Technical Documentation for JAR Version 5.00.0 for the CMG Classification System Version 5.00

Centers for Medicare & Medicaid Services

October 1, 2020

This documentation is for a new implementation of the CMG classification system, written in the Java programming language, for use in classifying patients in Inpatient Rehabilitation Facilities (IRFs). This new implementation is delivered as a Java Archive (JAR) library and represents version 5.00 of the CMG classification system with the JAR version being 5.00.0. This new version (5.00) applies to assessments with discharge date on or after October 1, 2020. For a description of the changes with CMG version 5.00, and an explanation of the new JAR versioning scheme, see the "Changes with CMG Version 5.00 and JAR Version 5.00.0" section later in this document.

Note that version 5.00.0 of the JAR is backwardly compatible with prior CMG classification versions 3.10, 4.00 and 4.01, and it will calculate the CMG group code for all IRF-PAI assessments with discharge date on or after 10/1/2018.

This documentation and the CMG JAR are published by the Centers for Medicare & Medicaid Services (CMS). The documentation and JAR may be copied freely, as our goal is broad dissemination to facilitate accurate classification of Inpatient Rehabilitation Facility (IRF) patients with the Case Mix Group (CMG) classification system.

Disclaimer

To the maximum extent permitted by applicable law, CMS and its contractors/distributors make no representations about the suitability, for any purpose or use, of the software and documents. THE SOFTWARE AND DOCUMENTS ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND. ANY WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR USE, TITLE, AND NON-INFRINGEMENT ARE HEREBY DISCLAIMED. Recipient shall not, in any event, be entitled to, and CMS or contractors/distributors shall not be liable for indirect, special, incidental, or consequential damages of any nature including, without being limited to, loss of use, data, or profit irrespective of the nature of the claim, whether in contract, tort, warranty, or otherwise.

Introduction

This documentation describes a JAR that can be used to calculate a patient's CMG group from Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI) v4.0 data. The CMG_500 JAR is a Java library compatible with Java 8 and later that can be called from Java applications. The JAR can accept any of the following inputs:

(1) a string containing an IRF-PAI data record in the standard CMS fixed-length string format

(2) a string containing an IRF-PAI data record in the standard CMS XML submission format

(3) a string containing the filename of a standard CMS XML submission file.

It returns the CMG value and associated information. Documentation for the IRF-PAI standard XML and fixed-length string submission formats, as well as the JAR and associated documentation, is available at:

http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/InpatientRehabFacPPS/Software.html

The ZIP file (CMG_5.00.ZIP) containing the JAR software and documentation may be freely distributed, and you may freely use and distribute the JAR in your applications.

Later sections of this document (1) describe the input and output parameters used when calling the JAR, (2) the error codes that are returned by the JAR, and (3) IRF-PAI assessment test data with correct CMG values included.

Changes with CMG Version 5.00 and JAR Version 5.00.0

The prior CMG and DLL Versions were both 4.01, allowing processing of IRF-PAI assessments with discharge date on or after 4/1/2020. In addition to the change from a DLL to JAR library, there were several processing changes with Version 5.00. Three ICD-10-CM codes, J82, J84.17 and T86.842 were removed from Tier 3 (D) and seventeen ICD-10-CM codes were added to Tier 3 (D).The code changes are indicated in Appendix C of the Program Document in the "Comorbidity Tier Code Lookup Table."

Versioning

There are two separate version designators related to the JAR. The first is the version of the CMG classification model. The new version of the CMG model has been designated by CMS as version 5.00 and this version is based on the October 1, 2020 addition of seventeen ICD-10-CM codes to Tier 3 (D) and removal of three ICD-10-CM codes to Tier 3 (D). The new model is implemented in the JAR that is named CMG_500.JAR to indicate that it computes the version 5.00 model. The class implemented by the JAR is named Cmg, and the parameter usedIrfVersion which is returned by the JAR has a value of "5.00". The name of the JAR, the class, and the CmgVersion will not change unless CMS publishes a new regulation containing a new CMG model.

