied to Measure Observations. This section describes how to use the tool to add an association. When more than one initial population is added to the package grouping for ratio measures, the measure package will fail if the numerator and denominator are not associated to the initial populations.

Steps for adding an association in a ratio measure are provided below.

1. Navigate to the Measure Packager for a Ratio or Continuous Variable Measure. (This example uses a Ratio measure.)
2. Create a Package Grouping with all required populations and including more than one Initial Population.
3. Select the Denominator in Package Grouping. ‘Add Associations’ appears to the right of Package Grouping.
4. Select the checkbox that corresponds with the population to associate with the Denominator. In this example, Denominator 1 is associated with Initial Population 1.
5. Select the Numerator 1 in Package Grouping. The checkbox for Initial Population 2 is selected by default since Initial Population 1 is already associated to Denominator 1.
6. Now that associations are made, select Save Grouping. If associations are not designated in ratio measures when more than one Initial Population is added to the Package Grouping, the measure grouping fails and an error message displays.

Figure 20: Adding Associations

SELECT SUPPLEMENTAL DATA ELEMENTS

Supplemental data elements are those that should be identified for each patient for whom the measure is applicable. Such 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). The supplemental data elements are available in the MAT and are listed below.

**SDE Sex:** ONC Administrative Sex using ONC Administrative Sex Value Set (2.16.840.1.113762.1.4.1)

**SDE Race:** Race using Race CDC Value Set (2.16.840.1.114222.4.11.836)

**SDE Ethnicity:** Ethnicity using Ethnicity CDC Value Set (2.16.840.1.114222.4.11.837)

**SDE Payer:** Payer using Payer Source of Payment Typology Value Set (2.16.840.1.114222.4.11.3591)

These four supplemental data elements are already populated in the right-hand side of the Supplemental Data Elements section. If users do not want to include one or more of these elements, they can be moved back to the left-hand side using the arrows between the boxes and then clicking the ‘Save Supplemental Data Elements’ button.
Additionally, any definitions created in the CQL Workspace will be available on the left-hand side to be included as a Supplemental Data Element if desired. To include a definition as a Supplemental Data Element, select the definition desired in the left-hand box titled Definitions, click the right-facing arrow to move the definition to the right-hand box titled Supplemental Data Elements and click the ‘Save Supplemental Data Elements’ button.

**ADD RISK ADJUSTMENT VARIABLES**

Within the Measure Packager, MAT users have the option to add definitions to define Risk Adjustment Variables for the selected measure.

Instructions for adding Risk Adjustment Variables are provided next.

1. Select the desired definition from the left-hand list.
2. Select the right pointing arrow to move a definition from the list of definitions on the left-hand side to the Risk Adjustment Variables list on the right-hand side. Continue moving definitions as needed until all desired definitions are transferred to the Risk Adjustment Variables list. Users can move definitions back and forth between the definition list and the Risk Adjustment Variables list using both the left and right pointing arrows.
3. Select the ‘Save Risk Adjustment Variables’ button once the desired definitions appear in the list box.
4. A success message displays when the definitions are saved.

**PACKAGING OPTIONS**

To successfully prepare a measure package and export a measure in Measure Packager the following steps must be completed.

1. Create one or more Measure Groupings.
2. Add and save Supplemental Data Elements, if applicable.
3. Add and save Risk Adjustment Variables, if applicable.
4. Select one of the two packaging options.

The two packaging options that are available are: Create Measure Package or Create Measure Package and Export.

**CREATE MEASURE PACKAGE**

Upon selecting the ‘Create Measure Package’ button a success or error message is generated and displayed on the Measure Packager page.

The MAT user must then navigate to the Measure Library and select the Export icon for the measure.

Once the export icon is selected, the user has the option to select which format to export, Human Readable eCQM, CQL Library information, ELM file, JSON file, or the full eCQM Package.
It’s important to note that, depending on the size and complexity of the measure, creating a measure package may take a few moments. There is a loading bar at the top of the screen which will indicate that the MAT is still working on creating the package.

CREATE MEASURE PACKAGE AND EXPORT

Upon selecting the ‘Create Measure Package and Export’ button a validation of the measure package occurs.

An error message displays if the package attempt fails.

If successful, the measure package is automatically generated in a zip file.

