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**Centers for Medicare & Medicaid Services and The Office of  
the National Coordinator for Health Information Technology**

**CMS Alliance to Modernize Healthcare  
Federally Funded Research and Development Center**



**An Open Source Electronic Clinical Quality Measure Testing and  
Certification Tool**

## **Cypress User Guide**

**Version 5.0**

**July 25, 2019**

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## Record of Changes

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The Centers for Medicare & Medicaid Services (CMS) sponsors the CMS Alliance to Modernize Healthcare Federally Funded Research and Development Center (the Health FFRDC), the first FFRDC dedicated to strengthening our nation's healthcare system.

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# 1. Introduction

Cypress™ v5.0 is the rigorous and repeatable testing tool of Electronic Health Records (EHR) and health information technology (IT) modules used in calculating electronic Clinical Quality Measures (eCQM). Cypress v5.0 is the official testing tool for the 2015 EHR Certification program supported by the Office of the National Coordinator for Health Information Technology (ONC). The 2015 Edition final rule, published by the ONC, updates the ONC Health IT Certification Program and includes certification criteria to support electronic clinical quality measurement (eCQM) and reporting across the healthcare ecosystem. The 2015 Edition eCQM certification criteria also support the requirements of the Centers for Medicare & Medicaid Services (CMS) Promoting Interoperability Program and other CMS program requirements.

ONC and CMS developed the Cypress v5.0 User Guide for test proctors who test and certify EHRs and health IT modules at Authorized Testing Labs (ATL). EHR software engineers, quality assurance engineers, and production release engineers may draw on the guide when they use Cypress in a pre-testing mode to understand how their health IT product will perform in an ATL-conducted operational test.

This guide provides instructions on how to use the open source Cypress v5.0 tool (it is assumed the user has downloaded the software). It addresses the requirements and steps for testing health IT products for calculating and reporting eCQMs.

The Cypress tool is freely available for use or adoption by the health IT community, including EHR vendors and testing labs. The open source project website at [Project Cypress](#) provides information detailing the set up and configuration of Cypress v5.0 open source software.

## 2. Cypress Testing Capabilities

To achieve certification pursuant to the most recent 2015 standards, each health IT product must show that it meets four criteria by demonstrating required capabilities specified in the regulation and described in the following subsections. The Cypress v5.0 software verifies four required eCQM capabilities for health IT certification (Capture/Record and Export, Import and Calculate, Electronic Submission, and Data Filtering), as described in the following subsections.

### 2.1 Capture/Record and Export

Cypress v5.0 supports the requirements for Capture/Record and Export capabilities as follows:

- **Capture/Record** – To be certified in accordance with 45 CFR §170.315(c), the technology must be able to electronically capture/record all of the data identified in the specified procedure necessary to calculate each eCQM. Data required for eCQM exclusions or exceptions must be codified entries. These entries may include specific terms as defined by each eCQM, or may include codified expressions, such as “patient reason,” “system reason,” or “medical reason.”
- **Export** – As provided in 45 CFR §170.315(c)(1), the technology must be able to electronically export a data file formatted in accordance with the Quality Reporting Document Architecture (QRDA) Category I standard that includes all of the data captured for each and every eCQM for which the technology is being certified.

The functionality requirement for Capture/Record and Export specifies that a system user can record and export individual, patient-level eCQM data formatted to the Health Level Seven International (HL7) QRDA Category I Release 5.1 Implementation Guide (IG) at any time the user chooses, for one or multiple patients, without needing developer support. The requirement for Capture/Export is part of the certification criteria necessary to satisfy the 2015 Edition Base EHR definition. The capability to export eCQM data serves two purposes: (1) a provider or health system can view and verify their eCQM results for quality improvement on a near real-time basis, and (2) providers can export their results to multiple programs, such as those run by CMS, states, and private payers.

Figure 1 depicts the basic concept for Capture/Record and Export. The primary purpose of this step is to verify the technology’s ability to export data in the proper QRDA Category I format with the proper Quality Data Model (QDM) data elements.

To verify this capability, Cypress produces static patient data for each of the eCQMs that are to be tested and exports the relevant patients. This data is entered into the technology. The technology is then commanded to export the patient test data as a set of QRDA Category I files that contain the proper elements from the QDM for calculating the eCQMs under test. These QRDA files are loaded back into Cypress where they are tested for validity, determining valid QRDA Category I Extensible Markup Language (XML) documents, and correctness, containing only the elements required to calculate the eCQMs.

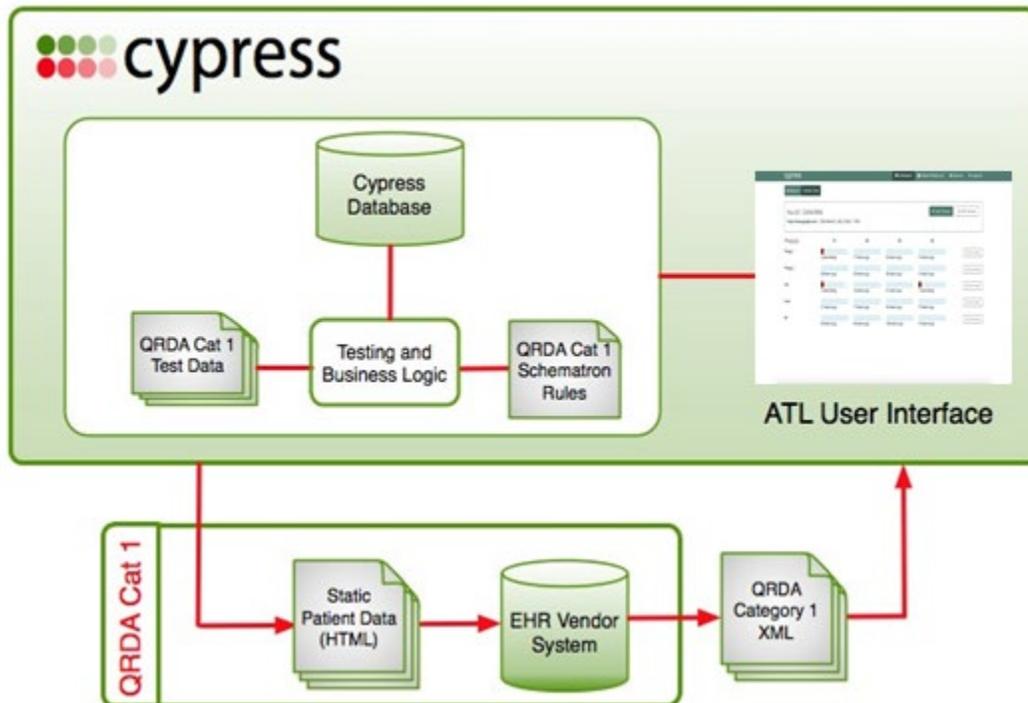


Figure 1. Capture/Record and Export

## 2.2 Import and Calculate

Cypress v5.0 supports the requirements for Import and Calculate capabilities as follows:

- **Import** – The technology must be able to electronically import a data file formatted in the QRDA Category I format.
- **Calculate** – The technology must be able to electronically calculate each and every clinical quality measure for which it is presented for certification.

A Health IT Module must be capable of demonstrating that it can import data to warrant certification against this criterion using the QRDA Category I IG, even if the module is also certified to provide “capture/record and export” and “report” functions.<sup>1</sup> The requirement ensures that users of certified health IT can import eCQM data formatted to the QRDA Category I standard for one or more patients without needing to request developer support.

<sup>1</sup> From Federal Regulation (80 FR 62650-62651): “First, this functionality could streamline the testing and certification process by importing QRDA Category I files rather than systems needing to manually enter test patient data. Second, the import functionality can promote quality improvement and data sharing between systems by providing systems the ability to import CQM data from other systems in a standardized format.”

## 2.3 Electronic Submission

Cypress v5.0 supports the requirements for Electronic Submission capabilities as follows:

- Electronic Submission enables a user to electronically create a data file in QRDA Category III format for transmission of clinical quality measurement data that can be electronically accepted by CMS.

The criterion for certification of Electronic Submission capabilities supports eCQM reporting using the consensus, industry-based QRDA Category I Release 5.1 and QRDA Category III Release 2.1 IGs. It also supports better alignment with the reporting requirements of CMS programs. The CMS reporting requirements (e.g., use of the CMS QRDA IG) are included as an optional provision within the criterion because not all certified health IT is intended for CMS reporting. The certification to the HL7 QRDA Category I and III standards provides a baseline for interoperability of eCQM data because these standards are consensus based and industry developed. Moreover, the program-agnostic HL7 QRDA standards can support several use cases for exchanging eCQM data.

Figure 2 shows the basic concept for Import, Calculate, and Electronic Submission. These steps provide for automated verification that a health IT product can:

- Import and calculate the eCQM results for the quality measures being certified based on the synthetic patient data that Cypress presents to the technology under test
- Generate a properly formatted summary eCQM report that could be electronically submitted using QRDA Category III format

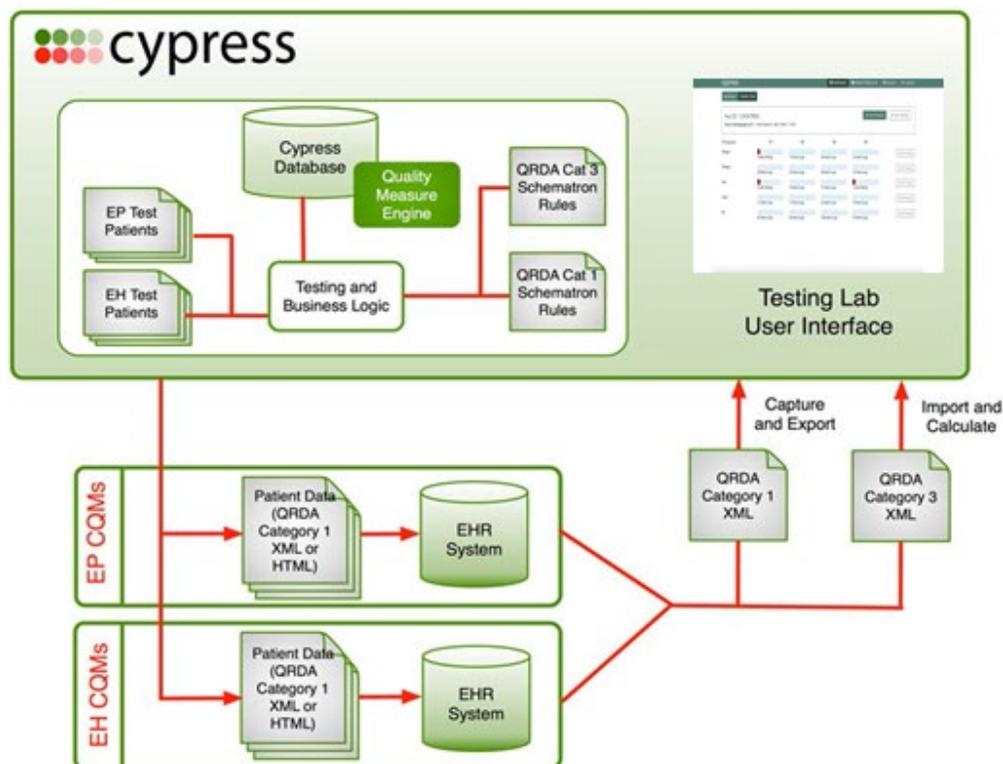


Figure 2. Import, Calculate, and Electronic Submission

## 2.4 Data Filtering

Cypress v5.0 supports the requirements for Data Filtering capabilities as follows:

- The technology must be able to record data (according to specified standards, where applicable) and filter eCQM results at both patient and aggregate levels.<sup>2</sup>

Filtering individual patient-level and aggregate-level eCQM results by data supports administrative reporting as well as identification of health disparities and gaps in care for patients treated at particular group practice sites or in a given Accountable Care Organization (ACO).