The JAR also has its own internal version number which can be different than the CMG model version number. The JAR version numbering is slightly different than the DLL version numbering, in that there is an extra digit at the end of the JAR version number that represents the build number of the JAR. This allows the first digits of the JAR version to match exactly with its corresponding CMG version. Thus, this initial version of CMG.JAR has a JAR version number of "5.00.0" (available from the JARVERSION constant). If the JAR for CMG model version 5.00 is later corrected or revised, then a new JAR version number will be used (e.g., "5.00.1"). However, regardless of the JAR version number, the name of the JAR that calculates version 5.00 of the CMG model will be CMG.JAR.

Contents of the CMG_500.ZIP File

The CMG_500.ZIP file contains the following files:

1. **Technical Documentation.pdf --** The current document, which explains the use of the JAR.

2. **Program Documentation.pdf --** Explains how to calculate CMG group codes. This document is primarily for programmers who wish to write their own CMG calculation software rather than using the JAR. Programmers who wish to use the JAR do not need to read this document to use the JAR correctly.

3. **CMG_500_JAR.zip** – a zip file containing:
   - **CMG.jar**
     — Java archive that performs CMG classification
   - **Cmg.zip**
     — Java source code and content defining RIC, CMG group, and comorbidity tier lookup table code for the CMG classification logic
4. **INTEGRATOR JAR.zip –** a zip file containing:
   - **Irf-Integrator.jar**
     — Java archive application that performs integration with the CMG classification to process IRF-PAI records
   - **Irf-Integrator.zip**
     — Java source code containing logic to integrate with the CMG classification, in addition to logic to perform read and write operations of IRF fixed string record

5. **Standard Test Data.zip** – This ZIP file contains standard test data for testing applications using the JAR provided in the CMG package. The JAR has been extensively tested for calculation of the motor score, cognitive score (for claims with a discharge date prior to 10/1/2019), and age; correct RIC lookup for all impairment codes at admission (Item 21A); correct CMG group lookup; and correct comorbidity tier assignment for each single comorbidity code and code combination (always a pair of codes in this version). The standard version 5.00 test data address all these calculations.

   CURRENT VERSION

   - **CmrTest v500 v6.txt** – a text file with 2,127 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing comorbidity tier assignment. All records have discharge date in October 2020.

   - **IRF_v500_AgeTest.txt** – a text file with 54 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing Age calculations. All records have discharge date in October 2020.

   - **IRF_v500_RIC_Test.txt** – a text file with 85 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing the Impairment Group Codes driving to the correct RIC Code. All records have discharge date in October 2020.

   - **IRF_v500_MotorScores.txt** – a text file with 148 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing all possible Motor Scores. All records have discharge date in October 2020.

   - **IRF_v500_Spec.txt** – a text file with 66 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing all added and deleted comorbidity codes. Files have discharge date in either April 2020 (v4.01) or October 2020 (v5.00).

   REGRESSION:

   The following are test files from past versions of the CMG, updated simply to be run with the 5.00 version of the JAR, and are being provided to demonstrate the requisite backwards compatibility with versions 4.01, 4.00 and 3.10.

   - **Cmg1F17 v7.txt** – a text file with 1,003 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing CMG group number assignment. All records have discharge date in April 2020 (v4.01).
     (**Cmg1F17 v6.txt** = the v4.00 file with discharge dates in October 2019).
     (**Cmg1F17 v5.txt** = the v3.10 file with discharge dates in October 2018).

   - **CM1F17 v7.zip** – a ZIP file containing 1,003 test files in standard XML submission format, testing CMG group number assignment. All files have discharge date in April 2020 (v4.01).
     (**Cmg1F17 v6.zip** = the v4.00 XML ZIP file with discharge dates in October 2019).
     (**Cmg1F17 v5.zip** = the v3.10 XML ZIP file with discharge dates in October 2018).

   - **CmrTest1 4_01 v6.txt** – a text file with 2,127 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing comorbidity tier assignment. All records have discharge date in April 2020 (v4.01).
     (**CmrTest1 3_00 v5.txt** = the v4.00 file with discharge dates in October 2019).
     (**CmrTest1 3_00 v4.txt** = the v3.10 file with discharge dates in October 2018).

