AIM

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ON MATERNAL HEALTH

AIM Guide to Implementing the Severe Maternal Morbidity Algorithm

For use with hospital inpatient discharge data

Version: March 22, 2022

Introduction

This guide is intended to assist analysts with the initial calculation of Severe Maternal Morbidity (SMM) using the methods developed by a national workgroup with representatives from AHRQ, HRSA, CDC and AIM.

This may be used with datasets containing ICD-10 diagnostic and procedure codes. Examples of appropriate data sources are electronic health records, hospital inpatient discharge records, and all-payer claims data.

There is no single "right" approach or tool to implement these methods. This guide uses widely known methods. This is not the most efficient method. Analysts with experience in tools such as SAS[1], SPSS, R, SQL and other programs/languages may find more efficient ways to calculate this measure and may want to consider alternative approaches. However, this guide aims to be tool agnostic and has the advantage of using methods that are accessible to a wide range of analysts. Further, the provision of **AIM flagging tables** described in the example provide standardization in a way that can assure consistency in the calculation of the measure.

In alignment with the Federally Available Data (FAD) Resource Document (see link in footnote), we retain the category of Blood Transfusions in the coding but exclude it in the final calculation of the measure.

The example presented in the following pages uses the following nomenclature.

Field definitions:

- Key: Unique Record ID
- DX: ICD-10 Diagnostic Code
- PR: ICD-10 Procedure Code
- DRG: ICD-10 Diagnosis-Related Group

[1]SAS code from CDC for calculating SMM is available in the Federally Available Data Resource Document here: **https://mchb.tvisdata.hrsa.gov/Home/Resources**

SMM Component Variable Names & Labels

Alphabetical List of SMM Component Variable Names and Labels		
Variable Label	**Variable Name**	**SAS Variable Name** (for reference only)
Acute Myocardial Infarction	AMI	SMM1
Acute Renal Failure	ARF	SMM3
Adult Respiratory Distress Syndrome	ARDS	SMM4
Air and thrombotic embolism	ATE	SMM17
Amniotic Fluid Embolism	AFE	SMM5
Aneurysm	ANR	SMM2
Blood products transfusion	BPT	SMM18
Cardiac arrest/ventricular fibrillation	CAVF	SMM6
Conversion of cardiac rhythm	CCR	SMM7
Disseminated intravascular coagulation	DIC	SMM8
Eclampsia	ECL	SMM9
Heart failure/arrest during surgery or procedure	HFADSP	SMM10
Hysterectomy	HYST	SMM19
Puerperal cerebrovascular disorders	PCD	SMM11
Pulmonary Edema/Acute Heart Failure	PEAHF	SMM12
Sepsis	SEPS	SMM14
Severe anesthesia complications	SAC	SMM13
Shock	SHK	SMM15
Sickle cell disease with crisis	SCDWC	SMM16
Temporary tracheostomy	TT	SMM20
Ventilation	VENT	SMM21
Severe Maternal Morbidity Numerator (include)	SMMnum	n/a
Severe Maternal Morbidity Numerator Excluding Transfusions (include)	SMMnumNoTrnsfs	n/a
Severe Maternal Morbidity Denominator (include)	SMMden Include	n/a
Severe Maternal Morbidity Denominator (exclude)	SMMden Exclude	n/a

Example

Step 1

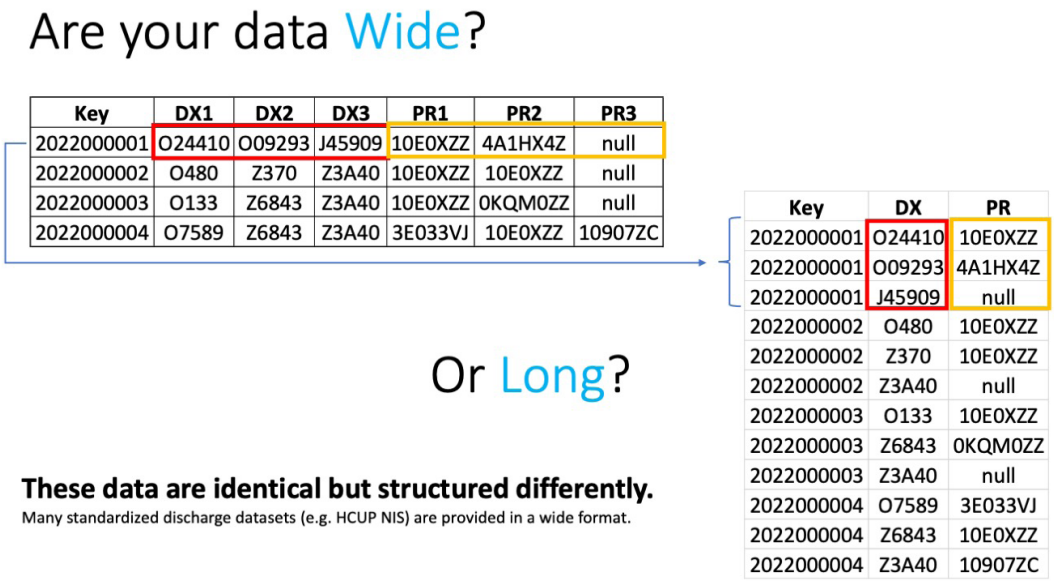
Limit your data to:

- Sex = Female
- Age >= 12 and <=55
- If you are calculating a measure that further requires a subset of patients (e.g. SMM among patients with preeclampsia or hypertensive disorders) please limit your dataset to only those records now.

Step 2

Determine if your discharge records are in a "wide" or "long" format. It is more common to have inpatient discharge data in the wide format. If so, you'll need to convert it to the long format (and then back to wide). This is explained further below.