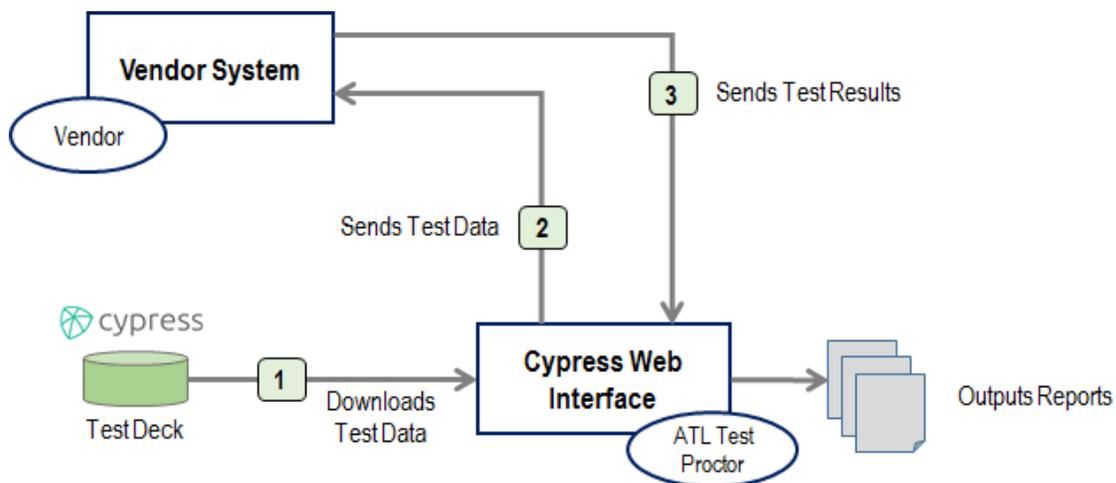
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<sup>2</sup> Rule Reference: 2015 Edition Health Information Technology (Health IT) Certification Criteria, Base Electronic Health Record (EHR) Definition, and ONC Health IT Certification Program Modifications Final Rule (The “2015 Edition”): “The filter functionality included in this criterion will allow a provider to make a query for eCQM results using one or a combination of data captured by the certified health IT for quality improvement and quality reporting purposes. It can also aid in the identification of health disparities, enable care quality improvement, and support providers in delivering more effective care to their patient populations. These filters include, but are not limited to, practice site address, patient age, patient sex, and patient problem list.”

### 3. Detailed Description of Cypress Workflow

Figure 3 illustrates the general workflow of a test performed with the Cypress open source software tool and a description of how the test procedure is organized and conducted. The augmentation of the test procedure to include Cypress is based on the ONC-approved and the National Institute of Standards and Technology (NIST)-published procedure for testing the accurate calculation, submission, and degree of correctness of eCQMs.

As shown in Figure 3, the vendor interacts with the vendor system. An ATL test proctor interacts with the Cypress web interface. The test proctor downloads test data from Cypress, which is then sent from Cypress and entered into the vendor system. The vendor returns test results to Cypress, which generates reports reflecting assessment of certification testing.



**Figure 3. Cypress Workflow in an Authorized Testing Lab**

Cypress can perform the following types of tests in support of eCQM certification:

1. XML Data conformance testing of the QRDA Category I standard for individual patient-level data used for eCQM calculation
2. XML Data conformance testing of the QRDA Category III standard for aggregate reporting of eCQM calculation
3. Accuracy calculation testing of the Eligible Professional / Eligible Clinician eCQMs
4. Accuracy calculation testing of the Eligible Hospital / Critical Access Hospital eCQMs

The Cypress website provides a complete description of the Cypress Testing Procedure (available at <http://healthit.gov/cypress/resources.html>).

The following subsections present a detailed description of Cypress v5.0, from accessing Cypress, overview of administrative functions, preparation for testing, test execution, exit success criteria, and submission to verification.

### 3.1 Accessing Cypress

To access and download the Cypress Software, go to [Project Cypress](#):

- The Project Cypress site provides several options and detailed instructions for downloading and installing the Cypress software. If the software has not been installed, please follow the Cypress Download Instructions located on the Project Cypress site. This User Guide does not provide instructions for downloading the Cypress software.

After Cypress is downloaded and installed, it is accessible via a URL, bookmark, or icon you created as part of the download/installation process.

Upon accessing the installed instance of Cypress, the Sign In screen should appear. Figure 4 presents a screenshot of the “Sign In” screen. To create an account, select **Sign Up**.

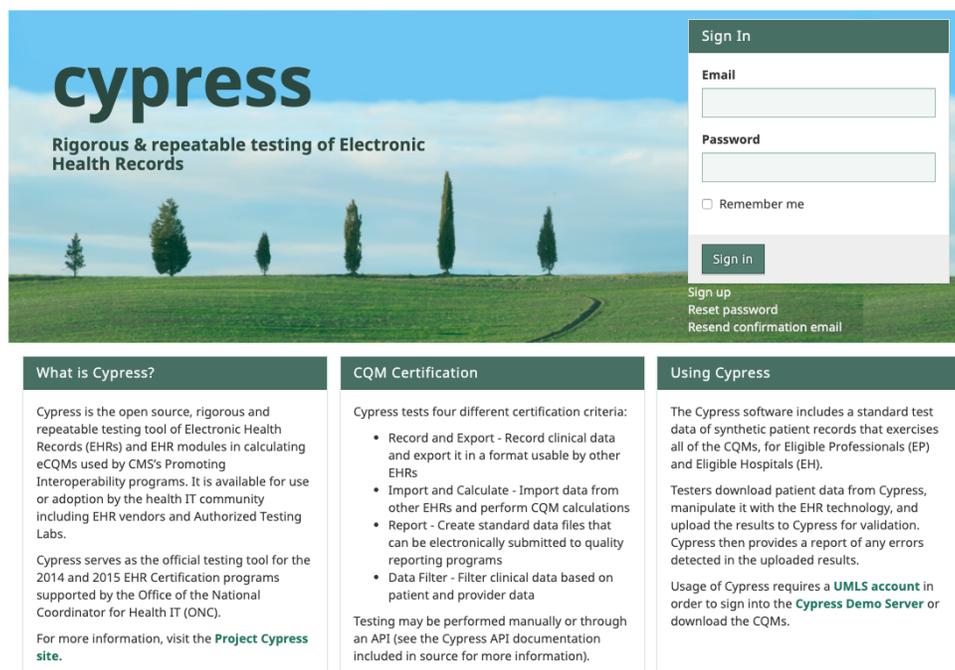


Figure 4. Cypress Sign In Page

- If you have previously set up an account, enter your email and password, and select **Sign In**.
- If you have previously created an account and forgotten your password, select **Reset password**. In the **Forgot your Password?** screen, enter the email address associated with your Cypress account, and select **Send me reset password instructions**. You will be sent a link to reset your password.
- **Sign Up** will bring you to the Sign Up and Terms and Conditions page. Click on the **Terms and Conditions** link on that page. Figure 5 presents a screenshot of the Terms and Conditions page.

**Terms and Conditions for use of Cypress**

Performance measures and related data specifications (the "Measures") are copyrighted by the noted quality measure providers as indicated in the applicable Measure. Coding vocabularies are owned by their copyright owners. By using the Measures, a user ("User") agrees to these Terms of Use. Measures are not clinical guidelines and do not establish a standard of medical care and quality measure providers are not responsible for any use of or reliance on the Measures.

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Back

**Figure 5. Cypress Terms and Conditions Page**

- To **Sign up**, enter your Email, a Password, and then confirm that Password.
- Read the Terms and Conditions, check **I agree to the above Terms and Conditions**, and select **Sign up** to create your Cypress Account as shown in the screenshot of the Cypress Account creation page (Figure 6).

**Sign Up**

**Email**

**Password**

*8 characters minimum and include at least 3 of the following: lowercase letters, uppercase letters, digits, and special characters.*

**Confirm Password**

Terms and Conditions

I agree to the above Terms and Conditions

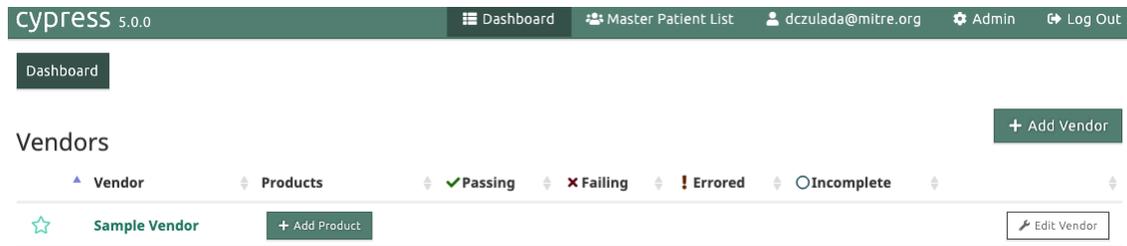
**Sign up**

Sign in  
Resend confirmation email

**Figure 6. Cypress Account Creation**

## 3.2 Overview of Administrative Functions

Cypress displays the **Dashboard** after you create your account, as shown in Figure 7.



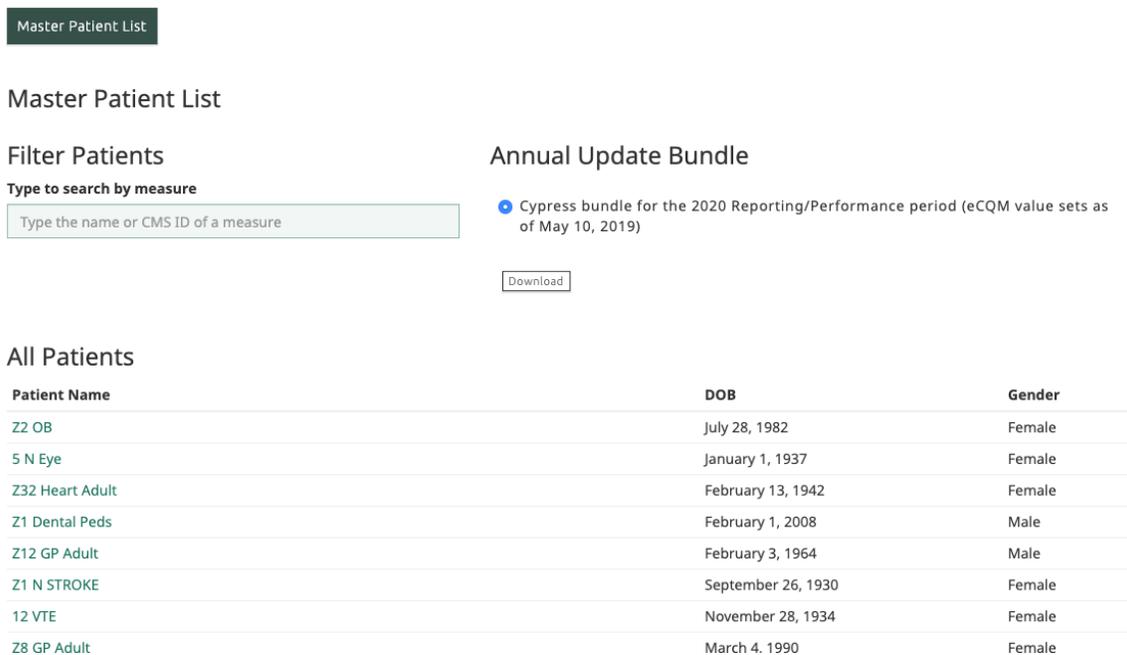
**Figure 7. Cypress Dashboard**

The Dashboard includes the following Cypress Administrative Functions:

1. Master Patient List – Provides a list of all test data for eCQMs
2. Account – Update a Cypress Account Password
3. Log Out – Log out of the Cypress Application
4. Add Vendor – Add vendor by entering EHR Vendor contact and product information (please refer to “Cypress v5.0 Preparation for Testing,” subsection 4.3)
5. Edit EHR Vendor – Edit EHR Vendor contact and product information (please refer to “Cypress v5.0 Preparation for Testing,” subsection 4.3)

### 3.2.1 Master Patient List

Figure 8 presents the Master Patient List page that provides a list of all test data for eCQMs for calendar year 2020 reporting.



**Figure 8. Master Patient List of Test Patients**

By selecting the **Filter by Measure** drop-down, you can select a specific measure from a list of patient records that apply to a specific eCQM and eCQM qualifiers. Figure 9 presents an example screenshot of filtering by the measure, CMS2v9 Preventive Care and Screening: Screening for Clinical Depression and Follow-Up Plan Patients.