- **CmrTest1 4_01 v6.zip** -- a ZIP file containing 2,127 test files in standard XML submission format, testing comorbidity tier assignment. All files have discharge date in April 2020 (v4.01).
  (**CmrTest1 3_00 v5.zip** = the v4.00 XML ZIP file with discharge dates in October 2019).
  (**CmrTest1 3_00 v4.zip** = the v3.10 XML ZIP file with discharge dates in October 2018).

- **MCAF17 v5.txt** -- a text file with 169 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing motor score, cognitive score, and age calculation. All records have discharge date in April 2020 (v4.01).
  (**MCAF17 v4.txt** = the v4.00 file with discharge dates in October 2019).
  (**MCAF17 v3.txt** = the v3.10 file with discharge dates in October 2018).

- **MCAF17 v5.zip** -- a ZIP file containing 169 test files in standard XML submission format, testing motor score, cognitive score, and age calculation. All files have discharge date in April 2020 (v4.01).
  (**MCAF17 v4.zip** = the v4.00 XML ZIP file with discharge dates in October 2019).
  (**MCAF17 v3.zip** = the v3.10 XML ZIP file with discharge dates in October 2018).

- **Cmr1 F16F17 v6.txt** -- a text file with 16 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing previously added comorbidity codes. Records have discharge date in either March 2020 (v4.00) or April 2020 (v4.01).
  (**Cmr1 F16F17 v5.txt** = the v4.00 file with discharge dates in October 2019).
  (**Cmr1 F16F17 v4.txt** = the v3.10 file with discharge dates in October 2018).

- **Cmr1 F16F17 v6.zip** – a ZIP file containing 16 test files in standard XML submission format, testing previously added comorbidity codes. Files have discharge date in either March 2020 (v4.00) or April 2020 (v4.01).
  (**Cmr1 F16F17 v5.zip** = the v4.00 XML ZIP file with discharge dates in October 2019).
  (**Cmr1 F16F17 v4.zip** = the v3.10 XML ZIP file with discharge dates in October 2018).

- **motortestv2.txt** -- a text file with 87 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing the possible motor score. Records have discharge date in April 2020 (v4.01).
  (**motortest.txt** = the v4.00 file with discharge dates in October 2019).

- **motortest v2.zip** – a ZIP file containing 87 test files in standard XML submission format, testing the possible motor score combinations. Files have discharge date in April 2020 (v4.01).
  (**motortest.zip** = the v4.00 XML ZIP file with discharge dates in October 2019).

- **U071 test.txt** -- a text file with 2 IRF-PAI assessment test records in the IRF-PAI standard fixed record format, testing the addition of ICD-10 code U07. One record has discharge date prior to April 1, 2020 (v4.00), and the other has a discharge date after April 1, 2020 (v4.01).

- **U071 test.zip** – a ZIP file containing 2 test files in standard XML submission format, testing the addition of ICD-10 code U07.1. One record has discharge date prior to April 1, 2020 (v4.00), and the other has a discharge date after April 1, 2020 (v4.01).

The known, correct CMG results in the "txt" test data files are located in the standard fixed record as follows:

KNOWN RESULT	START BYTE	END BYTE	FORMAT
Motor Score	2285	2289	Right Justified
Cognitive Score	2290	2294	Right Justified
Age	2282	2284	Right Justified
CMG group code	2138	2147	Left Justified

The known, correct CMG result in the XML test data files is the CMG group code in the SBMTD_CMG_TXT tag.

Developing CMG Applications

The Java source code illustrates how to call and use the JAR from Java and should serve as a model for developing Java applications and applications in other languages. The IrfIntegrator.java file provided in the package gives an example of how to call the JAR. The JAR is a Java 8 library that requires a Java 8 compatible Java Runtime Environment (for both paid and free license JRE options, go to https://www.java.com/en/download/) and a calling application in order to be used properly. For applications using the JAR, it is sufficient to use the standard test data.