It’s important to note that, depending on the size and complexity of the measure, creating a measure package may take a few moments. There is a loading bar at the top of the screen which will indicate that the MAT is still working on creating the package.

CONTENTS OF THE MEASURE PACKAGE

The measure package contains the Human Readable, the CQL Library information file, the ELM file, the JSON file, and the eCQM HQMF XML file. It also contains a CQL, ELM, and JSON file for any additional libraries that were included within the measure.

It is recommended that all files within a measure package are housed in the same place and naming conventions preserved, as the computer readable files will reference the library files by name. Changing the name or removing files from the package may result in implementers having a difficult time calculating the measure.

Note: Measure Packages that were created prior to the implementation of CQL into the MAT, will contain only an eCQM HQMF XML file, and the Human Readable file for the measure, as the other exports are specific to CQL.

HUMAN READABLE FILE

The Human Readable file is exported from the MAT named with the following pattern: \{AbbreviatedName\}_v{MATMajor_MinorVersion}_HumanReadable.html. It is a representation of the measure presented in a way that makes it easier to understand for a person who is not familiar with the computer coded files. This document contains all of the metadata that was added to the measure on the Measure Details tab of the tool. In addition, it contains all of the logic expressions and data used within the measure, formatted into labeled sections to allow it to be more easily understood.

CQL FILE

The CQL file is exported from the MAT named with the following pattern: \{CQLLibrary\}-\{CQLLibraryVersion\}.cql. It is a representation of all the data and the expressions created within the
CQL library that is attached to the measure. This document is laid out in more of a list fashion which represents all the elements of the CQL library.

As this file is directly referenced by name in the HQMF and ELM computer executable documents of the measure package, it is not recommended that users change the name of this file.

**ELM FILE**

The ELM file is exported from the MAT named with the following pattern: `{CQLLibrary}-{CQLLibraryVersion}.xml`. This file is the machine-readable representation of the CQL that has been designed for sharing and implementation applications. The ELM file provides the semantics necessary to retrieve the correct data from the Electronic Health Record (EHR).

As this file is directly referenced by name in the HQMF computer executable document of the measure package, it is not recommended that users change the name of this file.

**JSON FILE**

The JSON file is exported from the MAT named with the following pattern: `{CQLLibrary}-{CQLLibraryVersion}.json`. This file is a JavaScript serialized format of the ELM file.

As this file is directly referenced by name in the HQMF computer executable document of the measure package, it is not recommended that users change the name of this file.

**ECQM HQMF XML FILE**

The Health Quality Measure Format (HQMF) is exported from the MAT named with the following pattern: `{AbbreviatedName}_v{MATMajor_MinorVersion}_eCQM.xml`. This file is a Health Level Seven (HL7) standard for representing a health quality measure in an electronic format. This file provides for consistency in interpretation of quality measures and the capability of efficient automated processing of electronic clinical quality measures (eCQMs) by health IT systems.
CHAPTER 11: MEASURE COMPOSER/REFERENCE-ONLY TABS

Chapter Overview: This chapter describes the two tabs of the measure composer that are preserved from the previous version of the MAT for reference. These two tabs, the Clause Workspace and the QDM Elements tab, do not have a function in the MAT with CQL but still contain data that was entered into the MAT in previous versions, for users to reference when creating their measures in the CQL environment.

CLAUSE WORKSPACE

The Clause Workspace will contain any clauses that were entered into a measure in a previous version of the MAT. These clauses are in a read-only status and can not be changed. Nor can new clauses be added in this area. Clauses are not included in the exports for the MAT with CQL. All logic must be created and saved within the CQL Workspace. The presence of the clauses has been maintained solely for the purpose of reference by the measure developer.

To view a clause, highlight the name of the clause in the Clause Library box on the right-hand side of the screen and click the ‘Show Clause’ button just below the list. This will show the clause in a tree structure on the left-hand side of the screen.

The ‘Save’, ‘Validate’, and ‘Delete Clause’ buttons have been disabled on this tab.

QDM ELEMENTS

The QDM Elements tab is located to the far-right within the Measure Composer tab. This tab contains a record of any QDM Elements that were designated for the measure prior the implementation of Clinical Quality Language into the MAT. There are no longer any actionable fields on this screen. The list is provided for reference purposes only.