Master Patient List

### Master Patient List

#### Filter Patients

Type to search by measure

#### Annual Update Bundle

● Cypress bundle for the 2020 Reporting/Performance period (eCQM value sets as of May 10, 2019)

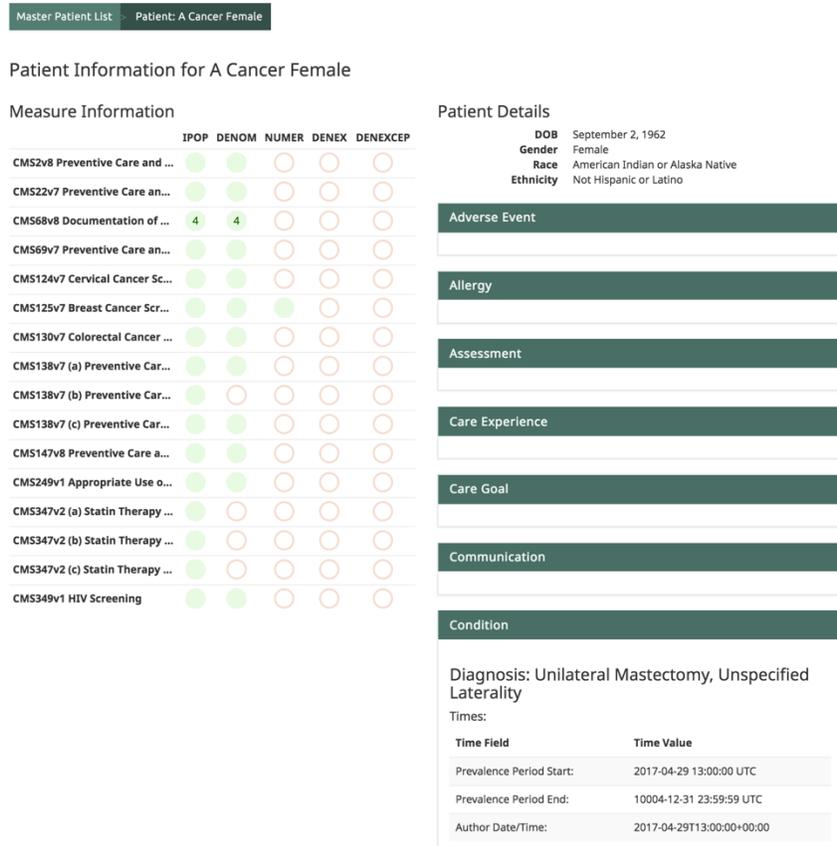
[Download](#)

#### CMS2v9 - PopulationSet\_1 Patients

Patient Name	DOB	Gender	IPOP	DENOM	NUMER	DENEX	DENEXCEP
5 N Eye	January 1, 1937	Female	●	●	○	○	○
Z32 Heart Adult	February 13, 1942	Female	●	●	○	○	○
Z12 GP Adult	February 3, 1964	Male	●	●	○	○	○
Z8 GP Adult	March 4, 1990	Female	●	●	○	○	○
B (Independent Risk Factors 3) Cancer Female	September 1, 1957	Female	●	●	○	○	○
Z13 N GP Adult	February 13, 1964	Male	●	●	○	○	○
Z6 BH Adult	July 2, 1987	Male	●	●	○	○	○
Z17 GP Adult	March 20, 1961	Female	●	●	○	○	○
Z9 Heart Adult	March 9, 1954	Female	●	●	○	○	○

**Figure 9. Patients Specific to CMS2v9 Preventive Care and Screening: Screening for Clinical Depression and Follow-Up Plan Patients**

If you click on the patient's name in the patient record list, Cypress will display an individual patient record and their eCQM qualifiers as shown in Figure 10.



**Figure 10. Patient Test Record Data Requirements and eCQM Qualifiers**

### 3.2.2 Account

If you have previously set up an account, this function allows you to change your Password or delete your account. Figure 11 presents a screenshot of the account password update and delete page.

The screenshot shows the 'Edit User' form in the Cypress v5.0 interface. The form is titled 'Edit User' and contains the following fields and instructions:

- Email:** A text input field containing the email address 'rlghapn@sharklasers.com'.
- Password:** A text input field. Below it, the instruction reads: 'we need your current password to confirm your changes'.
- New Password:** A text input field. Below it, the instruction reads: 'leave blank if you don't want to change it'.
- Confirm New Password:** A text input field.

At the bottom of the form, there are two buttons: 'Update' and 'Back'. Below the form, there is a red header for 'Delete Account' with a warning message: 'Once you delete your account you cannot get it back. Be sure you want to do this.' and a 'Delete Account' button.

Figure 11. Account Password Update

### 3.2.3 Log Out

Figure 12 presents a screenshot of the Log Out function that allows a user to return to the Account Sign In (as shown in Figure 4).

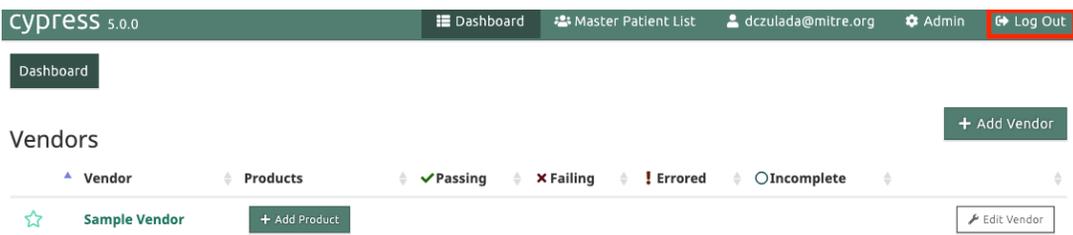


Figure 12. Cypress v5.0 Log Out

### 3.2.4 Add Vendor

The Add Vendor function allows the user to enter EHR vendor contact and product information (as described in subsection 3.3, Cypress v5.0 Preparation for Testing) as shown in Figure 13.

Dashboard > Add Vendor

**Add Vendor**

Vendor Name

Vendor ID

URL

Address

State

Zip

Add Point of Contact

Add Vendor Cancel

Figure 13. Add Vendor Page

### 3.2.5 Edit Vendor

The Edit Vendor function allows a user to edit EHR Vendor contact and product information (as described in subsection 3.3, Cypress v5.0 Preparation for Testing) as shown in Figure 14.

Dashboard > Vendor: Sample Vendor > Edit Vendor

**Save Changes: Sample Vendor**

Vendor Name  
Sample Vendor

Vendor ID  
ID 1

URL  
www.samplevendor.com

Address  
1287 enterprise way

State  
DC

Zip  
20013

POC Name John Doe	Email johndoe@samplevendor.com	Telephone 111-111-1111	Type of Contact Manager	Remove
----------------------	-----------------------------------	---------------------------	----------------------------	--------

Add Point of Contact

Save Changes Cancel

**Delete Vendor**

Removing a vendor will also delete all associated products, product tests, and test execution results. Be sure you want to do this.

Delete Vendor

Figure 14. Edit Vendor Page

### 3.3 Cypress v5.0 Preparation for Testing

#### Add Vendor Information

- Once you have created an account, you can begin testing by adding a Vendor and Contact Information.
- Select **Add Vendor** from the Dashboard as shown in Figure 15.

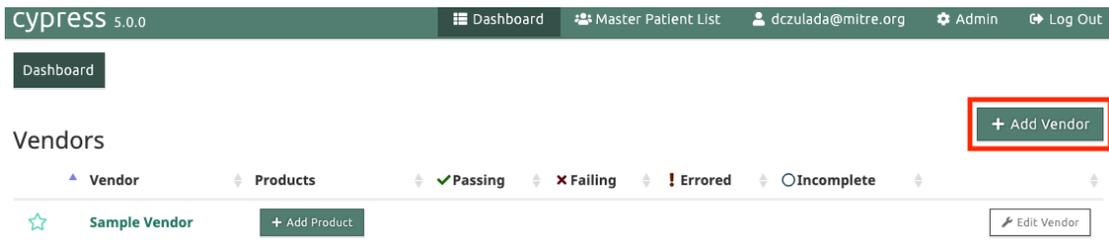


Figure 15. Dashboard Select Add Vendor

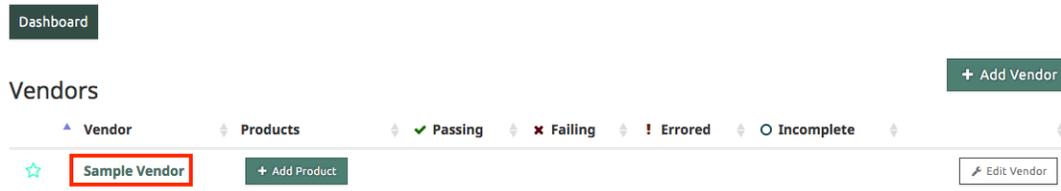
- After selecting **Add Vendor**, the **Create Vendor** information will be displayed as shown in Figure 16.
- Complete the fields listed under Create Vendor and select **Create Vendor**.

 The screenshot shows the 'Add Vendor' form. The form has a dark green header with 'Add Vendor'. Below the header, there are several input fields: 'Vendor Name' (Sample Vendor), 'Vendor ID' (ID 2), 'URL' (www.samplevendor.com), 'Address' (1287 enterprise way), 'State' (DC), and 'Zip' (20013). At the bottom, there are four columns for 'POC Name' (John Doe), 'Email' (johndoe@samplevendor.com), 'Telephone' (111-111-1111), and 'Type of Contact' (Manager). A 'Remove' button is next to the 'Type of Contact' field. At the bottom left, there is an 'Add Point of Contact' button. At the bottom right, there is a red box around the 'Add Vendor' button and a 'Cancel' button.

Figure 16. Create Vendor Page

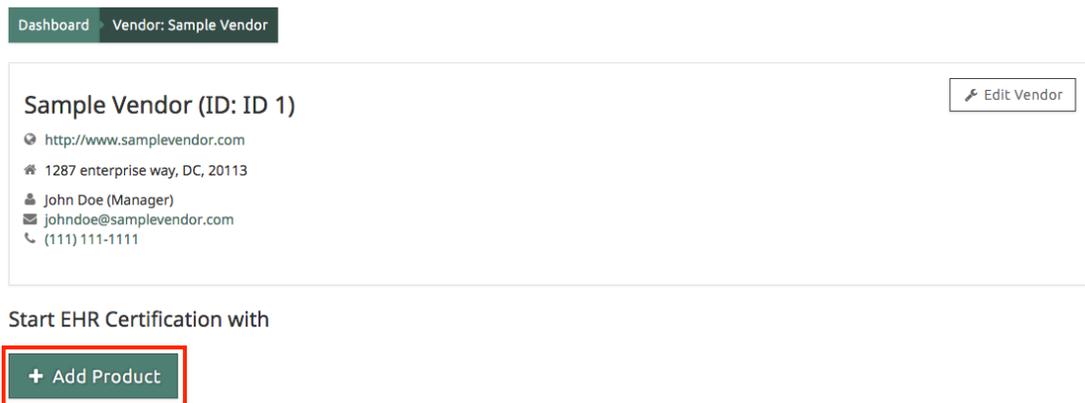
#### Enter Product Information

- The next step is to enter Product Information. Begin by clicking the Vendor name displayed on the Dashboard as shown in Figure 17.



**Figure 17. Dashboard with New Vendor Created**

- Next, click **Add Product**, as shown in Figure 18, to begin entering vendor product information.



