



**Centers for Medicare & Medicaid Services**

# **Guide for Reading Digital Quality Measure (dQM) Test Cases**

**January 2026**

## 1. BACKGROUND

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A digital quality measure (dQM) is a quality measure that uses standardized digital data from one or more sources of health information that are captured and exchanged via interoperable systems; apply quality measure specifications that are standards-based and use code packages; and are computable in an integrated environment without additional effort. The Centers for Medicare & Medicaid Services (CMS) uses dQMs—including electronic clinical quality measures (eCQMs), which are a subset of dQMs that only use data extracted from electronic health records (EHR) and/or health information technology (IT) systems—in quality reporting and incentive programs. CMS is preparing to transition from eCQMs expressed using the Quality Data Model (QDM) to dQMs based on the Health Level Seven® (HL7®) Fast Healthcare Interoperability Resources (FHIR) standard for exchanging health care information electronically.

Measure developers build a synthetic patient test deck for each dQM from the clinical and administrative elements defined during the measure construction process. Using dQM Clinical Quality Language (CQL) as a basis for building synthetic patients, measure developers can create a test deck to support efforts to validate that the code executes as intended given the measure’s clinical intent. A test deck is a group of test cases evaluating each part of the dQM’s logic. Measure developers build their measures in the Measure Authoring Development Integrated Environment (MADiE), a software tool that helps measure developers execute the dQM logic against the constructed patient test deck and evaluate whether the logic aligns with the intent of the dQM. MADiE also shows which dQM sections the test deck has evaluated, allowing measure developers to ensure that all logic in the dQM has been tested.

This Guide seeks to help measured entities, including clinicians and hospitals, as well as quality analysts, dQM implementers, and health IT vendors understand how to read and interpret FHIR-based test case decks. As a part of the FHIR public comment period, CMS is releasing four test decks to support reviews of dQMs whose CQL code has been validated for compliance with the Quality Improvement Core (QI-Core) Standard for Trial Use version 6.0.0 (STU6). In addition, test cases in each of the four decks posted for review comply with QI-Core STU6. Please refer to the HL7 QI-Core Implementation Guide (<https://hl7.org/fhir/us/qicore/STU6/>) for more information on QI-Core and mapping recommendations from QDM to QI-Core STU 6.0.0 (<https://hl7.org/fhir/us/qicore/STU6/qdm-to-qicore.html>).

## 2. GUIDANCE FOR REVIEWING TEST CASE PACKAGES

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CMS has posted test case package files for four FHIR-based dQM measures that the public can review during the 2026 FHIR public comment period:

- CMS2FHIR-v1.0.000-FHIR-TestCases.zip (Preventive Care and Screening: Screening for Depression and Follow-Up Plan)
- CMS506FHIR-v1.0.000-FHIR-TestCases.zip (Safe Use of Opioids)
- CMS986FHIR-v1.6.000-FHIR-TestCases.zip (Malnutrition Care Score)
- CMS996FHIR-v1.0.000-FHIR-TestCases.zip (Appropriate Treatment for ST-Segmentation Elevation Myocardial Infarction (STEMI) Patients in the Emergency Department (ED))

CMS has validated that the posted test decks (exported from MADiE) satisfy the following requirements:

- 100% coverage, meaning that all components of the measure code and requirements are included in at least one “pass” and one “fail” scenario across the test cases, thereby providing a representative sample of expected pass/fail scenarios, and
- 100% passing, meaning that all test cases execute successfully in alignment with the expected results.

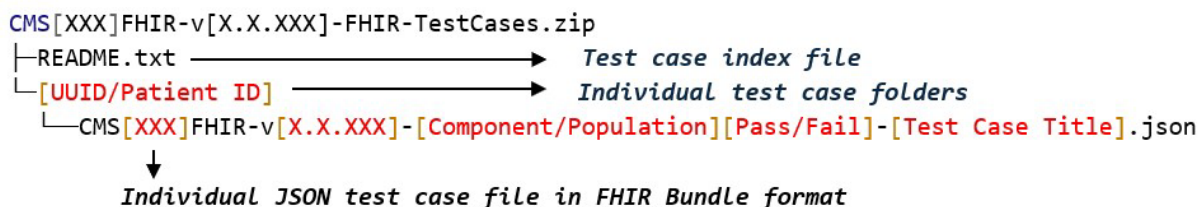
Please limit feedback to comments relevant to answering the following questions:

- Do the test cases sufficiently reflect real-world scenarios, including concepts such as multiple simultaneous conditions, provider-patient interactions, and potential data inconsistencies?
- Do the test cases sufficiently address boundary timing scenarios, such as events occurring just before, during, or immediately after critical time points (e.g., measurement periods, lab tests, medication administrations, or encounters)?
- What additional information should CMS consider posting as a supplement to FHIR test case packages published during future annual FHIR measure releases?