For applications rewriting CMG from scratch, custom test data should be developed and used, in addition to the standard test data. The custom test data should test all CMG calculations, including calculation of the motor score, cognitive score, and age; correct RIC lookup for all impairment codes at admission (Item 21A); correct CMG group lookup; and correct comorbidity tier assignment for each single comorbidity code and code combination (always a pair of codes in this version).

Interfacing with the JAR

Below are a list of the inputs and outputs of the JAR. The "Method" column contains both the class name and method associated with a particular input or output.

Cmg				
Method	**Parameter Name**	**Parameter Type**	**Data Type**	**Description**
Cmg.process	source, format	Input	String, RecordFormat	**source** - A string containing the IRF-PAI record in standard CMS format (length=2785 bytes with a "%" character in the last byte). **format** – Use *RecordFormat.FIXED_STRING* when providing an IRF_PAI record in standard CMS format.
Cmg.process	source, format	Input	String, RecordFormat	**source** - A string containing the IRF-PAI record in standard CMS XML submission format. **format** – Use *RecordFormat.XML_STRING* when providing an IRF_PAI record in standard XML submission CMS format.

Cmg				
Method	**Parameter Name**	**Parameter Type**	**Data Type**	**Description**
Cmg.process	source, format	Input	String, RecordFormat	**source** - The path to a file containing an assessment in standard CMS XML submission format. **format** – Use *RecordFormat.XML_FILE_PATH* when providing a filename of a file containing an assessment in CMS standard XML format.
Cmg.JARVERSION	JARVERSION	Output	String	JARVERSION is a constant string set to "5.00.0", the version number for the present JAR.
IrfClaim				
irfClaim.getCmg Group	cmgGroup	Output	String	CmgGroup is a 5-byte string containing the CMG group. If no value has been calculated or the Error parameter is non-zero, CmgGroup will contain 5 spaces.
irfClaim.getError	Error	Output	Int	If the Error parameter is equal to zero, no errors occurred and CmgGroup will contain a valid CMG group designation. If an error occurred, the Error parameter will be non-zero and CmgGroup will contain 5 spaces. The possible values of the Error parameter are listed in a later section of this document.
irfClaim.get CalculatedMotor Score	calculatedMotorScore	Output	Double	Calculated CMG motor score. For assessments with discharge date prior to 10/01/2019: If the Error parameter is equal to zero, the value of Motor will be between 12.0 and 84.0, otherwise Motor will be equal to zero. For assessments with discharge date on or after 10/01/2019: If the Error parameter is equal to zero, the value of Motor will be between 18.0 and 104.0, otherwise Motor will be equal to zero.
irfClaim.get CalculatedCognitive Score	Calculated Cognitive Score	Output	Int	Calculated CMG cognitive score. For assessments with discharge date prior to 10/01/2019: If the Error parameter is equal to zero, the value of Cognitive will be between 5 and 35, otherwise Cognitive will be equal to zero. For assessments with discharge date on or after 10/01/2019: Cognitive will be equal to zero.

Cmg				
Method	**Parameter Name**	**Parameter Type**	**Data Type**	**Description**
irfClaim.get CalculatedAge	calculatedAge	Output	Int	Calculated age (computed by comparing date of birth with date of admission). If the Error parameter is equal to zero, the value of age will be between 0 and 140, otherwise Age will be equal to zero.
irfClaim.getUsedIrf Version	usedIrfVersion	Output	String	UsedIrfVersion is a string which returns a value of "5.00", the version number of the present CMG calculation model.
irfClaim.getFixed LengthResult	fixedLengthRe sult	Output	String	Method only works with RecordFormat.FIXED_STRING input. Takes fixed length input claim, substitutes calculated values into string and returns modified string

Error Codes

The JAR returns the value for the Error parameter. If no errors are detected by the JAR, the Error value is returned as zero and a non-blank cmgGroup (calculated CMG group code) is returned. If errors are detected, the Error parameter returns a non-zero value (indicating the error found) and cmgGroup is returned as 5 spaces. Your code should always check the value of the Error parameter on every claim after any call to Cmg.process().