**Figure 18. Vendor Product Information Page**

- On the **Vendor Add Product** page, presented in Figure 19:
  - Enter Product information (Name, Version, and Description). Examples would be product version number, the name and version of any optional modules installed in the product at the time of the test, and the operating system.
  - For Certification Types, a product must, at a minimum, certify to either the C1 test or the C2 test. To indicate which tests are being certified, check the box selecting from the following options:
    - ◆ C1 Test – Record and Export
    - ◆ C2 Test – Import and Calculate
    - ◆ C3 Test – Data Submission
    - ◆ C4 Test – Data Filtering
  - For Records Options, note that Randomize Records and Duplicate Records have already been pre-checked because these options are recommended for the most robust testing (although they can be unselected, if needed)
  - For Annual Update Bundle, you must select which bundle of eCQMs you are certifying for:

- ◆ Cypress bundle for the 2020 Reporting/Performance period (eCQM value sets as of May 10, 2019)

Dashboard Vendor: Sample Vendor > Add Product

### Add Product

**Name**

**Version**

**Description**

**Product Types**

- Certification Product
- CVU+ Product

**Certification Types**

- C1 Test
- C2 Test
- C3 Test
- C4 Test

*Select the certification type Cypress should use to certify this product*

**Records Options**

- Randomize Records
- Duplicate Records

*Recommended for most robust testing.*

**Bundle Options**

- Cypress bundle for the 2020 Reporting/Performance period (eCQM value sets as of May 10, 2019) 2019.0.0.2

*Select the measure versions Cypress should use to certify this product.*

- Shift Records

*Selecting Shift Records will move patient data forward into the appropriate reporting period. Otherwise patient data will remain in a previously completed calendar year.*

**Measures Options**

- Eligible Hospital eCQMs
- Eligible Professional eCQMs
- All eCQMs
- Custom...

*Indicate the clinical quality measures Cypress should use to certify this product. Testing will be performed on a measure-by-measure basis. Click 'Custom' to specify individual measures.*

**Add Product**

**Figure 19. Vendor Add Product Page**

- The Vendor Add Product page also has a section entitled “Measures Options” that must be completed before adding a product. For Measures Options, you must indicate the clinical quality measures (i.e., select one option) Cypress should use to certify this product, as shown in Figure 20. The options are:
  - Eligible Hospital eCQMs
  - Eligible Provider eCQMs
  - All eCQMs
  - Custom. Selecting “Custom” allows you to specify any individual measures Cypress should use to certify this product. Figure 21 presents a screenshot of the option for “Custom”.

Dashboard Vendor: Sample Vendor > Add Product

### Add Product

**Name**

**Version**

**Description**

**Product Types**

Certification Product

CVU+ Product

**Certification Types**

C1 Test

C2 Test

C3 Test

C4 Test

*Select the certification type Cypress should use to certify this product*

**Records Options**

Randomize Records

Duplicate Records

*Recommended for most robust testing.*

**Bundle Options**

Cypress bundle for the 2020 Reporting/Performance period (eCQM value sets as of May 10, 2019) 2019.0.0.2

*Select the measure versions Cypress should use to certify this product.*

Shift Records

*Selecting Shift Records will move patient data forward into the appropriate reporting period. Otherwise patient data will remain in a previously completed calendar year.*

**Measures Options**

Eligible Hospital eCQMs

Eligible Professional eCQMs

All eCQMs

Custom...

*Indicate the clinical quality measures Cypress should use to certify this product. Testing will be performed on a measure-by-measure basis. Click 'Custom' to specify individual measures.*

Add Product Cancel

Figure 20. Eligible Hospital eCQMs Measure Selection

Dashboard Vendor: Sample Vendor > Add Product

### Add Product

**Name**

**Version**

**Description**

**Product Types**

Certification Product

CVU+ Product

**Certification Types**

C1 Test

C2 Test

C3 Test

C4 Test

*Select the certification type Cypress should use to certify this product*

**Records Options**

Randomize Records

Duplicate Records

*Recommended for most robust testing.*

**Bundle Options**

Cypress bundle for the 2020 Reporting/Performance period (eCQM value sets as of May 10, 2019) 2019.0.0.2

*Select the measure versions Cypress should use to certify this product.*

Shift Records

*Selecting Shift Records will move patient data forward into the appropriate reporting period. Otherwise patient data will remain in a previously completed calendar year.*

**Measures Options**

Eligible Hospital eCQMs

Eligible Professional eCQMs

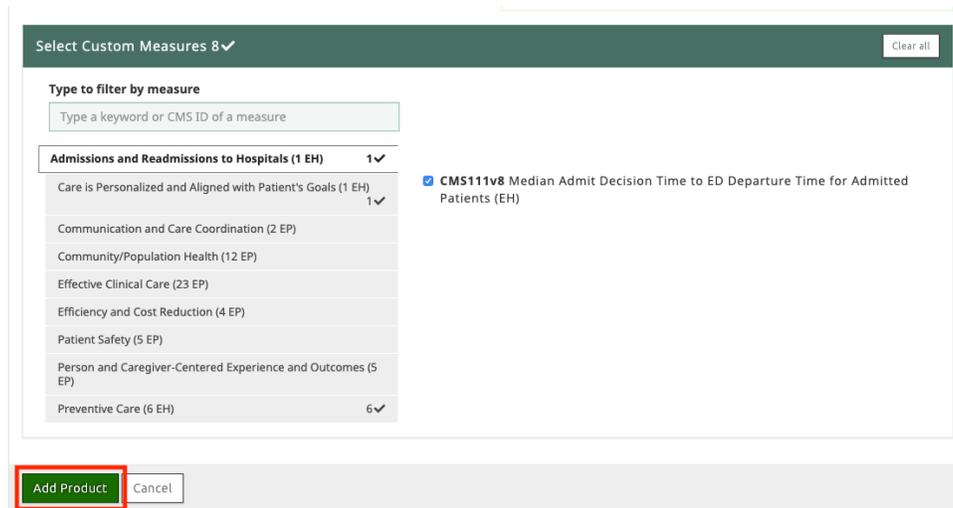
All eCQMs

Custom...

*Indicate the clinical quality measures Cypress should use to certify this product. Testing will be performed on a measure-by-measure basis. Click 'Custom' to specify individual measures.*

Figure 21. Vendor Add Product, "Custom" Measures Option

- Please note that testing will be performed on a measure-by-measure basis.
- Once all of the information has been entered on the Vendor Add Product page, select **Add Product**, as shown in Figure 22.



**Figure 22. Vendor Add Product page, Select “Add Product”**

- The Vendor and Product will now display on the Dashboard.
- Select the product name under Products to begin defining tests for the product as shown in Figure 23.

Dashboard Vendor: Sample Vendor

Sample Vendor (ID: ID 1) + Add Product Edit Vendor

<http://www.samplevendor.com>  
 1287 enterprise way, DC, 20113  
 John Doe (Manager)  
 johndoe@samplevendor.com  
 (111) 111-1111

2 Products

EH Product	C1		C2	C3			C4	
	Sample	QRDA-I	QRDA-III	Sample	QRDA-I	QRDA-III	QRDA-I	QRDA-III
✓ 0 Passing Tests								
✗ 0 Failing Tests								
○ 28 Not started Tests	3	3	3	3	3	3	5	5

Sample Product	C1		C2	C3			C4	
	Sample	QRDA-I	QRDA-III	Sample	QRDA-I	QRDA-III	QRDA-I	QRDA-III
✓ 0 Passing Tests								
✗ 0 Failing Tests								
○ 90 Not started Tests	4	18	18	4	18	18	5	5

**Figure 23. Dashboard Displaying a Vendor with Two Products Added**

## 3.4 Test Execution

### Background

This process evaluates the capability of the health IT system under test (SUT) to electronically generate the proper eCQM artifacts for the eCQMs being certified.

The Test Proctor provides the Cypress v5.0 Test Data for the clinical quality measures for which the technology will be tested in the format selected by the EHR vendor.

Depending on the test, the vendor manually inputs or electronically downloads the patient test data from Cypress that is used to test their technology.

- Selecting C1 certification along with C2, C3, and C4 will provide the vendor with the following certification test options that allow a Test Proctor to examine the eCQMs implemented in their technology:
  - C1-C3 Record Sample tests, which will have only four predetermined measures for testing of C1 and C3 certifications. This tab validates the technology for C1 and C3 certifications by entering specified patient data for four measures. Certifiers will download a QRDA zip file of patients, which is uploaded into their technology and re-uploaded into Cypress.
  - C1-C3 (QRDA-I), which will contain measures (based on your selection of all eCQMs or Custom for either hospitals or professionals). This tab will test the technology's ability to record and export (C1) and submit (C3) measure-based data.
  - C2-C3 (QRDA-III), which tests the technology's ability to import and calculate (C2) and submit (C3) measure-based data. Certifiers will submit XML patient files exported from their technology to verify calculation and submission of reporting.
  - C4 (QRDA-I and QRDA-III), which test the technology's ability to filter patient records.

This process enables you to test the product based on the Certification Types and Measures Options you selected when you created the product.

### 3.4.1 Automated Measure Test Execution

C1 as well as a C2, C3, or C4 certification type all require automated measure test execution. Figure 24 shows C1 and C2 certification types selected for all hospital eCQMs with randomized and duplicate records to be included in the test data files created by Cypress. Products certifying to C2 criteria in addition to C1 will create a product that has a limited number of C1 record sample test measures, automated C1 measure test, and any other certification tests created.

**Figure 24. C1-C2 Automated Entry Certification**

Figure 25 shows the result of adding the C1-C2 certification.

Sample Product	C1		C2	C3			C4	
	Sample	QRDA-I	QRDA-III	Sample	QRDA-I	QRDA-III	QRDA-I	QRDA-III
0 Passing Tests								
0 Failing Tests								
0 Not started Tests	4	16	16					

**Figure 25. Add Product for Automated Entry of Measure Data**

To select a measure for testing, click on the product name shown in Figure 26.

Dashboard Vendor: Sample Vendor

'Sample Product' was created.

Sample Vendor (ID: ID 1) + Add Product Edit Vendor

<http://www.samplevendor.com>  
 1287 enterprise way, DC, 20113  
 John Doe (Manager)  
 johndoe@samplevendor.com  
 (111) 111-1111

2 Products

☆ Sample Product	C1		C2	C3			C4	
	Sample	QRDA-I	QRDA-III	Sample	QRDA-I	QRDA-III	QRDA-I	QRDA-III
✓ 0 Passing Tests ✗ 0 Failing Tests ○ 36 Not started Tests								
	4	16	16					

**Figure 26. Selecting A Product to Test**

Figure 27 shows the certification tests created for C1-C2 Hospital measures. Note the tab for record sample that contains only four measures as well as tabs for C1 all Hospital and C2 certifications. The first Record Sample Test validates the technology for C1 certification by entering specified patient data for those identified measures. The second tab, C1 (QRDA-I), tests the technology's ability to record and export (C1), while the third tab, C2 (QRDA-III) tests the technology's ability to import and calculate (C2). Two sections appear, side by side, toward the top of the page: Product Status and Download Full Test Deck. On the left side of the page is the Product Status section that provides, for each Certification Type (based on the Measures Options you selected), a quick summary of the test cases that have passed, failed, and not yet started. On the right side of the page is a section entitled Download Full Test Deck. This download contains a folder for each measure selected for this product. These folders contain XML documents for each patient associated with that measure.

Dashboard Vendor: Sample Vendor Product: Sample Product

Sample Product [Edit Product](#) [Download Report](#)

	C1		C2		C3		C4	
	Sample	QRDA-I	QRDA-III	Sample	QRDA-I	QRDA-III	QRDA-I	QRDA-III
✔ 0 Passing Tests								
✘ 0 Failing Tests								
○ 36 Not started Tests	4	16	16					

**Download Full Test Deck**

This download contains a folder for each measure selected for this product. Inside these folders are XML documents for each patient associated with that measure.

[Download All Patients \(.zip\)](#)

**C1 Sample** [C1 \(QRDA-I\)](#) [C2 \(QRDA-III\)](#)

Validate the EHR system for C1 certification by entering specified patient data for the following measures.

[View Record Sample](#)

Upload Results	C1 Upload Results	Status
○ Not Started	○ Not Started	○ Not Started

Data Criteria Verification	Status
CMS31v6 Hearing Screening Prior To Hospital Discharge	Not Started
CMS104v6 Discharged on Antithrombotic Therapy	Not Started
CMS105v6 Discharged on Statin Medication	Not Started
CMS107v6 Stroke Education	Not Started

**Figure 27. Showing C1 Record Sample, C1 Automated, and C2 Product Measures**

To execute a Test for C1 (QRDA-1), select that tab and select the desired measure to begin testing, using either the Upload Link (if you already have your zip file ready for upload), or click on the Measure Name to download a test file to upload for C1 Certification testing as shown in Figure 28. The upload button will display a file selection dialogue box to select your file. The Measure Name Link will take you to the screen shown in Figure 29.

