TITLE:
Comorbidities among patients with Severe Maternal Morbidity: A comparison of conditions identified through active hospital-based surveillance versus OMOP CDM

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FUDNING:
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BACKGROUND:
Annually, more than 50,000 women experience severe maternal morbidity (SMM) [1], which is defined as potentially life-threatening conditions or complications resulting from labor and delivery that can significantly affect a woman's health [2]. Patient characteristics, especially presence of comorbid conditions, strongly affect the risk of SMM [3,4].

Since 2020, the Maryland Maternal Health Innovation Program (MDMOM) has conducted active facility-based surveillance of SMM in birthing hospitals in Maryland [5]. The goal of this surveillance is to identify factors associated with SMM to prevent future SMM and other adverse maternal outcomes. Through this initiative, we have identified that nearly 80% of patients in Maryland with SMM have one or more comorbidities and other risk factors for SMM.

The aim of this exploratory analysis is to compare the prevalence of comorbidities and risk factors for SMM identified through our surveillance efforts, based on manual chart abstraction and reviews by hospital committees, to those available through a cohort characterization exercise in the OMOP common data model.

METHODS:
Data are derived from two sources: 1) MDMOM's SMM facility-based surveillance and 2) electronic health records (EHR) data structured using the OMOP CDM. For the purpose of this analysis, SMM surveillance data are limited to hospitals from the Johns Hopkins Health System (Johns Hopkins Hospital and Bayview Medical Center). Trained clinician abstractors in each participating hospital identified all cases that met our SMM surveillance definition (i.e., patients admitted to an intensive care unit and/or receiving 4 or more units of blood products transfused during pregnancy or within 42 days postpartum) [6]. Abstractors reviewed the EHR record to document information about the patient and SMM event using a standardized electronic REDCap form including relevant medical history and health conditions that occurred during the current and prior pregnancies. SMM

surveillance data captures data between July 2020 and December 2023, during this period 205 patients were identified as meeting SMM criteria.

EHR data includes records from all patients with live birth deliveries within the Johns Hopkins Health System between July 2016 and May 2024. SMM events are identified using the CDC algorithm of 21 indicator corresponding to ICD10-CM codes documented during the delivery hospitalization [7]. During this period, 1,014 patients were identified as having experienced SMM during delivery. A computable phenotype for SMM in the form of a standard concept set developed by the OHDSI Perinatal and Reproductive Health working group (PRHeG) was applied to the JHM OMOP instance for identifying patients with SMM during delivery.

We computed the incidence of 24 comorbidities and pregnancy risk factors identified using SMM surveillance to those identified in the EHR data using the JHU Atlas instance. Conditions and risk factors with less than 20% difference in prevalence between the two methods are deemed aligned, those 20-50% different are deemed moderately aligned, and those greater than 50% different are deemed not aligned.

RESULTS:
Prevalence for 11 health conditions and risk factors identified through SMM surveillance and EHR data structured with OMOP-CDM were closely aligned (Table 1). Both processes identified mental health conditions as occurring among more than one-third of patients experiencing SMM. Obesity was also noted at high rates through both processes (among 32.6% of the SMM cohort identified through OMOP and 39% of patients with SMM identified through surveillance).

Other conditions that were closely aligned included prior cesarean delivery, hypertensive disorders of pregnancy, asthma, chronic hypertension, hypothyroidism, sexually transmitted infections, fibroids, and sickle cell. Conditions that were moderately aligned included anemia, gestational diabetes, substance use, preexisting diabetes, twin or higher order pregnancy, and lupus. Conversely, conditions that were not aligned included renal conditions, elderly primigravida, prior preterm delivery, placental complications, and cardiovascular conditions.

CONCLUSIONS:
Comorbidities and pregnancy risk factors identified through SMM surveillance using manual chart abstraction and EHR data structured with OMOP-CDM were similar, particularly for the most prevalent conditions. However, large differences in prevalence were noted for five conditions and risk factors examined. These differences may be because different definitions were used to characterize the SMM cohorts in surveillance data versus EHR, and different time periods were used to identify risk factors. SMM surveillance data abstractors were instructed to note any relevant medical conditions, with no limit on the timeframe, including data found in provider notes and flowsheets, while the EHR only included conditions coded using standardized vocabularies (SNOMED, ICD10-

PCS, and CPT4). Importantly, temporality of some conditions (i.e. before SMM event) may not have been considered or captured in the EHR data, speaking to the value of surveillance for key adverse clinical events such as SMM – for example, some conditions identified as risk factors may be outcomes of the SMM itself. This is likely the case for anemia and renal conditions, which were both noted at higher rates through the EHR than through manual chart abstraction for SMM surveillance, and are typical complications associated with many conditions that cause SMM such as obstetric hemorrhage.

This analysis demonstrates the utility of using EHR data structured with the OMOP-CDM for identifying conditions, particularly rare conditions, that may be risk factors for SMM. Thorough and systematic dentification of these conditions is critical for developing strategies to prevent SMM and for quality improvement initiatives in maternal health.

Table 1. Prevenance of comorbidities and risk factors identified among patients with SMM

	OMOP (n=1,014)	SMM Surveillance (n=205)	Alignment
Mental health conditions	35.8	36.6	Close
Anxiety	22.1	22.0	Close
Depression	15.2	20.0	Moderate
Bipolar disorder	2.5	2.0	Moderate
Obesity	32.6	39.0	Close
Prior cesarean	22.8	30.7	Close
HDP	18.8	21.5	Close
Asthma	17.2	17.1	Close
Chronic hypertension	14.7	17.1	Close
Hypothyroidism	6.7	5.9	Close
Sexually transmitted infections	6.7	5.9	Close
Fibroids	6.5	6.8	Close
Sickle cell	4.9	4.9	Close
Anemia	29.7	22.0	Moderate
Gestational diabetes	12.0	8.8	Moderate
Substance use	9.9	16.1	Moderate
Preexisting diabetes	5.0	7.8	Moderate
Twins or higher order	4.7	3.4	Moderate
Lupus	2.0	1.5	Moderate
Renal conditions	15.3	1.5	Not aligned
Elderly primigravida	10.5	5.9	Not aligned
Prior preterm delivery	4.6	15.1	Not aligned
Placental complication	2.1	25.4	Not aligned
CVD	1.2	10.7	Not aligned

Note: HDP, Hypertensive disorders of pregnancy; CVD, Cardiovascular disease

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