CHAPTER 12: STAND-ALONE CQL LIBRARIES

Chapter Overview: This chapter explores stand-alone CQL libraries. A stand-alone CQL library is a collection of CQL expressions with the single purpose of being used at a later time within a measure. The Measure Authoring Tool (MAT) created two new tabs, the CQL Library and the CQL Composer, to allow for the creation and management of the stand-alone CQL libraries.

CQL LIBRARY TAB

The CQL Library tab is used to create new stand-alone CQL libraries, version completed CQL libraries, and create drafts of previously versioned CQL libraries.
Upon clicking on the tab, users will see a Recent Activity Table in the upper-left hand side of the screen, a table containing an alphabetized list of the current CQL libraries in the bottom half of the screen, and a search bar with two icons above it in the upper right-hand side of the screen.

The features and functions of the CQL Library Tab have been designed to mimic the features and functions of the Measure Library Tab whenever possible.

SEARCHING STAND-ALONE CQL LIBRARIES

The table of available stand-alone CQL libraries is automatically defaulted to show only the libraries owned by the user who is logged into the system. To change the view to show all available stand-alone CQL libraries, uncheck the box under the search box titled “Filter by My Libraries” and click ‘Search’. Text can be entered into the search box to further narrow down the results.

The table also contains the following icons:

The Version icon (gold star) will allow users to create a version of a library that is currently in a draft state. A user must be the owner or have had the library shared with them by the owner, in order for this icon to be enabled.

The Draft icon (piece of paper with a pencil) will allow a user to create a new draft of a library that is in a versioned state. A user must be the owner or have had the library shared with them by the owner, in order for this icon to be enabled.

The History icon (clock) will show all notable milestones for that particular CQL library and the name of the user who completed those milestones.

The Edit icon (yellow pencil) will allow a user to edit the library name on the General Information Section of the CQL Composer.

The Read Only icon (newspaper) will show a user that the CQL library is currently in a read-only state. This could mean that the library has been versioned, or that the user currently logged into the MAT does not have editing rights to that library.

The Lock icon (gold padlock) indicates that another user currently has the library open and therefore, it is not available for editing. The library will remain in a read-only state until the other users lock has been released.

The Share icon (document with arrow pointing to the right) is used to share editing rights to the stand-alone CQL library. Clicking this icon will open a list of available users. Choose the desired user and click Save and continue. Only the owner of a library can share editing rights with another person.

The Delete icon (trashcan) will allow users to delete a library that is in a draft state, but only if it is owned by the user. The user will need to enter their password to confirm the delete.
The recent activity table in the upper left-hand will show the two stand-alone CQL libraries most recently accessed by that user. If this is the first time the user has accessed the CQL Library tab, that Recent Activity Table will show “No Recent Activity”.

**CREATING A NEW STAND-ALONE CQL LIBRARY**

Click on the New Library icon in the upper right-hand of the CQL Library tab.

Enter a name for your CQL Library.

Note: CQL library names must be alpha-numeric only, can not contain spaces, and can not contain any special characters other than an underscore. It also can not begin with a number.

Click Save and Continue.

These actions will create a new stand-alone CQL library and take the user to the CQL Composer Tab. Please see the CQL Composer Tab section for additional information.

**VERSIONING A STAND-ALONE CQL LIBRARY**

A stand-alone CQL library can not be used within a measure unless it is in a versioned state. Versioning a stand-alone CQL library means that no more changes can be made to that instance of the library.

To create a version of a stand-alone CQL library that is currently in a draft state, click the gold star icon in the Create Version/Draft column of the CQL library table. This will open another screen where the user will select Major or Minor to indicate whether or not it will be a Major version or a Minor version, and click ‘Save and Continue’.

**CREATING A NEW DRAFT OF A STAND-ALONE CQL LIBRARY**

Once a stand-alone CQL library has been versioned, it can not be edited. To make any changes, a new draft of that stand-alone CQL library must be made.

To create a new draft of a previously versioned stand-alone CQL library, click the piece of paper with a pencil icon in the Create Version/Draft column of the CQL library table.

This action will create a new draft of that stand-alone CQL library and take the user to the CQL Composer Tab. Please see the CQL Composer Tab section for additional information.

