Severe Maternal Morbidity, New York City 2008-2012

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BACKGROUND
Maternal Mortality in the U.S.

Why is the maternal mortality rate going up in the United States?

MHTF Blog
Maternal Health and Rights in the United States: Inequity in the Land of Plenty

Rewire
The U.S. Is The Only Developed Nation With A Rising Maternal Mortality Rate

Maternal Mortality Down Worldwide, Except in United States
New data shows there has been a 44 percent decrease in the maternal mortality rate worldwide over the last 25 years
“Tip of the iceberg”

Maternal Deaths
Near Miss
Severe Maternal Morbidity
Morbidity
Severe Maternal Morbidity

- Life-threatening complications during delivery
- Increasing interest given lack of progress in reducing maternal deaths
- Challenge to define and measure

Figure 1. Continuum of Maternal Morbidity Showing Variation in Severity
Enhanced Surveillance on Maternal Mortality

• The NYC DOHMH has conducted enhanced surveillance of pregnancy-associated mortality in NYC from 2001-2010

• Most recent report showed:
  – Rate decreased
  – 12 to 1 disparity between Black and White non-Hispanic women
Rationale for SMM Surveillance

• Opportunity to better explore risk factors to inform interventions by community

• First step towards informing health equity

• Estimate burden of SMM in NYC
  – Disparities by race, ethnicity, nativity, neighborhood
  – Non-Hispanic black women 2x more likely to have SMM

• Data can help mobilize people and resources to collectively improve health
Rationale for Cost Analysis

• Little is known about the economic impact of SMM on health care system
  – Childbirth one of the most frequent and expensive reasons to be hospitalized.
  – SMM, though rare, likely increases need for services and hospital stay
SMM Surveillance Project

• Two-year grant from Merck for Mothers
• Project Objectives:
  1. Define and assess the occurrence of SMM in NYC;
  2. Disseminate a final report and other communications to stakeholders to inform program and policy initiatives;
  3. Estimate the direct medical costs of SMM hospitalizations
PROCESS
NYC Process

• Reviewed literature
• Finalized data agreements and access
• Conducted outreach to key players and stakeholders
  – Including: CBO’s, Federal and State agencies, Academic partners, Advocacy groups, etc.
  – Clinical input on algorithm and conditions of interest
• Prepared data and documentation, checking quality across time and facilities
SMM Identification


• 25 ‘indicators’ of SMM
  – Based on literature and expert review of codes associated with maternal mortality
  – Reflect life threatening conditions and management
  – Identified based on ICD-9-CM codes
    • 18 Diagnoses and 7 Procedures
Validation

• Tested adding / removing indicators
  – Clinical experts didn’t think it was necessary
  – Minimal benefit in terms of cases, limited comparability

• Confirmation from Main et al (2015)
  – 77% Sensitivity; 86% once you add in prolonged length of stay requirement
Analysis

• **SMM**: Presented SMM rates over time and by maternal, clinical, geographic characteristics

• **Cost**: Estimated costs using established methodology from Healthcare Cost and Utilization Project (HCUP) at AHRQ

• Created multivariable model to estimate mean SMM cost controlling for other drivers (e.g. demographic, clinical and hospital-level factors)
  – All costs were adjusted for inflation to 2012 costs
Population and data

• Live deliveries in NYC facilities
  – Approximately 125,000 births year
  – Diverse population
  – 41 facilities with high level of care

• 2008-2012 hospital discharge data matched with birth certificates
  – Birth data improves sampling and demographic information
  – Discharge data provides clinical, hospital, and billing information
FINDINGS
SMM affects 2500 women a year, increased from 2008-2012, and is 1.6x national averages

Figure 3. Severe Maternal Morbidity Rate per 10,000 Deliveries and Number of Cases, New York City, 2008–2012

Leading SMM Diagnoses

Figure 5. Leading Diagnosis-Based Indicators of Severe Maternal Morbidity, New York City, 2008–2012

- Complications of surgery or medical procedures: 19.7
- Disseminated intravascular coagulation: 17.1
- Adult respiratory distress syndrome: 6.6
- Acute renal failure: 6.5
- Eclampsia: 4.3

Leading SMM Procedures

Figure 6. Leading Procedure-Based Indicators of Severe Maternal Morbidity, New York City, 2008–2012

- Blood transfusion: 176.5
- Hysterectomy: 12.5
- Ventilation: 11.4
- Operations on the heart and pericardium: 6.4

Rate per 10,000 deliveries

SMM rates were highest among women less than 20 or over 40 years of age.

Figure 8. Severe Maternal Morbidity by Maternal Age, New York City, 2008–2012

Black non-Latina women were 3x as likely to have SMM as White non-Latina women.

Black Non-Latina women bear a disproportionate burden of SMM relative to live births.

Figure 11. Distribution of Live Births and Severe Maternal Morbidity Cases by Race/Ethnicity, New York City, 2008–2012

Caribbean, Mexican / Central American, and African born women had higher SMM rates than US-born women.