CMS ID	Measure Name	C1 Results	Quick Upload	Last Updated
CMS108v6	Venous Thromboembolism Prophylaxis	○ Not Started	<a href="#">upload</a>	○ 3 minutes ago
CMS190v6	Intensive Care Unit Venous Thromboembolism Prophylaxis	○ Not Started	<a href="#">upload</a>	○ 3 minutes ago
CMS105v6	Discharged on Statin Medication	○ Not Started	<a href="#">upload</a>	○ 3 minutes ago
CMS107v6	Stroke Education	○ Not Started	<a href="#">upload</a>	○ 3 minutes ago
CMS102v6	Assessed for Rehabilitation	○ Not Started	<a href="#">upload</a>	○ 3 minutes ago
CMS104v6	Discharged on Antithrombotic Therapy	○ Not Started	<a href="#">upload</a>	○ 3 minutes ago

**Figure 28. Product Measure Upload or Measure Name Selection**

Once you have selected the Measure Name you want to test, Cypress displays the test page for that individual measure (e.g., CMS108v6) as shown in Figure 29.

Measure Test Information		C1	C2
<b>Measure:</b> Venous Thromboembolism Prophylaxis <b>HQMF ID:</b> 40280382-5ABD-FA46-015B-1F6B95092A9D <b>CMS ID:</b> CMS108v6		<b>QRDA Errors</b> -- <b>Reporting Errors</b> -- <b>Execution Date</b> --	<b>QRDA Errors</b> -- <b>Reporting Errors</b> -- <b>Execution Date</b> --
<b>Provider Name:</b> Graves, Danielle <b>Provider NPI:</b> 1513804843 <b>Provider TIN:</b> 268221413 <b>Provider CCN:</b> 242520			start
<a href="#">View Patients</a> <a href="#">Get Known Good Result</a>			
<b>1</b> Download Test Deck Download and import this data into your EHR clinical quality measure calculator. <a href="#">Download QRDA Category I (.zip)</a>		<b>2</b> Upload Files Upload results from the EHR system in the form of a zip file of QRDA Category I documents to get test results. This will automatically run a test execution. <input type="text"/> <a href="#">Select file</a>	

**Figure 29. Individual Measure Test Page**

- Patient test data for the selected eCQMs of the specified test must be downloaded in the format required for the test.
- Click the **Download QRDA Category I (.zip)** button to download the test data for that selected eCQM. The downloaded zip file will contain duplicate and randomized patient records that your technology should correct for the uploaded portion of the test. The downloaded patient record test data will be contained in a zip file. Figure 30 shows an example filename entry.



**Figure 30. Zip File of Patient Test Data for Selected eCQM**

- If you click the **View Patients** link (shown in Figure 29), you will see a listing of the patients for that specific measure.
- Click **Get Known Good Results** link to download a zip file of patients that will pass the measure test you are planning to conduct as shown in Figure 31.

Name	Size	Kind
0_Allison_Wilkerson.xml	16 KB	XML
1_Ana_Johnston.xml	14 KB	XML
2_Anita_Quinn.xml	17 KB	XML
3_Anita_Wilson.xml	19 KB	XML
4_Arlene_George.xml	18 KB	XML
5_Ben_Payne.xml	21 KB	XML
6_Bill_Cannon.xml	22 KB	XML
7_Brandy_Nelson.xml	18 KB	XML
8_Brian_Hoffman.xml	20 KB	XML
9_Calvin_Kelley.xml	20 KB	XML
10_Carl_Perry.xml	16 KB	XML
11_Carla_Hawkins.xml	15 KB	XML
12_Cathy_Rowe.xml	16 KB	XML
13_Cindy_Perry.xml	26 KB	XML

Figure 31. Listing of Zip File of XML Patient Test Data for Testing Selected eCQM

- Select a single patient record and open the XML from the zip file listing to view the information. Figure 32 presents an example screenshot.

```

<?xml version="1.0" encoding="utf-8"?>
<ClinicalDocument xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="urn:h17-org:v3"
  xmlns:cda="urn:h17-org:v3">
  <!--
  *****
  CDA Header
  *****
  -->
  <realmCode code="US"/>
  <typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040"/>
  <!-- QRDA Category III Release 1 template ID (this template ID differs from QRDA III comment only
  template ID). -->
  <templateId root="2.16.840.1.113883.10.20.27.1.1"/>
  <id root="23440020-ff41-0133-b3b7-00505601057e" extension="CypressExtension"/>

  <!-- SHALL QRDA III document type code -->
  <code code="55184-6" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LOINC"
    displayName="Quality Reporting Document Architecture Calculated Summary Report"/>
  <!-- SHALL Title, SHOULD have this content -->
  <title>QRDA Calculated Summary Report</title>
  <!-- SHALL -->
  <effectiveTime value="20160518161144"/>
  <confidentialityCode codeSystem="2.16.840.1.113883.5.25" code="N"/>
  <languageCode code="en"/>
  <!-- SHOULD The version of the file being submitted. -->
  <versionNumber value="1"/>
  <!-- SHALL contain recordTarget and ID - but ID is nulled to NA. This is an aggregate summary report.
  Therefore CDA's required patient identifier is nulled. -->
  <recordTarget>
    <patientRole>
      <id nullFlavor="NA"/>
    </patientRole>
  </recordTarget>

  <!-- SHALL have 1..* author. MAY be device or person.
  The author of the CDA document in this example is a device at a data submission vendor/registry. -->
  <author>
    <time value="20160518161144"/>
    <assignedAuthor>

```

Figure 32. Patient XML File for C2 Test

- Once the technology has generated the test results in the QRDA Category I format, the results are uploaded from that individual measure's test page under the Upload files section. For C2 and C3 testing, this upload would occur in QRDA Category III format.
- Click on **Select file** as shown in Figure 33, browse to the QRDA Category I file you want to upload, and click **Choose**.

### Measure Test Information

Measure: Venous Thromboembolism Prophylaxis  
 HQMF ID: 40280382-5ABD-FA46-015B-1F6B95092A9D  
 CMS ID: CMS108v6

Provider Name: Graves, Danielle  
 Provider NPI: 1513804843  
 Provider TIN: 268221413  
 Provider CCN: 242520

[View Patients](#)  
[Get Known Good Result](#)

C1

QRDA Errors --  
 Reporting Errors --  
 Execution Date --

C2

QRDA Errors --  
 Reporting Errors --  
 Execution Date --

start

1 ⚡ Download Test Deck

Download and import this data into your EHR clinical quality measure calculator.

[Download QRDA Category I \(.zip\)](#)

2 ⚡ Upload Files

Upload results from the EHR system in the form of a zip file of QRDA Category I documents to get test results. This will automatically run a test execution.

[Select file](#)

Figure 33. Upload Test Execution Results

- The Test Proctor will then validate that the proper eCQM artifacts in QRDA Category I file format for the test being performed are electronically generated by the health IT SUT.
- Validation results will then be displayed in the Dashboard for that specific vendor’s product as shown in Figure 34.

2 Products

EH Product	C1		C2	C3			C4	
	Sample	QRDA-I	QRDA-III	Sample	QRDA-I	QRDA-III	QRDA-I	QRDA-III
✓ 2 Passing Tests		1			1			
✗ 0 Failing Tests								
○ 26 Not started Tests	3	2	3	3	2	3	5	5

Sample Product	C1		C2	C3			C4	
	Sample	QRDA-I	QRDA-III	Sample	QRDA-I	QRDA-III	QRDA-I	QRDA-III
✓ 0 Passing Tests								
✗ 1 Failing Tests		1						
○ 35 Not started Tests	4	15	16					

Figure 34. Example of Test Execution Summary Results

### 3.4.2 Record Sample Test

To begin record sample testing (and validate the technology for C1 certification by entering specified patient data for specific measures), select the Record Sample Test tab and then select **View Test** as shown in Figure 35.

**C1 + C3 Sample** C1 + C3 (QRDA-I) C2 + C3 (QRDA-III) C4 (QRDA-I and QRDA-III)

Validate the EHR system for C1 and C3 certifications by entering specified patient data for the following measures.

[View Record Sample](#)

Upload Results	C1 Upload Results	C3 Upload Results	Status
<input type="radio"/> Not Started			

Data Criteria Verification	Status
CMS32v7 Median Time from ED Arrival to ED Departure for Discharged ED Patients	Not Started
CMS55v6 Median Time from ED Arrival to ED Departure for Admitted ED Patients	Not Started
CMS11v6 Median Admit Decision Time to ED Departure Time for Admitted Patients	Not Started

**Figure 35. Record Sample Test, Select "View Test"**

As shown in Figure 36, this action will bring you to the Record Sample Checklist test page, which displays the status of each test on the right margin (i.e., Not Started, Passing, or Failing). The Record Sample Checklist page also displays a summary of each test and allows the user to check off (and save) a test when it has been completed.

[View Results](#)

Upload Results	C1 Upload Results	Status
<input type="radio"/> Not Started	<input type="radio"/> Not Started	<input type="radio"/> Not Started

Data Criteria Verification	Status
CMS32v8 Median Time from ED Arrival to ED Departure for Discharged ED Patients	Not Started

[Edit Test](#)

**CMS32v8 Median Time from ED Arrival to ED Departure for Discharged ED Patients**

Validated in QRDA	Data Criteria	Section	Required Attributes	Value Set(s)	Recorded Code/Attribute Value
	Encounter, Performed	Valuesets		Encounter Inpatient 2.16.840.1.113883.3.666.5.307	Code
				Emergency Department Visit 2.16.840.1.113883.3.117.1.7.1.292	<input type="text"/>
	Encounter, Order	Valuesets		Observation Services 2.16.840.1.113762.1.4.1111.143	Code
				Attributes	<input type="text"/>

[Save](#)

**Figure 36. Record Sample Page**

When choosing a code to demonstrate entry of a Record Sample data criteria, click on the allowable value sets to view a listing of valid codes as shown in Figure 37. Clicking on the allowable value sets will open a window displaying all the codes in the value sets as shown in Figure 38. The list is searchable, allowing a user to find an appropriate code for entry.

Validated in QRDA	Data Criteria	Section	Required Attributes	Value Set(s)	Recorded Code/Attribute Value
	Encounter, Performed	Valuesets		Encounter Inpatient 2.16.840.1.113883.3.666.5.307 Emergency Department Visit 2.16.840.1.113883.3.117.1.7.1.292	Code
	Encounter, Order	Valuesets		Observation Services 2.16.840.1.113762.1.4.1111.143	Code
<input type="button" value="Save"/>					

Figure 37. View Listing of Valid Codes

Not Started

Data Criteria Verification

CMS32v8 Median Time from ED Arrival to ED Departure for Discharged ED Patients

Edit Text

CMS32v8 Median Time from ED Arrival to ED Departure for Discharged ED Patients

Validated in QRDA

Data Criteria

Section

Required Attributes

Value Set(s)

Recorded Code/Attribute Value

Status

Failing

List of codes

Filter codes

Emergency hospital admission (procedure): 183452005

Hospital admission (procedure): 32485007

Hospital admission, elective (procedure): 8715000

Emergency department patient visit (procedure): 4525004

Close

Encounter, Performed

Valuesets

Encounter, Order

Valuesets

Attributes

Attributes

Code

Code

4525004

448851000124103

Save

Figure 38. Search for Valid Codes

Completing and saving a test, as shown in Figure 39, will then refresh the page and provide an updated status description for that specific test.

Validated in QRDA	Data Criteria	Section	Required Attributes	Value Set(s)	Recorded Code/Attribute Value
	Encounter, Performed	Valuesets		Encounter Inpatient 2.16.840.1.113883.3.666.5.307 Emergency Department Visit 2.16.840.1.113883.3.117.1.7.1.292	Code
	Encounter, Order	Valuesets		Observation Services 2.16.840.1.113762.1.4.1111.143	Code
<input type="button" value="Save"/>					

Figure 39. Complete and Save a Test

When all of your manual test measure entries are correct and have a completed checkmark, the select button will be enabled to allow upload of your XML files (zipped into a single file) into Cypress for certification as shown in Figure 40.