Note that the diagnostic (DX) and procedure (PR) codes are limited to three per unique ID in this example for brevity. All primary and secondary codes should be used for this measure. DRG codes are also a component of SMM but are excluded from this example for simplicity. The methods described below for DX and PR codes are identical to those for DRG codes.



Key	DX1	DX2	DX3	PR1	PR2	PR3
2022000001	O24410	O09293	J45909	10E0XZZ	4A1HX4Z	null
2022000002	O480	Z370	Z3A40	10E0XZZ	10E0XZZ	null
2022000003	O133	Z6843	Z3A40	10E0XZZ	0KQM0ZZ	null
2022000004	O7589	Z6843	Z3A40	3E033VJ	10E0XZZ	10907ZC

Key	DX	PR
2022000001	O24410	10E0XZZ
2022000001	O09293	4A1HX4Z
2022000001	J45909	null
2022000002	O480	10E0XZZ
2022000002	Z370	10E0XZZ
2022000002	Z3A40	null
2022000003	O133	10E0XZZ
2022000003	Z6843	0KQM0ZZ
2022000003	Z3A40	null
2022000004	O7589	3E033VJ
2022000004	Z6843	10E0XZZ
2022000004	Z3A40	10907ZC

Re-structuring your data from wide to long format is usually a function provided by whatever software tool you are using to manipulate your data. It is sometimes referred to as "pivoting" the data. Try searching for the name of your software tool (e.g. Excel) and "convert wide to long." Guides to doing this are common online for a variety of tools.

Step 3

Download the AIM flagging table for this measure. Open the Excel file and familiarize yourself with it. The three worksheets you'll be joining to your data are labeled DX, PR, and DRG (DRG not shown in this example, but it is a necessary component of SMM). For each of these code types you'll see a list of codes with additional columns to their right containing zeroes and ones. A zero indicates the code is not needed for that variable (e.g. for SMMnum) and a one indicates the code will be flagged for that variable.

AIM provides flagging tables that can be **joined** to your long format data to facilitate calculation of the measure

AIM Diagnostic Code Flags

DX	SMMnum	AMI	ARF	ARDS
I2101	1	1	0	0
I2102	1	1	0	0
I2109	1	1	0	0
I2111	1	1	0	0
I2119	1	1	0	0

{truncated}

AIM Procedure Code Flags

PR	SMMnum	AMI	ARF	ARDS
30230H0	1	0	0	0
30230H1	1	0	0	0
30230K0	1	0	0	0
30230K1	1	0	0	0
30230L0	1	0	0	0

{truncated}

AIM DRG Code Flags

DRG	SMMden Include
765	1
766	1
767	1
768	1
774	1
775	1
783	1
784	1
785	1
786	1
787	1
788	1
796	1
797	1
798	1
805	1
806	1
807	1

Step 4

Join your data to the AIM Flagging Tables. You will have three joins to perform (DX, PR, DRG).

Example: Join your data to AIM Flagging Table

Your Long Data (Left)

Key	DX
2022000001	O24410
2022000001	I2101
2022000001	J45909
2022000002	O480
2022000002	I2102
2022000002	Z3A40
2022000003	O133
2022000003	I2111
2022000003	Z3A40
2022000004	O7589
2022000004	I2109
2022000004	Z3A40

AIM Diagnostic Code Flags (Right)

DX	SMMnum	AMI	ARF	ARDS
I2101	1	1	0	0
I2102	1	1	0	0
I2109	1	1	0	0
I2111	1	1	0	0
I2119	1	1	0	0

{truncated}

In this example, you join on the field DX.
A Left Join would keep all records in your data and add numeric flags (SMMnum, AMI, ARF, ARDS, etc.) to your dataset. These flags will be aggregated and used later to calculate the measure. Do the same thing for the PR (procedure) column in your data (join on the PR field).

Here's what your data will look now

Key	DX	SMMnum	AMI	ARF	ARDS
2022000001	O24410	0	0	0	0
2022000001	I2101	1	1	0	0
2022000001	J45909	0	0	0	0
2022000002	O480	0	0	0	0
2022000002	I2102	1	1	0	0
2022000002	Z3A40	0	0	0	0
2022000003	O133	0	0	0	0
2022000003	I2111	1	1	0	0
2022000003	Z3A40	0	0	0	0
2022000004	O7589	0	0	0	0
2022000004	I2109	1	1	0	0
2022000004	Z3A40	0	0	0	0

Note that in this example, each of the 4 unique records flagged for SMMnum and AMI. No records in this example flagged for ARF or ARDS.

BUT, this is difficult to see in this format...

Step 5

After completing joins for your procedure codes transform your data back to Wide format to make analysis easier. Remember to also join the DRG flags to your wide data format.

- Aggregating your data by grouping on the *Key* and retaining the ***maximum*** value in each flag field will result in one record per discharge with flags for each group of codes that may be joined back into your full dataset if other variables are needed. The example below shows an example of records flagged for DX codes.

Key	SMMnum	AMI	ARF	ARDS
2022000001	1	1	0	0
2022000002	1	1	0	0
2022000003	1	1	0	0
2022000004	1	1	0	0

This is easier to read because it contains only one row per delivery discharge.

Step 6

Calculate SMM by applying the initial filters, identifying the denominator (deliveries) and numerator (any SMM component).

The Logic for calculating the measure

You began by limiting your data sets to:

- Sex = Female
- Age >= 12 and <= 55
- Any other subset required, such as patients with hypertension

Next:

- Exclude all records with SMMden Exclude = 1
- Exclude all records with SMMden Include = 0
    - You now have your denominator
- Exclude all records with SMMnumNoTrnsfs = 0
    - You now have your numerator

The additional flagging fields may be used to assess the components of SMM.

Questions, comments, suggestions for improvements?

Contact us at **aimdatasupport@acog.org**