**CQL COMPOSER TAB**

The CQL Composer tab is used to create the logic expressions that will be housed within that particular library.

The features and functions of the CQL Composer Tab have been designed to mimic the features and functions of the Measure Composer/CQL Workspace Tab whenever possible.


PARTS OF THE CQL COMPOSER / CQL LIBRARY WORKSPACE

1. **General Information**
   
   The General Information section contains the CQL Library Name, the Library version number, the declaration of the Model the MAT is using, and the Model version number. These fields are auto-populated. The only field that can be edited on this screen is the CQL Library Name.

   Note: CQL library names must be alpha-numeric only, can not contain spaces, and can not contain any special characters other than an underscore. It also can not begin with a number.

   There are two icons on this page, the save icon (floppy disk) and a cancel icon (x). The save icon will save any changes to this screen. The cancel icon will undo any changes not yet saved.

2. **Includes**
   
   The Includes section is used to include additional CQL libraries into your stand-alone CQL library. Only CQL libraries that are in a versioned state and that have no included libraries will be shown on this screen and available for inclusion into the stand-alone CQL library. See the Using The Includes Section for more information.

3. **Value Sets**
   
   The Value Sets section is used to retrieve value set OIDs from the Value Set Authority Center (VSAC) for use within the library. See the Using The Value Sets Section for more information.

4. **Codes**
   
   The Codes section is used to retrieve direct referenced codes from the Value Set Authority Center (VSAC) for use with the library. See the Using The Codes Section for more information.

5. **Parameter**
   
   The Parameter section is a CQL editor space in which users may define parameters to be used in other expressions. See the Using The Parameter Section and Using The CQL Editor for more information.

6. **Definition**
   
   The Definition section is where most of the logic in CQL is constructed. The CQL editor is where users construct the remaining logic for the library. See the Using The Definition Section and Using The CQL Editor for more information.

7. **Function**
   
   The CQL version of the MAT has a number of pre-defined functions already in place for use in definitions; however, if users find they need additional functions, the Function section is the place to create them. In addition to the CQL editor users have a section to add arguments to their functions. See the Using The Function Section and Using The CQL Editor for more information.
8. **View CQL**

The View CQL section is there to allow users to see all of the CQL logic from beginning to end as it currently stands. This view will also show users if there are errors within the logic and on which lines those errors are occurring. This section is for reference only and is un-editable; therefore, if there is an error, users will need to return to where the problem expression was created and fix any errors there.
GLOSSARY

ATTRIBUTE - A constraint on a QDM datatype that further defines the requirements for the measure logic and provides specific detail about the item to which it is associated. Certain datatypes only accept certain attributes. See Appendix A for details on which attributes are associated with which datatypes.

CLINICAL QUALITY LANGUAGE (CQL) - A language developed to allow measure developers to express both clinical quality measurement and clinical decision support use cases in a human readable format. For more information on CQL, please reference: https://ecqi.healthit.gov/cql.

CLONE - The ability to reproduce the key elements within a measure in a brand-new draft that can then be modified into a similar measure.

COHORT MEASURE SCORE - A measure score in which a population is identified from the population of all items being counted. For example, one can identify all the patients who have had H1N1 symptoms. This population is very similar to the Initial Population but is called a Cohort Population for public health purposes.

CONTINUOUS VARIABLE MEASURE SCORE - A measure score in which each individual value for the measure can fall anywhere along a continuous scale (e.g., mean time to thrombolytics which aggregates the time in minutes from a case presenting with chest pain to the time of administration of thrombolytics).

COPYRIGHT - Identifies the organization(s) who own the intellectual property represented by the measure.

DATATYPE - The context in which each category is used to describe a part of the clinical care process (i.e. Encounter, Performed; Diagnosis; Medication, Ordered, etc…).

DENOMINATOR - The denominator can be the same as the initial patient population or a subset of the initial patient population to further constrain the population for the purpose of the measure. Different measures within a set may have the same initial patient population but different denominators. Continuous Variable measures do not have a Denominator, but instead define a Measure Population. For proportion or ratio measures, the verbiage “Equals Initial Population” with no additional criteria indicate the denominator is identical to the initial patient population. It can be the same as the initial population or a subset of the initial population to further constrain the population for the purpose of the measure. Different measures within a measure set may have different Denominators. Continuous Variable measures do not have a Denominator, but instead define a Measure Population.