**1 Record Sample Instructions**

- Fill in the Data Criteria fields below.
  - If a Data Criteria has value sets listed, an appropriate code needs to be entered into the "Recorded Code" text box.
  - If an Attribute has a value set, an appropriate code needs to be entered into the "Recorded Attribute Code" text box.
  - Codes are validated upon saving.
  - Result, Date Times, and Related To are to be recorded as free text. ATLS will record the values they have observed being entered into the system under test.
- Create (at least) one patient for each measure below. Patients may be created using a user interface, or may be created as a structured document to be imported into the system under test.
  - There are no requirements on what format the structured data artifact must be. Could be CCDA, QRDA, or other formats.
  - This structured data artifact needs to be created at the time of certification
  - The created patients must contain all required Data Criteria, for the selected measures, to pass certification.
  - Export the created patients as QRDA Category I, and create a zip file.
- Upload zip file with created test patients.

**2 Upload Files**

Fill in the Data Criteria fields before you upload results from your EHR system.

Figure 40. Select File to Upload

### 3.4.3 CQM Filtering Test

The filter functionality included in this criterion allows a provider to query for eCQM results using one or a combination of data captured by the certified health IT for quality improvement and quality reporting purposes. It can also help identify health disparities, enable care quality improvement, and support providers in delivering more effective care to their patient populations. This certification criterion requires that a Health IT Module be capable of recording data (according to specified standards, where applicable) and filtering eCQM results at both patient and aggregate levels. These filters include, but are not limited to, practice site address, patient age, patient sex, and patient problem list.

- To begin eCQM filtering testing, click the C4 (QRDA-I and QRDA-III) Filtering Test tab, and click **start** on the Category I or Category III filtering criteria you are interested in testing, as shown in Figure 41.

C1 + C3 Sample   C1 + C3 (QRDA-I)   C2 + C3 (QRDA-III)   **C4 (QRDA-I and QRDA-III)**

Test the EHR system's ability to filter patient records.

Filtering Criteria	QRDA Category I	QRDA Category III	Last Updated
Age/Ethnicities	<input type="radio"/> start upload	<input type="radio"/> start upload	<input type="radio"/> an hour ago
NPI & TIN	<input type="radio"/> start upload	<input type="radio"/> start upload	<input type="radio"/> an hour ago
NPI, TIN & Provider Location	<input type="radio"/> start upload	<input type="radio"/> start upload	<input type="radio"/> an hour ago
Payers/Ethnicities	<input type="radio"/> start upload	<input type="radio"/> start upload	<input type="radio"/> an hour ago
Races/Genders	<input type="radio"/> start upload	<input type="radio"/> start upload	<input type="radio"/> an hour ago

Figure 41. Select a Category I or Category III to Test

- In this example, the Category I test page for Median Time from ED Arrival to ED Departure for Discharged ED Patients will be displayed as shown in Figure 42.

The screenshot displays the Cypress workflow interface for a QRDA Category I test. At the top, there are navigation tabs labeled C1, C2, C3, and C4, with C4 being the active tab. Below the tabs are buttons for 'Previous Test: CMS32v7' and 'Next Test: CMS32v7'. The main content area is divided into three columns:

- Filtering Test Information:** Contains the measure name 'Median Time from ED Arrival to ED Departure for Discharged ED Patients', HQMFI ID: 40280382-5A66-EAB9-015A-AF5BA5D72C52, and CMS ID: CMS32v7. It also includes links for 'View Patients' and 'Get Known Good Result'.
- QRDA Category I:** A summary table showing counts for QRDA Errors, Reporting Errors, Submission Errors, Warnings, and Execution Date.
- QRDA Category III:** A summary table showing counts for QRDA Errors, Reporting Errors, Submission Errors, Warnings, and Execution Date, with a 'start' button below it.

At the bottom, there are three main action panels:

- 1 Download Test Deck:** A panel with a button to 'Download QRDA Category I (.zip)' and instructions to download and import data into an EHR clinical quality measure calculator.
- 2 Filter Patients:** A panel with instructions to remove patients not meeting criteria. It lists filters: 'Age As Of July 14, 2017' with a 'Minimum 62' value, and 'Ethnicities' with 'Not Hispanic or Latino (code: 2186-5)'. There is a 'Select file' button.
- 3 Upload Files:** A panel with instructions to upload results from the EHR system as a zip file of QRDA Category I documents. It includes a 'Select file' button.

**Figure 42. Category I Test Page for Median Time from ED Arrival to ED Departure for Discharged ED Patients**

- Patient test data for the specified test must be downloaded in the format required for the test. This step, and those following, adhere to the same process as the steps outlined in the *Measure Tests* section, and will not be repeated here.

### 3.5 Test Execution Success Criteria

The criteria to determine a successful test outcome depend on whether the health IT product is being certified against the EP eCQMs or the EH eCQMs. The criteria for test execution success are as follows:

- For EP eCQMs,** a successful test outcome is one in which the following conditions are true:
  - There were no XML validation errors in either the QRDA Category I submitted data or the QRDA Category III submitted data.
  - All of the eCQM results calculated and submitted by the health IT SUT exactly match the values that Cypress v4.0 was expecting.
- For EH eCQMs,** a successful test outcome is one in which the following conditions are true:
  - There were no XML validation errors in either the QRDA Category I submitted data or the QRDA Category III submitted data.
  - All of the eCQM results calculated and submitted by the health IT SUT for discrete measures exactly match the values that Cypress v5.0 was expecting.
  - The eCQM results calculated and submitted by the health IT SUT for continuous variable tests are within a defined delta of the value that Cypress v5.0 was expecting.

For both types of technologies, it is acceptable to have XML validation *warnings* generated by the Cypress validation process. These warnings do not constitute a test failure; however, the Test Proctor should review the warnings generated and record any relevant observations about the reasons for the warnings.

Cypress groups failed test cases into three categories: (1) QRDA errors associated with logic and improper use of the QRDA standard, (2) reporting errors associated with errors in the calculation and aggregation of measure data for reporting purposes, and (3) submission errors associated with improper logic and formatting for submitting measure data to CMS. In addition to errors, Cypress will flag and report on warnings that indicate non-conformance with the CMS Implementation Guide (and associated schematron validation). Note, for health IT products not certifying for reporting (C3), non-conformance with the HL7 QRDA Implementation Guide will be treated as warnings. Figure 43 provides an example of measure test failure results.

The screenshot displays the Cypress Measure Test Failure Messages interface. At the top, there are tabs for 'C1' and 'C2'. Below the tabs, there are buttons for 'Previous Test: CMS107v6' and 'Next Test: CMS111v6'. The main section is titled 'Measure Test Information' and contains details for 'C1' and 'C2'. For 'C1', the status is 'Failing' and it shows 0 QRDA Errors and 10 Reporting Errors. For 'C2', the status is 'start' and it shows 0 QRDA Errors, 0 Reporting Errors, and 0 Execution Date. Below this, there are two main sections: '1 Download Test Deck' and '2 Upload Files'. The 'Results' section shows a summary of 'Failed with 10 errors' and a list of 'Missing or Duplicate Files' (61 files expected but was 67). The 'Errors and Warnings' section shows a list of files with error counts, including '17\_Dale\_Parker.xml' with 1 error and warning. A detailed view of this error shows the message: 'Patient 'DALE PARKER' not expected to be returned.'

Figure 43. Measure Test Failure Messages

## 3.6 Submit

### Electronically Submit Generated eCQM Artifacts

This functionality allows evaluation of the capability to electronically submit (a) calculated quality measures in accordance with the standard and implementation specifications, and (b) exported patient data sufficient to allow external calculation as follows:

- The Test Proctor commands the health IT SUT to generate and electronically submit the patient-level export in the QRDA Category I format for the clinical quality measures being tested.
- The Test Proctor commands the health IT SUT to generate and electronically submit an aggregate report in the QRDA Category III format of the clinical quality measures calculated in the test.
- The Test Proctor validates that the calculated clinical quality measures are submitted in accordance with the QRDA Category III standard and implementation specifications by uploading the QRDA Category III XML via the Cypress v5.0 User Interface and the Cypress-supplied XML Schema validation.
- The Test Proctor validates that the exported patient-level eCQM data are submitted in accordance with the QRDA Category I standard and implementation specifications by uploading the QRDA Category I XML via the Cypress v5.0 User Interface and the Cypress-supplied XML Schema validation.

## 3.7 Verify

### Verify Electronic and Accurate Generation of Clinical Quality Measure Artifacts

This functionality allows evaluation of the capability to electronically and accurately generate eCQM artifacts appropriate for each phase of the test procedure as follows:

- After the Test Proctor validates the submission of the QRDA Category III, the Test Proctor evaluates and displays the accuracy of the submitted clinical quality measure results via the Cypress v5.0 User Interface.
- The Test Proctor generates a test artifact bundle containing all test data used for this test execution, all products generated and submitted by the health IT SUT, and any other additional notes or information that the Test Proctor deems relevant into a single archive file that is cryptographically signed.

## 3.8 Cypress Validation Utility + Calculation Check (CVU+)

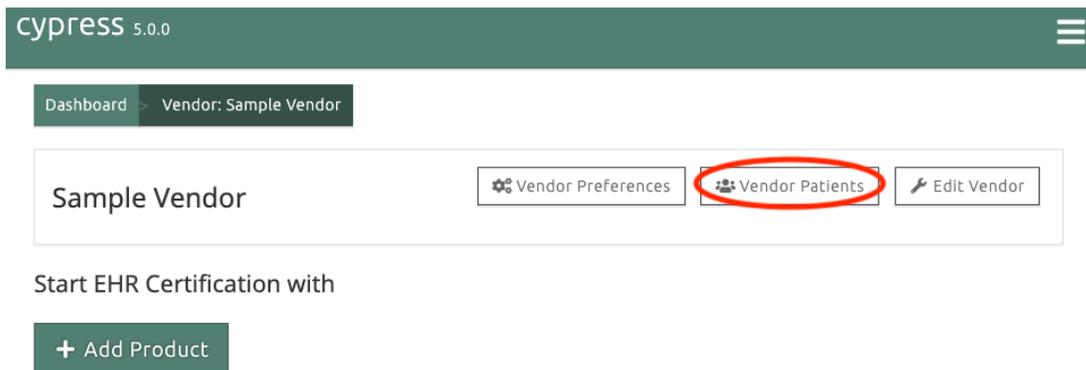
This functionality integrates the existing Cypress Validation Utility into Cypress with the following enhancements to align with the CMS submission systems:

- Developer generated test patients – A vendor can supplement Cypress test patients with their own test patients to increase eCQM logic/code coverage.
- Code System Preference – A vendor can choose preferences for the code systems to be used in test patients.

- Multi-Measure Tests – A vendor can test calculations with a single test deck across multiple measures.
- Enhanced CMS Implementation Guide validations – CVU+ verifies Implementation Guide constraints that are not validated by schematron.

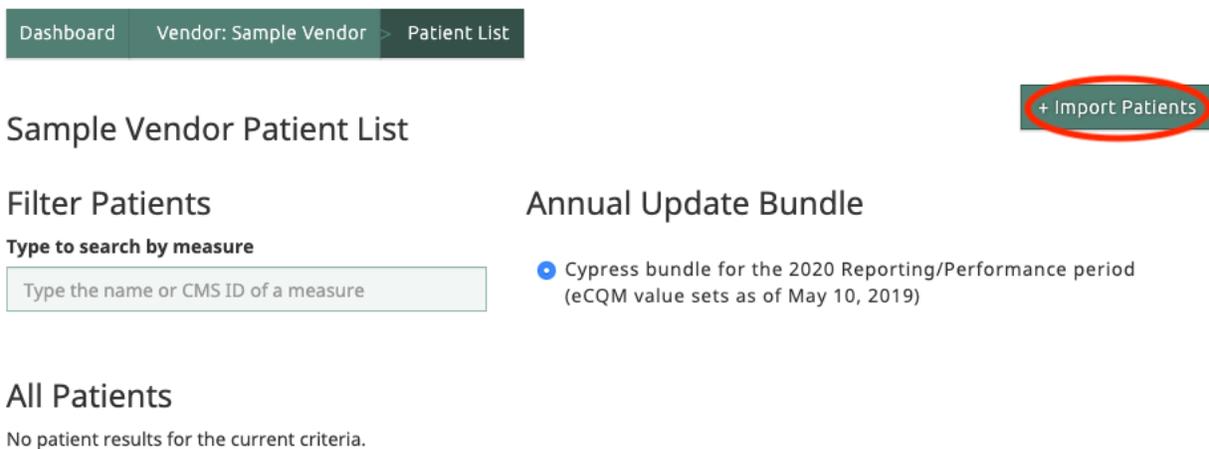
### 3.8.1 Developer generated test patients

After following the instructions in subsection 3.3, Cypress v5.0 Preparation for Testing, to add a vendor, a user can manage a set of ‘Vendor Patients’ for use with CVU+ tests created for that vendor. This set of ‘Vendor Patients’ can be managed by selecting Vendor Patients from the Vendor Page as shown in Figure 44.