Note that the JAR does not check to ensure that the IRF-PAI assessment record complies with the standard data specifications requirements. It is therefore possible for the JAR to return a valid CMG value from an IRF-PAI record that is not compliant and would be rejected by the standard CMS IRF-PAI system.

The values returned for the Error parameter are as follows:

Error Code	Reason
0	No errors found
1	Not an IRF-PAI record, as indicated by ASMT_SYS_CD not equal to 'IRF-PAI'.
2	The record is a request to inactivate a CMS database assessment rather than an IRF-PAI assessment record. Request to inactivate is indicated by TRANS_TYPE_CD = 3.
3	Birth date is missing or is invalid (Format YYYYMMDD)
4	Admission date is missing or is invalid (Format YYYYMMDD)
5	Admission date is *before* the birth date
6	Admission date is *after* the discharge date
7	Comorbidity code(s) is/are not formatted properly
8	List of codes is not continuous, there are gaps
9	Assessment(s) has invalid values
10	The admission impairment group code is missing

11	The calculated motor score is out of range (12 – 84 [v310], 18 – 104 [v400+] inclusive) or cannot be calculated
12	The calculated cognitive score is out of range (5 – 35 inclusive) or cannot be calculated. *Only applicable to versions prior to 400.*
13	The calculated age is out of range (0 – 140 inclusive) or cannot be calculated
14	The rehabilitation impairment code cannot be determined
15	Case Mix Group cannot be determined
16	Discharge date is before 10/01/2018, is missing or is invalid, and is not support by the CMG calculation
17	Unable to load content for processing, data files may be corrupted

Version History

DLL Version History

Version	Comments
Beta 01	Initial beta release.
Beta 02	Second beta release.
Beta 03	Third beta release.
Beta 04	Fourth beta release.
Beta 05	Fifth beta release.
Beta 06	Not released.
Beta 07	Seventh beta release. Posted on CMS website on 10/2001.
1.10	Second public version of the DLL, posted on CMS website on 6/2002.
1.20	Third public version of the DLL, released in July 2004.
1.21	Internal release – not publicly distributed.
1.22	Fourth public version of the DLL, released in December 2004.
2.00	Fifth public version of the DLL, released August 2005. Implements the second version (Version 2.00) of the CMG classification system.
2.01	Sixth public version of the DLL, released August, 2005. The only change with DLL Version 2.01 was to fix a problem in DLL Version 2.00 that prevented an application from loading DLL Version 2.00 and a prior version (e.g., Version 1.22) simultaneously in a Visual Basic 6 application.
2.02	Seventh public version of the DLL, released March, 2006. Removed one comorbidity that had been included in DLL Version 2.00.
2.10	Eighth public version of the DLL, released August, 2006. Many comorbidities were added, deleted, or changed tiers per the FY 2007 IRF PPS Final Rule due to be published on August 1, 2007 and the FY 2007 annual revision to the ICD9 codes.
2.20	Ninth public version of the DLL, released August, 2007. Several comorbidities were added and 2 comorbidities were deleted per the FY 2008 annual revision to the ICD9 codes.