DENOMINATOR EXCEPTIONS - Denominator exceptions are those conditions that should remove a patient, procedure, or unit of measurement from the denominator only if the numerator criteria are not met. Denominator exceptions allow for adjustment of the calculated score for those providers with
higher risk populations. Denominator exceptions are used only in proportion measures. They are not appropriate for ratio or continuous variable measures.

Denominator exceptions allow for the exercise of clinical judgment and should be specifically defined where capturing the information in a structured manner that fits the clinical workflow. Generic denominator exception reasons used in proportion measures fall into three general categories: medical reasons, patients’ reasons, and system reasons.

**DENOMINATOR EXCLUSIONS** - Patients who should be removed from the measure population and denominator before determining if numerator criteria are met. Denominator exclusions are used in proportion and ratio measures to help narrow the denominator.

**EXPRESSION** – A CQL expression is a parameter, definition, or function created either within a measure or within a stand-alone CQL library.

**EXPRESSION LOGICAL MODEL (ELM)** - A standardized machine-friendly representation of the Clinical Quality Language (CQL) in an XML format.

**EXPORT** - Export allows the user to export the measure artifact files that include the HQMF XML measure, HTML human-readable document, a CQL File and an ELM XML File.

**FUNCTION** – A named expression within CQL that is allowed to take in arguments. Each argument has a name and a declared type.

**GROUPING** - Groupings are combinations of system populations that can be included in a single measure package.

**HQMF** – An acronym for Health Quality Measures Format which is a standardized XML format for measure exports.

**INITIAL POPULATION** - All entities to be evaluated by a measure which may but are not required to share a common set of specified characteristics within a named measurement set to which the measure belongs.

This initial population is present regardless of the measure scoring type; i.e., proportion, ratio, cohort, and continuous variable measures all have an initial population section. Details often include information based upon specific age groups, diagnoses, diagnostic and procedure codes, and enrollment periods.

**MEASURE OBSERVATION** - Measure observations are used only in continuous variable and ratio measures. They provide the description of how to evaluate performance, (e.g., the mean time across all Emergency Department visits during the measurement period from arrival to departure). Measure observations are generally described using a statistical methodology such as: count, etc.
**MEASURE PACKAGE** - The measure information needed to export a measure, which includes the measure details, value sets, logic, and groupings.

**MEASUREMENT PERIOD** - The time period for which the measure applies.

**MEASURE POPULATION** - Measure population is used only in continuous variable measures. It is a narrative description of the measure population. (e.g., all patients seen in the Emergency Department during the measurement period).

**MEASURE SCORING** - Indicates how the calculation is performed for the measure (e.g., proportion, continuous variable, ratio, cohort)

**NUMERATOR** - Numerators are used in proportion and ratio measures. In proportion measures the numerator criteria are the processes or outcomes expected for each patient, procedure, or other unit of measurement defined in the denominator. In ratio measures the numerator is related, but not directly derived from the denominator (e.g., a numerator listing the number of central line blood stream infections and a denominator indicating the days per thousand of central line usage in a specific time period).

**NUMERATOR EXCLUSIONS** - Numerator Exclusions are used only in ratio measures to define instances that should not be included in the numerator data. (e.g., if the number of central line blood stream infections per 1000 catheter days were to exclude infections with a specific bacterium, that bacterium would be listed as a numerator exclusion.)

**PROPORTION MEASURE SCORING** - The population types for a Proportion measure are "Initial Population", "Denominator", "Denominator Exclusion", "Numerator", "Numerator Exclusion" and "Denominator Exception".

**QDM** – The Quality Data Model (QDM) is an information model that defines relationships between patients and clinical concepts in a standardized format to enable electronic quality performance measurement. The model is the current structure for electronically representing quality measure concepts for stakeholders involved in electronic quality measurement development and reporting. For more information on the QDM refer to [https://ecqi.healthit.gov/qdm](https://ecqi.healthit.gov/qdm).

**RATIO MEASURE SCORING** - A measure scoring that may have a value of zero or greater that is derived by dividing a count of one type of data by a count of another type of data (e.g., the number of patients with central lines who develop infection divided by the number of central line days).