**Figure 44. Vendor Page Select Vendor Patients**

From the Vendor Patient page, you can add Vendor Patients by selecting **Import Patients** from the Vendor Patients page as shown in Figure 45.



**Figure 45. Import Patients**

From the **Import Patients** page, you can **select** the bundle you would like to upload the Vendor Patients into (e.g., Cypress Bundle for 2020 Reporting/Performance period). Select **Choose File** on the **Import Patients** page to select a .zip file of QRDA documents to upload. After a .zip file

of QRDA documents is chosen, select **Import Patients** to start the import process as shown in Figure 46.

**Figure 46. Import Vendor Patients**

After the import process has completed you will be redirected back to the **Vendor Patients** page where you will be able to view a listing of the imported patients shown in Figure 47. The **Vendor Patients** page has all of functionality as the **Master Patient List**. This functionality is described in subsection 3.2.1, Master Patient List.

Select	Patient Name	DOB	Gender
<input type="checkbox"/>	Vendor Patient 2	January 12, 1945	Female
<input type="checkbox"/>	Vendor Patient 1	November 1, 2011	Female

**Figure 47. Listing of Imported Vendor Patients**

From the **Vendor Patients** page, you can also delete patients you would no longer like to use in test generation. Deleting patients is accomplished by selecting the **checkboxes** to the left of the patients you would like removed and selecting **Delete Selected Patients** when it appears at the bottom of the page. This is shown in Figure 48. Note that a confirmation action is required to complete the any deletion actions.

Dashboard > Vendor: Sample Vendor > Patient List

Sample Vendor Patient List + Import Patients

Filter Patients Annual Update Bundle

Type to search by measure Cypress bundle for the 2020 Reporting/Performance period (eCQM value sets as of May 10, 2019)

Type the name or CMS ID of a measure

All Patients

Select	Patient Name	DOB	Gender
<input checked="" type="checkbox"/>	Vendor Patient 2	January 12, 1945	Female
<input type="checkbox"/>	Vendor Patient 1	November 1, 2011	Female

**Delete Selected Patients**

Deletion is permanent and cannot be undone. Be sure you want to do this.

**Delete Selected Patients**

Figure 48. Delete Selected Patients

### 3.8.2 Code System Preference

After following the instruction subsection 3.3, Cypress v5.0 Preparation for Testing, to add a vendor, a user can manage code system preferences for use with CVU+ tests created for that vendor. These code system preferences will be used when selecting the codes to be included in generated test patients. Code system preference can be managed by selecting **Vendor Preference** from the **Vendor Page** as shown in Figure 49.

Dashboard > Vendor: Sample Vendor

Sample Vendor **Vendor Preferences** Vendor Patients Edit Vendor

Start EHR Certification with

**+ Add Product**

Figure 49. Vendor Preferences

On the **Vendor Preferences** page you can reorder the list of code systems available for each Quality Data Model data type. For example, the Adverse Event data types uses codes from the RXNORM and SNOMEDCT code systems. You can indicate RXNORM as your preferred code system by clicking and dragging the handle on the left side of the code system name and moving it to the top of the list as shown in Figure 50. By prioritizing RXNORM over SNOMEDCT, when a test patient has both RXNORM and SNOMEDCT codes available, only the RXNORM code will be exported in the QRDA document. After re-ordering a code system, you will need to select **Save** at the bottom of the page.

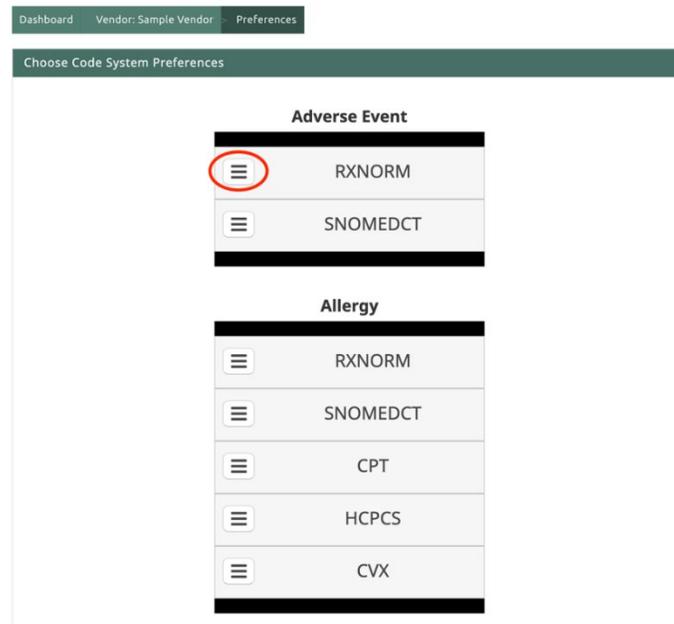


Figure 50. Ordering Code Systems

### 3.8.3 Creating CVU+ Tests

After following the instruction in subsection 3.3, Cypress v5.0 Preparation for Testing, to add a vendor, and following the instructions in 3.8.1, Developer Generated Patients and 3.8.2, Code System Preference, a user can create a CVU+ test to test calculations with a single test deck across multiple measures and test the ability to report QRDA documents to CMS submission systems. This test can be created by selecting Add Product from the Vendor Page as shown in Figure 51.

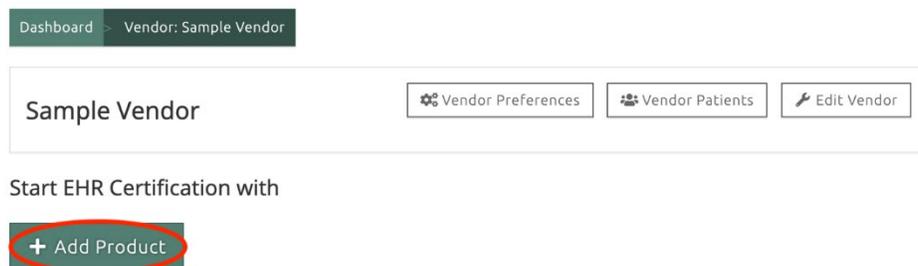


Figure 51. Add CVU+ Product

The main difference between creating a test for certification and creating a test for CVU+ is that you will need to select the CVU+ Product radio button highlighted in Figure 52 and you will have the option of selecting Include bundle patients (which will include test patients from the Cypress Bundle in the generated test decks), and the option of selecting Include vendor patient (which will include test patients uploaded following the steps in subsection 3.8.1, Developer Generated Patients). Additionally, CVU+ test do not require the selection of C1, C2, C3, or C4 certification criteria (as CVU+ is not a certification test).

The screenshot shows the 'Add Product' form in the Cypress application. The form is divided into several sections:

- Name:** CVU+ Product
- Version:** (empty field)
- Description:** (empty text area)
- Product Types:**
  - Certification Product
  - CVU+ Product
- Records Options:**
  - Randomize Records
  - Duplicate Records

*Recommended for most robust testing.*
- Bundle Options:**
  - Cypress bundle for the 2020 Reporting/Performance period (eCQM value sets as of May 10, 2019) 2019.0.0.2

*Select the measure versions Cypress should use to certify this product.*
- Include bundle patients:**  (highlighted with a red circle)
- Include vendor patients:**  (highlighted with a red circle)
- Shift Records:** 

*Selecting Shift Records will move patient data forward into the appropriate reporting period. Otherwise patient data will remain in a previously completed calendar year.*
- Measures Options:**
  - Eligible Hospital eCQMs
  - Eligible Professional eCQMs
  - All eCQMs
  - Custom...

*Indicate the clinical quality measures Cypress should use to certify this product. Testing will be performed on a measure-by-measure basis. Click 'Custom' to specify individual measures.*

Below the form, there is a section titled 'Select Custom Measures 18 ✓' with a 'Clear all' button. It includes a search box and a list of measure categories:

- Admissions and Readmissions to Hospitals (1 EH)
- Care is Personalized and Aligned with Patient's Goals (1 EH)
- Communication and Care Coordination (2 EP)
- Community/Population Health (12 EP) 12 ✓
- Effective Clinical Care (23 EP)
- Efficiency and Cost Reduction (4 EP)
- Patient Safety (5 EP)
- Person and Caregiver-Centered Experience and Outcomes (5 EP)
- Preventive Care (6 EH) 6 ✓

On the right side of this section, there are several checkboxes for specific measures:

- Select all 6 Preventive Care measures
- CMS71v9 Anticoagulation Therapy for Atrial Fibrillation/Flutter (EH)
- CMS72v8 Antithrombotic Therapy By End of Hospital Day 2 (EH)
- CMS104v8 Discharged on Antithrombotic Therapy (EH)
- CMS105v8 Discharged on Statin Medication (EH)
- CMS108v8 Venous Thromboembolism Prophylaxis (EH)
- CMS190v8 Intensive Care Unit Venous Thromboembolism Prophylaxis (EH)

At the bottom of the form, there are 'Add Product' and 'Cancel' buttons.

Figure 52. Creating a CVU+ Product

Once the CVU+ product is created, a user will be redirected to a CVU+ product page shown in Figure 53. This product page will list the Multi-Measure Tests for testing calculations with a single test deck across multiple measures, and CMS Program Tests for testing reporting requirement for CMS submission systems.

Dashboard Vendor: Sample Vendor Product: CVU+ Product

CVU+ Product [Edit Product](#) [Download Report](#)

	EP Measure Test	EH Measure Test	CMS Program Tests
✓ Passing Tests			
✗ Failing Tests			
○ Not started Tests	1	1	8

**Download Full Test Deck**

This download contains a folder for each measure selected for this product. Inside these folders are XML documents for each patient associated with that measure.

[Download All Patients \(.zip\)](#)

**MultiMeasureTest** CMSProgramTest

Test Name	Measures	Quick Upload	Last Updated
EH Measures	CMS105v8, CMS104v8, CMS190v8, CMS71v9, CMS108v8, CMS72v8	<a href="#">start</a> <a href="#">upload</a>	🕒 12 minutes ago
EP Measures	CMS22v8, CMS138v8, CMS2v9, CMS349v2, CMS127v8, CMS147v9, CMS75v8, CMS117v8, CMS82v7, CMS153v8, CMS155v8, CMS69v8	<a href="#">start</a> <a href="#">upload</a>	🕒 12 minutes ago

Figure 53. CVU+ Product Page

### 3.8.3.1 Multi-Measure Tests

When a **CVU+ Product** is created, Cypress will generate (at most) two Multi-Measure Tests. Cypress will generate one Multi-Measure Test for all of the Eligible Hospital/Critical Hospital eQMs and Cypress will generate one Multi-Measure Test for all of the Eligible Professional / Eligible Clinician eQMs. Both **EP Measures** and **EH Measures** tests require you to download a test deck of QRDA Category I patients and import the test deck into your system. The **EP Measures** test will only require you to upload a single QRDA Category III file that reports the calculations for all of the EP/EC measure. The **EH Measures** test will only require you to upload a single zip file of QRDA Category I files for the patients being reported. Error messages that result from the upload will be displayed in the same manner as the single measure tests in Figure 43.

### 3.8.3.2 CMS Program Tests

When a **CVU+ Product** is created, Cypress will generate a test for each appropriate CMS program shown in Figure 54. If EH measures are selected, Cypress will generate a test for the following programs:

- Hospital Quality Reporting for the Promoting Interoperability Program (HQR\_PI)
- Hospital Quality Reporting for the Inpatient Quality Reporting Program (HQR\_IQR)

- Hospital Quality Reporting for the Promoting Interoperability Program and the Inpatient Quality Reporting Program (HQR\_PI\_IQR)
- Hospital Quality Reporting for Inpatient Quality Reporting Program voluntary submissions (HQR\_IQR\_VOL)

If EP/EC measures are selected, Cypress will generate a test for the following programs:

- CPC+ (CPCPLUS)
- MIPS Individual (MIPS\_INDIV)
- MIPS Group (MIPS\_GROUP)
- MIPS Virtual Group (MIPS\_VIRTUALGROUP)

Dashboard Vendor: Sample Vendor Product: CVU+ Product

CVU+ Product [Edit Product](#) [Download Report](#)

	EP Measure Test	EH Measure Test	CMS Program Tests
✓ Passing Tests			
✗ Failing Tests			
○ Not started Tests	1	1	8

**Download Full Test Deck**

This download contains a folder for each measure selected for this product. Inside these folders are XML documents for each patient associated with that measure.