Version	Comments
2.30	Tenth public version of the DLL, released August, 2008. Several comorbidities were added and 1 comorbidity was deleted per the FY 2009 annual revision to the ICD9 codes.
2.40	Eleventh public version of the DLL, released August, 2009. Four comorbidities were added and 1 comorbidity was deleted per the FY 2010 annual revision to the ICD9 codes.
2.50	Twelfth public version of the DLL, released August, 2010. Seven comorbidities were added and two comorbidities were deleted per the FY 2011 annual revision to the ICD9 codes.
2.60	Thirteenth public version of the DLL, released August, 2011. Nineteen comorbidities were added, three comorbidities were deleted, and four comorbidities had label changes per the FY 2011 annual revision to the ICD9 codes.
2.70	Fourteenth public version of the DLL, released July, 2014. The only change was the use of the 25 comorbidity items implemented in the IRF-PAI assessment for October 1, 2014.
2.80	Fifteenth public version of the DLL, released August, 2015. The only major change was the shift from ICD-9-CM diagnosis codes to ICD-10-CM codes in the IRF-PAI assessment for October 1, 2015.
2.81	Sixteenth public version of the DLL, released January, 2016. The only change was revision of comorbidity handling to correct a flaw that occurred with the prior Version 2.80 for some IRF-PAI assessment records.
2.82	Seventeenth public version of the DLL, released May 22, 2016. The only change was correction of a comorbidity handling flaw in Version 2.81 for older IRF-PAI assessments with discharge date before 10/1/2015.
2.90	Eighteenth public version of the DLL, released August, 2016. One hundred and ninety-nine comorbidities were added and 45 comorbidities were deleted per the FY 2017 annual revision to the ICD-10-CM codes.
3.00	Nineteenth public version of the DLL, released August 2017. Five comorbidities were added and two comorbidities were deleted per the FY 2018 annual revision to the ICD-10-CM codes. The DLL was enhanced to allow processing of either the IRF-PAI standard XML submission format or the fixed-length string format.
3.10	Twentieth public version of the DLL, released August 2018. Eleven comorbidities were added and three comorbidities were deleted per the FY 2019 annual revision to the ICD-10-CM codes.
4.00	Twenty-first public version of the DLL, released September 2019. The calculation of the motor score is different for assessments with discharge date 10/01/2019 and later. The cognitive score is no longer calculated for assessments with discharge date 10/01/2019 and later. Two single ICD-10-CM codes assigning Tier 3 (D) were added, and two label changes were made per the FY 2020 annual revision to the ICD-10-CM codes. .
4.01	Twenty-second and final public version of the DLL, released April 2020. A single ICD-10-CM code, U07.1, assigning Tier 3 (D) was added.

JAR Version History

Version	Comments
5.00.0	First public version of the JAR released October 2020. Seventeen ICD-10-CM codes assigning Tier 3 (D) were added. Three ICD-10-CM codes assigning Tier 3 (D) were removed and one ICD-10-CM code had a description change.

Usages

CMG Integration

Initialize CMG

```
Cmg cmg = new Cmg();
```

CMG processing options:

1. With fixed string format

   ```
   String fixedStringRecord = "...";
   IrfClaim claim = cmg.process(irfFixedStringRecord, RecordFormat.FIXED_STRING);
   ```

2. With xml string

   ```
   String xmlRecord = "<ASSESSMENT>...</ASSESSMENT>";
   IrfClaim claim = cmg.process(xmlRecord, RecordFormat.XML_STRING);
   ```

3. With xml file path

   ```
   String xmlFilePath = "./samplexmlfile.xml";
   IrfClaim claim = cmg.process(xmlFilePath, RecordFormat.XML_FILE_PATH);
   ```

Obtain results from IrfClaim:

Java Object Output

```
int usedIrfVersion = claim.getUsedIrfVersion();
int cognitiveScore = claim.getCalculatedCognitiveScore();
int residentAge =    claim.getCalculatedAge();
Double motorScore =  claim.getCalculatedMotorScore();
int ric =            claim.getCalculatedRic();
String cmgValue =    claim.getCmgGroup();
int errorValue =     claim.getError();
```

Fixed Length Output – Only for RecordFormat.FIXED_STRING input. Takes input claim, writes calculated values and returns modified string.

```
String fixedLengthOutput = claim.getFixedLengthResult();
```

Miscellaneous

Error

To obtain the reason for an error:

```
int errorValue = 0;
```

```
String errorReason = Error.getError(errorValue);
```

The above would return "*No errors found*" for errorReason.

In addition, for the CMG version 5.00 beta test period, if the user decides to run the provided IrfIntegrator sample client, they will find that the sample client "borrows" bytes 2585-2684 of the fixed length format for outputting error codes and their descriptions.

Technical Assistance

If you have questions about the JAR which are not answered by this documentation, please refer to the CMS web site for further information or for contact information to receive assistance:

http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/InpatientRehabFacPPS/Software.html