**RETURN TYPE** – the return type refers to the type of the outcome that is produced by the executed expression. For more information on return types and what is required, please see v3 IG CQL based HQMF R1, Volume 1.

**RISK ADJUSTMENT** - The method of adjusting for clinical severity and conditions present at the start of care that can influence patient outcomes for making valid comparisons of outcome measures across
providers. Indicates whether a measure is subject to the statistical process for reducing, removing, or clarifying the influences of confounding factors to allow more useful comparisons.

**SHARE** - Sharing allows an owner of a measure to share it with another user in a Modify mode. The user who has the measure shared with them will have the ability to modify the measure.

**STRATIFICATION** - Describes the strata for which the measure is to be evaluated. There are three recognized reasons for stratification based on existing work. These include: (1) evaluate the measure based on different age groupings within the population described in the measure (e.g., evaluate the whole <age 14-25> and each sub-stratum <14-19> and <20-25>); (2) evaluate the measure based on either a specific condition, a specific discharge location, or both; (3) evaluate the measure based on different locations within a facility (e.g., evaluate the overall rate for all intensive care units and also some strata include additional findings <specific birth weights for neonatal intensive care units>.

**SUPPLEMENTAL DATA ELEMENTS** - Supplemental Data Elements are those that should be identified for each patient for whom the measure is applicable. Such additional data can be used to evaluate for disparities in care or to risk adjust with the data listed in this section. CMS defines four required Supplemental Data Elements (payer, ethnicity, race, and ONC Administrative Sex), which are variables used to aggregate data into various subgroups. Comparison of results across strata can be used to show where disparities exist or where there is a need to expose differences in results.

Additional supplemental data elements required for risk adjustment or other purposes of data aggregation can be included in the Supplemental Data Element section.

**VALUE SET** - A set of values that contain specific codes derived from a particular code system. The National Library of Medicine’s Value Set Authority Center stores and maintains value sets used within the MAT for measure development.

**XML** - Extensible Markup Language. XML provides a basic syntax used to share information among different computers, applications, and organizations without needing to pass through many layers of conversion.
APPENDIX A – ATTRIBUTES BY DATATYPES

This appendix will list all of the available datatypes within the MAT and which attributes are associated with each datatype.

ADVERSE EVENT
- authorDatetime
- code
- facilityLocation
- id
- recorder
- relevantPeriod
- reporter
- severity
- type

ALLERGY / INTOLERANCE
- authorDatetime
- code
- id
- prevalencePeriod
- recorder
- reporter
- severity
- type

ASSESSMENT, NOT PERFORMED
- authorDatetime
- code
- id
- negationRationale
- recorder
- reporter
- reason
- result

ASSESSMENT, RECOMMENDED
- authorDatetime
- code
- id
- method
- reason
- recorder
- relatedTo
- reporter
- result

CARE GOAL
- code
- id
- recorder
- relatedTo
- relevantPeriod
- reporter
- targetOutcome
COMMUNICATION, FROM PATIENT TO PROVIDER
- authorDatetime
- code
- id
- recorder
- relatedTo
- reporter

COMMUNICATION, FROM PATIENT TO PROVIDER, NOT DONE
- authorDatetime
- code
- id
- negationRationale
- recorder
- reporter

COMMUNICATION, FROM PROVIDER TO PATIENT
- authorDatetime
- code
- id
- recorder
- relatedTo
- reporter

COMMUNICATION, FROM PROVIDER TO PATIENT, NOT DONE
- authorDatetime
- code
- id
- negationRationale
- recorder
- reporter

DEVICE, APPLIED
- anatomicalApproachSite
- anatomicalLocationSite
- authorDatetime
- code
- id
- reason
- recorder
- relevantPeriod
- reporter

DEVICE, NOT APPLIED
- authorDatetime
- code
- id
- negationRationale
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- code
- id
- method
- reason
- recorder
- reporter

**DIAGNOSTIC STUDY, PERFORMED**
- authorDatetime
- code
- id
- components
- facilityLocation
- method
- reason
- recorder
- relevantPeriod
- reporter
- result
- resultDateTime
- status