### 3. TEST CASE PACKAGE FILE STRUCTURE

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Each test case package file (.zip) follows this standard structure (see screenshot):



#### A. README.txt Format

This file is an index of all test cases for a given measure. To find a specific test case file in the export, first locate the Test Case Title in this document and then use the associated Universally Unique Identifier (UUID), also referred to as the Patient ID, to find the name of the corresponding test case folder in the export. The following is the structure of how each test case is listed in the README.txt file:

Case # [Number] - [UUID/Patient ID] = [Component/Population Criterion][Expected Result (Pass/Fail)] [Test Case Title]

#### B. Example Entry:

Case # 12 - 0e463fc3-d1bf-4e19-882b-fad6342aa668 = DENEXCEPPass AdolescentMedicalReasonForNoDepressionScreenAge17

#### Interpretation:

- **Case # 12:** Sequential test case number
- **0e463fc3-d1bf-4e19-882b-fad6342aa668:** UUID/Patient ID; name of the test case folder

- **DENEXCEPPass**: Test Case Group (Component/population criterion to be tested and expected test result)
  - **DENEXCEP**: Denominator exception is the measure component/population criterion to be tested
  - **Pass**: Expected test result is PASS (case that does not meet numerator criteria is excluded from denominator)
- **AdolescentMedicalReasonForNoDepressionScreenAge17**: Test Case Title

#### 4. COMMON POPULATION CRITERIA

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Population criteria represent characteristics for a measure, such as information on specific age groups, diagnoses, procedures, medications, and timing relationships. Population criteria consist of a definition statement or reference another definition and can be found in the human readable file stored within each measure package, CMS[XXX]FHIR-v[X.X.XXX]-FHIR.zip. CQL specifies the data criteria within each population criterion. The public can access these detailed definitions in the Measure Group section(s) of the measure human readable file (CMS[XXX]FHIR-v[X.X.XXX]-FHIR.html) to help interpret test case results for CMS2FHIR, CMS506FHIR, CMS986FHIR, or CMS996FHIR.

##### A. Standard dQM Population Types:

- **Initial Population (IP)**: All events to be evaluated by the measure involving patients or episodes who share a common set of characteristics
- **Denominator (DENOM)**: The initial population, or a subset of the initial population, serving as a divisor in a calculation of a rate, proportion, or ratio; continuous variables do not have a denominator
- **Measure Population** (used only in continuous variables): The measure population; for example, all patients seen in the emergency department (ED) during the measurement period. The measure population could be the same as, or contain a subset of, the IP.
- **Measure Observations** (used only in continuous variable measures): The computation that reporting entities should perform on members of the measure population after removing exclusions.
- **Denominator Exclusion (DENEX)**: A case that should be excluded from the initial population and denominator before determining if numerator criteria are met
- **Denominator Exception (DENEXCEP)**: Any condition that should remove a patient, procedure, or unit of measurement from the denominator of the performance rate only if the numerator criteria are not met
- **Numerator (NUMER)**: The processes or outcomes expected for each patient, procedure, or other unit of measurement defined in the denominator that serves as the dividend in a calculation of a rate, proportion, or ratio
- **Numerator Exclusions (NUMEX)**: Defines an instance that should be excluded from the numerator; used only in ratio and proportion measures

##### B. Expected Results:

- **Pass**: The case should be included in this population (count  $\geq 1$ )
- **Fail**: The case should NOT be included in this population (count = 0)

## 5. INDIVIDUAL TEST CASE FILE STRUCTURE

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Each test case folder contains a single JSON test case file. As shown in the image on page 2 and repeated here for convenience, the naming convention for each test case file is as follows:

CMS[XXX]FHIR-v[X.X.XXX]-[Component][Pass/Fail]-[Test Case Title].json

Each test case file contains all FHIR resources<sup>1</sup> for that test case:

```
{
  "resourceType": "Bundle",
  "id": "[bundle-id]",
  "type": "collection",
  "entry": [
    {
      "fullUrl": "https://madie.cms.gov/Patient/[UUID]",
      "resource": {
        "resourceType": "Patient",
        "id": "[UUID]",
        // Patient demographics and characteristics
      }
    },
    {
      "fullUrl": "https://madie.cms.gov/MeasureReport/[UUID]",
      "resource": {
        "resourceType": "MeasureReport",
        // Expected results with population counts
      }
    },
    {
      "fullUrl": "https://madie.cms.gov/Encounter/[UUID]",
      "resource": {
        "resourceType": "Encounter",
        // Healthcare encounters
      }
    }
  ]
  // ... other resources vary by measure (Coverage, Observation,
  // Organization, Practitioner, Medication, Procedure, etc.)
}
```

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<sup>1</sup> In FHIR, health care data are broken down into categories such as patients, encounters, medications, etc. Each of these categories are represented by a FHIR resource which includes its data elements, constraints on data and relationships. Resources are designed for reuse, performance, usability, fidelity and ability to implement.