[Download All Patients \(.zip\)](#)

MultiMeasureTest **CMSProgramTest**

Test Name	Quick Upload	Last Updated
HQR_PI Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago
HQR_IQR Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago
HQR_PI_IQR Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago
HQR_IQR_VOL Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago
MIPS_GROUP Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago
MIPS_INDIV Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago
MIPS_VIRTUALGROUP Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago
CPCPLUS Test	<a href="#">start</a> <a href="#">upload</a>	🕒 a second ago

**Figure 54. CMS Program Tests**

**CMS Program Tests** follow a similar workflow as the C1 Record Sample Tests described in subsection 3.4.2. Clicking in the CMS Program Test name (shown in Figure 55) will take you to a test page for the specific program shown in Figure 56.

Test Name	Quick Upload	Last Updated
<b>HQR_PI Test</b>	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago
HQR_IQR Test	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago
HQR_PI_IQR Test	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago
HQR_IQR_VOL Test	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago
MIPS_GROUP Test	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago
MIPS_INDIV Test	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago
MIPS_VIRTUALGROUP Test	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago
CPCPLUS Test	<a href="#">start</a> <a href="#">upload</a>	🕒 10 minutes ago

**Figure 55. Select CMS Program Test**

Dashboard
Vendor: Health IT Vendor
Product: My Health IT Product
Program Test

### CMS Implementation Guide Checklist (HQR\_PI)

**1 ⚡ CMS Implementation Guide Checklist Instructions**

- Enter the information below into your EHR and record the entered values in the inputs boxes provided.
  - The "CMS IG Conformance Statement Reference" can be used to find specific guidance in the CMS Implementation Guide.
  - This information may need to be entered into a patient record, a provider profile or as a system configuration.
- Export (at least) one QRDA file that contains the information below and upload to Cypress.
  - Cypress will attempt to find the information below in the uploaded QRDA files.
  - When the information is found, a green checkmark will appear in the "Validated in QRDA" column. The file name where the information is found will also be indicated.
- Click the View Results link for:
  - Additional Program specific validations.
  - eCQM Calculation Results (for QRDA Category I uploads).

**2 ⚡ Upload Files**

Upload results from the EHR system in the form of a zip file of QRDA Category I documents to get test results. This will automatically run a test execution.

Select file

Upload Results	Status
<input type="radio"/> Not Started	<input type="radio"/> Not Started

Validated in QRDA	Data Criteria	Description	CMS IG Conformance Statement Reference	Recorded Value in Health IT
	CMS Certification Number	The organizations Facility CMS Certification Number (CCN). CCN is required for HQR.	(CONF:4388-28241_C01)	<input style="width: 100%; height: 20px;" type="text"/>
	Medicare HIC Number	Medicare HIC Number is not required for HQR but should be submitted if the payer is Medicare and the patient has an HIC number assigned.	(CONF:4388-16857_C01)	<input style="width: 100%; height: 20px;" type="text"/>
	Patient Identification Number	Patient Identification Number is required for HQR.	(CONF:CMS_0009)	<input style="width: 100%; height: 20px;" type="text"/>

**Figure 56. CMS Program Test**

Similar to the C1 Record Sample test, prior to running the CMS Program Test, you are required to fill out an entry form of information to capture in your EHR. The required information is specified in the CMS Implementation Guides for QRDA Category I and QRDA Category III. The specific conformance statement reference can be used to find the specific references in the appropriate CMS Implementation Guide. For example, HQR\_PR requires that a system be able to report a patient's Medicare HIC Number.

For example, you can demonstrate capturing this information by assigning a Medicare HIC Number of 1EG4TESMK73 to a test patient in your EHR system. Use the input form in Cypress to track the information that you have entered into your EHR. After entering all of the required information, **Save** the form shown in Figure 57. (Note that the example has only captured one of the seven required fields.)

Validated in QRDA	Data Criteria	Description	CMS IG Conformance Statement Reference	Recorded Value in Health IT
	CMS Certification Number	The organizations Facility CMS Certification Number (CCN). CCN is required for HQR.	(CONF:4388-28241_C01)	<input type="text"/>
	Medicare HIC Number	Medicare HIC Number is not required for HQR but should be submitted if the payer is Medicare and the patient has an HIC number assigned.	(CONF:4388-16857_C01)	<input type="text" value="1EG4TESMK73"/>
	Patient Identification Number	Patient Identification Number is required for HQR.	(CONF:CMS_0009)	<input type="text"/>
	Medicare Beneficiary Identifier	Medicare Beneficiary Identifier (MBI) is not required for HQR but should be submitted if the payer is Medicare and the patient has an MBI number assigned.	(CONF:4388-28697_C01)	<input type="text"/>
	CMS EHR Certification ID	The Certified Health Information Technology (IT) Product List (CHPL) is the authoritative and comprehensive listing of health IT certified through the Office of the National Coordinator for Health Information Technology (ONC) Health IT Certification Program. A CMS EHR Certification Identification Number is a number generated by the CHPL and used for reporting to CMS.	(CONF:CMS_0005)	<input type="text"/>
	Tax Identification Number	For HQR, TIN may not be applicable. If TIN is submitted for HQR, then it SHALL conform to the constraints specified for TIN, and the TIN must be in valid format (9 decimal digits).	(CONF:4388-16593)	<input type="text"/>
	National Provider Identification number	For HQR, NPI may not be applicable. If NPI is submitted for HQR, then the NPI SHALL conform to the constraints specified for NPI and the NPI must be in the correct format.	(CONF:3364-28497)	<input type="text"/>

**Figure 57. Capture CMS-Specific Information**

After saving, upload a .zip file with QRDA documents you created (in your EHR) with the information specified in the form (Note that the information does not need to be in a single QRDA document). Once the .zip file is uploaded, Cypress will verify that the expected information can be found in the uploaded QRDA files. When Cypress finds the required data

criteria, a checkmark will indicate the data criteria has been found with a note indicating which file that file was found in. For example, in Figure 58 the Medicare HIC Number was found in the file 0\_CVU\_Patient.xml.

Validated in QRDA	Data Criteria	Description	CMS IG Conformance Statement Reference	Recorded Value in Health IT
	CMS Certification Number	The organizations Facility CMS Certification Number (CCN). CCN is required for HQR.	(CONF:4388-28241_C01)	
✓ (0_CVU_Patient.xml)	Medicare HIC Number	Medicare HIC Number is not required for HQR but should be submitted if the payer is Medicare and the patient has an HIC number assigned.	(CONF:4388- 16857_C01)	1EG4TE5MK73
	Patient Identification Number	Patient Identification Number is required for HQR.	(CONF:CMS_0009)	

**Figure 58. Verifying CMS Specific Information**

In addition to finding the required data, Cypress preforms additional validations described in the CMS Implementation Guide, as well as performs measure calculation for the uploaded QRDA Category I documents. The results of these validations and calculations can be found by selecting **View Results** in Figure 59.

2 Upload Files

Upload results from the EHR system in the form of a zip file of QRDA Category I documents to get test results. This will automatically run a test execution.

Select file

Upload Results	Status
<div style="display: flex; align-items: center;"> <span style="font-size: 1.2em; margin-right: 5px;">View Results</span> </div>	<div style="display: flex; align-items: center;"> <span style="font-size: 1.2em; margin-right: 5px;">✗ Failing</span> </div>

Validated in QRDA	Data Criteria	Description	CMS IG Conformance Statement Reference	Recorded Value in Health IT
	CMS Certification Number	The organizations Facility CMS Certification Number (CCN). CCN is required for HQR.	(CONF:4388-28241_C01)	
✓ (0_CVU_Patient.xml)	Medicare HIC Number	Medicare HIC Number is not required for HQR but should be submitted if the payer is Medicare and the patient has an HIC number assigned.	(CONF:4388- 16857_C01)	1EG4TESMK73
	Patient Identification Number	Patient Identification Number is required for HQR.	(CONF:CMS_0009)	
	Medicare Beneficiary Identifier	Medicare Beneficiary Identifier (MBI) is not required for HQR but should be submitted if the payer is Medicare and the patient has an MBI number assigned.	(CONF:4388- 28697_C01)	
	CMS EHR Certification ID	The Certified Health Information Technology (IT) Product List (CHPL) is the authoritative and comprehensive listing of health IT certified through the Office of the National Coordinator for Health Information Technology (ONC) Health IT Certification Program. A CMS EHR Certification Identification Number is a number generated by the CHPL and used for reporting to CMS.	(CONF:CMS_0005)	
	Tax Identification Number	For HQR, TIN may not be applicable. If TIN is submitted for HQR, then it SHALL conform to the constraints specified for TIN, and the TIN must be in valid format (9 decimal digits).	(CONF:4388-16593)	
	National Provider Identification number	For HQR, NPI may not be applicable. If NPI is submitted for HQR, then the NPI SHALL conform to the constraints specified for NPI and the NPI must be in the correct format.	(CONF:3364-28497)	

**Figure 59. View Results and Calculation for CMS Program Test**

On the **View Results** page you can view the validation errors for the uploaded documents and view the measure calculations for the uploaded documents. Figure 60 shows validation error and measure calculations.

Results
Most Recent - June 24, 2019 5:54pm (8 errors) [Refresh View](#)

✘ Failed with 8 errors

#### Missing or Duplicate Files

- ✘ CMS Certification Number not complete
- ✘ Patient Identification Number not complete
- ✘ Medicare Beneficiary Identifier not complete
- ✘ CMS EHR Certification ID not complete
- ✘ Tax Identification Number not complete
- ✘ National Provider Identification number not complete

#### Errors and Warnings

✘ 0\_CVU\_Patient.xml 2

##### 0\_CVU\_Patient.xml - 2 errors and warnings

#### Measure Calculations

	IPOP	DENOM	NUMER	DENEX	DENEXCEP
CMS71v9 - PopulationSet_1	○	○	○	○	○
CMS72v8 - PopulationSet_1	○	○	○	○	○
CMS104v8 - PopulationSet_1	○	○	○	○	○
CMS105v8 - PopulationSet_1	○	○	○	○	○
CMS108v8 - PopulationSet_1	●	●	○	●	○
CMS190v8 - PopulationSet_1	●	●	○	●	○

View Uploaded XML with Errors

QRDA (0)
Reporting (1)
Submission (1)
CMS Warnings (0)
Other Warnings (0)

---

**Error message** [Go To in XML](#)

Expected to find program 'HQR\_PI' but no program code was found.

**Figure 60. Validation Results and Measure Calculation**

## Acronyms

<b>Acronym</b>	<b>Definition</b>
<b>ACO</b>	Accountable Care Organization
<b>ATL</b>	Authorized Testing Lab
<b>CMS</b>	Centers for Medicare & Medicaid Services
<b>CQM</b>	Clinical Quality Measure
<b>eCQM</b>	Electronic Clinical Quality Measure
<b>EH</b>	Eligible Hospital
<b>EHR</b>	Electronic Health Record
<b>EP</b>	Eligible Professional
<b>FFRDC</b>	Federally Funded Research and Development Center
<b>HEALTH FFRDC</b>	CMS Alliance to Modernize Healthcare
<b>HHS</b>	Department of Health and Human Services
<b>HL7</b>	Health Level Seven International
<b>HTML</b>	Hypertext Markup Language
<b>IG</b>	Implementation Guide
<b>IT</b>	Information Technology
<b>NIST</b>	National Institute of Standards and Technology
<b>ONC</b>	Office of the National Coordinator for Health Information Technology
<b>QDM</b>	Quality Data Model
<b>QRDA</b>	Quality Reporting Document Architecture
<b>SUT</b>	System Under Test
<b>XML</b>	Extensible Markup Language