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- code
- components
- id
- method
- reason
- recorder
- referenceRange
- relevantPeriod
- reporter
- result
- resultDatetime
- status

LABORATORY TEST, RECOMMENDED
- authorDatetime
- code
- id
- method
- reason
- recorder
- reporter

MEDICATION, ACTIVE
- code
- dosage
- frequency
- id
- recorder
- relevantPeriod
- reporter
- route
- supply

MEDICATION, ADMINISTERED
- authorDatetime
- code
- dosage
- frequency
- id
- reason
- recorder
- relevantPeriod
- reporter
- route
- supply

MEDICATION, DISCHARGE
- authorDatetime
- code
- dosage
- frequency
- id
- recorder
- refills
- reporter
- route
- supply

MEDICATION, DISPENSED
- authorDatetime
- code
- dosage
- frequency
- id
- recorder
- refills
- relevantPeriod
- reporter
- route
- supply
MEDICATION, NOT ADMINISTERED
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- code
- id
- negationRationale
- recorder
- reporter

MEDICATION, NOT DISCHARGED
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- id
- negationRationale
- recorder
- reporter

MEDICATION, NOT DISPENSED
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- negationRationale
- recorder
- reporter

MEDICATION, NOT ORDERED
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- negationRationale
- recorder
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MEDICATION, ORDER
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- code
- dosage
- frequency
- id
- method

PARTICIPATION
- code
- id
- participationPeriod
- recorder
- reporter

PATIENT CARE EXPERIENCE
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- code
- id
- recorder
- reporter

PATIENT CHARACTERISTIC
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- code
- id
- recorder
- reporter

PATIENT CHARACTERISTIC, BIRTHDATE
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- recorder
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- code
- id
- method
- reason
- recorder
- reporter

PHYSICAL EXAM, PERFORMED
- anatomicalLocationSite
- authorDatetime
- code
- components
- id
- method
- reason
- recorder
- relevantPeriod
- reporter
- result

PHYSICAL EXAM, RECOMMENDED
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- authorDatetime
- code
- id
- method
- reason
- recorder
- reporter

PROCEDURE, NOT ORDERED
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- code
- id
- negationRationale
- recorder
- reporter

PROCEDURE, NOT PERFORMED
- authorDatetime
- code
- id
- negationRationale
- recorder
- reporter

PROCEDURE, NOT RECOMMENDED
- authorDatetime
- code
- id
- negationRationale
- recorder
- reporter

PROCEDURE, ORDER
- anatomicalApproachSite
- anatomicalLocationSite
- authorDatetime
- code
- id
- method
- ordinality
- reason
- recorder
- reporter
PROCEDURE, PERFORMED
- anatomicalApproachSite
- anatomicalLocationSite
- authorDatetime
- code
- components
- id
- incisionDatetime
- method
- ordinality
- reason
- recorder
- relevantPeriod
- reporter
- result
- status

PROCEDURE, RECOMMENDED
- anatomicalApproachSite
- anatomicalLocationSite
- authorDatetime
- code
- id
- method
- ordinality
- reason
- recorder
- relevantPeriod
- reporter

PROVIDER CARE EXPERIENCE
- authorDatetime
- code
- id
- recorder
- reporter

PROVIDER CHARACTERISTIC
- authorDatetime
- code
- id
- recorder
- reporter

SUBSTANCE, ADMINISTERED
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- code
- dosage
- frequency
- id
- recorder
- relevantPeriod
- reporter
- route
- supply

SUBSTANCE, NOT ADMINISTERED
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## APPENDIX B – MODES BY ATTRIBUTES

This table shows users which mode types are available in the attribute builder to be used with which attribute. The attributes are listed along the left-most column. The subsequent columns indicate if the corresponding mode is available in the attribute builder for that attribute.

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APPENDIX C - RESOURCES FOR CLINICAL QUALITY LANGUAGE

CQL AND CQL SYNTAX INFORMATION
https://ecqi.healthit.gov/cql

CQL FORMATTING EXAMPLES

CQL EDUCATIONAL RESOURCES
https://ecqi.healthit.gov/cql/cql-educational-resources

CQL POPULATION SPECIFYING INFORMATION

CQL ALIAS, PARAMETER, DEFINITION, AND FUNCTION NAMING INFORMATION