## 6. HOW TO READ TEST CASES

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### A. Step 1: Extract and Navigate Files

1. Identify the measure (CMS2FHIR, CMS506FHIR, CMS986FHIR, or CMS996FHIR) for review
2. Download and extract contents from the test case and measure package files (.zip) available on the ASTP ONC Jira ticket

### B. Step 2: Understand the Scenario

1. Open the README file (.txt) from the test case package and review each of the Test Case Titles for that measure
2. Open the human readable file (.html) from the measure package and navigate to the Measure Group section(s) to review detailed definitions for population criteria
3. Choose the component(s) whose test case results you would like to review
4. In the README file (.txt), note the UUID/Patient ID for the test case to be examined

### C. Step 3: Parse the Bundle

1. Open the appropriate test case folder within the test case package
2. Open the test case JSON file (FHIR Bundle format)
3. Review the FHIR Bundle structure
4. Extract individual resources from the entry[] array to assess inputs for the tested measure component

### D. Step 4: Verify Expected Results

1. Find the MeasureReport resource in the test case JSON file
2. Check population count results for each tested measure component/population criterion:
  - **count: 1+** = Test patient is included (PASS)
  - **count: 0** = Test patient is not included (FAIL)
3. Compare the actual results in the test case JSON file with the expected results listed in the README.txt file for the tested measure component/population criterion.
  - As an example, for Case # 12 - 0e463fc3-d1bf-4e19-882b-fad6342aa668 = DENEXCEPPass AdolescentMedicalReasonForNoDepressionScreenAge17:
    - The population count should be 1 for the denominator exception population (DENEXCEPPass) and appears as 1 in the test case file (see screenshot).

```
    }, {
      "id": "DenominatorException_1",
      "code": {
        "coding": [ {
          "system": "http://terminology.hl7.org/CodeSystem/measure-population",
          "code": "denominator-exception",
          "display": "Denominator Exception"
        } ]
      },
      "count": 1
    }
  ]
}
```

- However, a test patient that meets the denominator exception criteria must also meet the initial population and denominator criteria. The actual results appear to be 1 for both populations as expected (see screenshot).

```

"group": [ {
  "id": "Group_1",
  "population": [ {
    "id": "InitialPopulation_1",
    "code": {
      "coding": [ {
        "system": "http://terminology.hl7.org/CodeSystem/measure-population",
        "code": "initial-population",
        "display": "Initial Population"
      } ]
    }
  }, {
    "count": 1
  } ],
  {
    "id": "Denominator_1",
    "code": {
      "coding": [ {
        "system": "http://terminology.hl7.org/CodeSystem/measure-population",
        "code": "denominator",
        "display": "Denominator"
      } ]
    }
  }, {
    "count": 1
  } ]
} ]

```

## E. Examples

### CMS2FHIR (Preventive Care and Screening: Screening for Depression and Follow-Up Plan) Example:

- **Test Case Title:** “DENEXCEPPass AdolescentMedicalReasonForNoDepressionScreenAge17”
- **UUID/Patient ID:** 0e463fc3-d1bf-4e19-882b-fad6342aa668
- **Test Case File Name:** CMS2FHIR-v1.0.000-DENEXCEPPass-AdolescentMedicalReasonForNoDepressionScreenAge17.json
- **Measure Component/Population Criterion:** DENEXCEP (Denominator Exception)
- **Expected Result:** PASS (case that does not meet numerator criteria is excluded from denominator)

### CMS506FHIR (Safe Use of Opioids) Example:

- **Test Case Title:** “NUMERPass 2ConcurrentOpioidMedsAtDisch”
- **UUID/Patient ID:** 132d772a-bf2d-4a80-998a-bef3b655501e
- **Test Case File Name:** CMS506FHIR-v1.0.000-NUMERPass-2ConcurrentOpioidMedsAtDisch.json
- **Measure Component/Population Criterion:** NUMER (Numerator)
- **Expected Result:** PASS (case meets numerator definition)

### CMS986FHIR (Malnutrition Care Score) Example:

- **Test Case Title:** “IPPFail HospiceExclusion1”
- **UUID/Patient ID:** 6ad4d973-4673-49bd-afb8-2678cb7f2963
- **Test Case File Name:** CMS986FHIR-v1.0.000-IPPFail-HospiceExclusion1.json
- **Measure Component/Population Criterion:** IP (Initial Population)
- **Expected Result:** FAIL (case does not qualify for the initial population)

**CMS996FHIR (Appropriate Treatment for ST-Segmentation Elevation Myocardial Infarction (STEMI) Patients in the Emergency Department (ED) Example:**

- **Test Case Title:** “NUMPASS Depart45minsfromEDstartMultLocation”
- **UUID/Patient ID:** 18031954-8ff7-4bb0-8d54-b5c88ab9c925
- **Test Case File Name:** CMS996FHIR-v2.0.000-NUMPASS-Depart45minsfromEDstartMultLocation.json
- **Measure Component/Population Criterion:** NUMER (Numerator)
- **Expected Result:** PASS (case meets numerator definition)