Figure 12. Severe Maternal Morbidity by Maternal Region of Birth,*
New York City, 2008–2012

<table>
<thead>
<tr>
<th>Region of birth</th>
<th>Rate per 10,000 live births</th>
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</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>229.8</td>
</tr>
<tr>
<td>Mexico and Central America</td>
<td>288.7</td>
</tr>
<tr>
<td>Caribbean</td>
<td>315.7</td>
</tr>
<tr>
<td>South America</td>
<td>232.1</td>
</tr>
<tr>
<td>Europe</td>
<td>119.9</td>
</tr>
<tr>
<td>Africa</td>
<td>282.3</td>
</tr>
<tr>
<td>Middle East</td>
<td>149.7</td>
</tr>
<tr>
<td>Asia</td>
<td>163.0</td>
</tr>
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</table>

* Region of birth based on the mother’s reported country of birth. Australian Region and Canada were excluded because of small numbers.

College educated Black non-Latina women had higher SMM rates than women of other race/ethnicities with less than a high school education.

Figure 13. Severe Maternal Morbidity by Educational Attainment, New York City, 2008–2012

Specific communities in Brooklyn and the Bronx had the highest rates of SMM.

While higher poverty was associated with higher SMM, Black NH women in low poverty had higher rates than all other racial/ethnic groups living in high poverty areas.

SMM rates increased as pre-pregnancy BMI increased

Figure 23. Severe Maternal Morbidity by Pre-Pregnancy Body Mass Index and Race/Ethnicity, New York City, 2008–2012

Women with any chronic condition were 3x as likely to have SMM

Cesarean deliveries accounted for nearly 67% of SMM cases.

Women who delivered at Level 3 and 4 hospitals had highest SMM rates

Figure 22. Severe Maternal Morbidity by Level of Care,* New York City, 2008–2012

The average cost of the delivery hospitalization increased with the number of SMM indicators.

Figure 25. Estimated Delivery Cost by Number of Severe Maternal Morbidity Indicators, New York City, 2008–2012

SMM deliveries cost 2xs more than other deliveries, even after adjusting for other drivers of cost

Figure 26. Estimated Delivery Cost With and Without Severe Maternal Morbidity, Adjusting for Other Factors,* New York City, 2008–2012

*Adjusted for maternal age, race/ethnicity, payer, method of delivery, plurality and comorbidity and clustered by hospital. The total sample for the adjusted analysis was 582,006 (excludes missing observations).

RECAP
Severe maternal morbidity affects approximately 2,500 women each year in New York City.

*Severe maternal morbidity is a life-threatening complication during delivery.*
Severe maternal morbidity* increased 28% from 2008 to 2012 in New York City.

2012

2008

2,374 CASES

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Black women are much more likely to experience severe maternal morbidity* than White women.

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SMM CASES PER 10,000 DELIVERIES
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*Severe maternal morbidity is a life-threatening complication during delivery.
The average cost of a hospital birth with severe maternal morbidity* is **NEARLY DOUBLE** that of hospital births without severe maternal morbidity.

*Severe maternal morbidity is a life-threatening complication during delivery.
Having a chronic condition **greatly increases** the risk of severe maternal morbidity. *

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<tr>
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<td>628</td>
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**CHRONIC CONDITION = 3X AS LIKELY TO HAVE SMM**

*Severe maternal morbidity is a life-threatening complication during delivery.*
Low-income neighborhoods had the highest severe maternal morbidity* rates compared to high-income neighborhoods.

SMM RATE PER 10,000 DELIVERIES

HIGH-INCOME NEIGHBORHOODS

- GREENWICH VILLAGE/SOHO: 115
- BATTERY PARK/TRIBECA: 118

LOW-INCOME NEIGHBORHOODS

- BROWNSVILLE: 497
- EAST NEW YORK: 404
- EAST FLATBUSH: 480

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NEXT STEPS AND LESSONS LEARNED
Report Recommendations

• Implement interventions that improve women’s overall health
• Focus on reducing SMM among populations with highest rates
• Explore savings of specific SMM interventions.
• Evaluate SMM trends
• Share population-level data with health care providers to improve their understanding of factors that contribute to health inequities
• Research modifiable contributors to poor health and poor pregnancy outcomes
Dissemination Activities

• Hosted on agency website
• Press release
• Traditional news media
• Electronic distribution to internal and external partners and listservs
• Conferences, webinars and meetings
  – Clinical Meeting
  – Neighborhood Dialogues
Agency’s Response

• Continuing maternal mortality and morbidity surveillance
• Creation of the Women’s Health Suites in the Neighborhood Health Action Centers to promote women’s health and maternal wellbeing
• Commitment to reducing health inequity
• Continued implementation of programs aimed to address chronic disease
• Improving women’s health throughout her life course
  – Supporting access to quality family planning services
  – Nurse Family Partnership
  – Healthy Start Brooklyn
Advantages of SMM Surveillance

• Broadens picture beyond death, greater sample for analysis, intervention, and advocacy

• Standard methodology across US allows comparison
Challenges

- SMM evolving concept
- Securing data and understanding coding practices
- Further research/investigation into the drivers of the disparities, particularly around the social determinants of health, needed
- Time for cost analysis needed; lack of good methods to look beyond hospital costs
- Managing project deliverables against competing public health emergencies
THANK YOU
MISCELLANEOUS SLIDES
Successes

• Built relationships with academic, clinical, and community partners
• Outreached to over 60 community-based organizations, researchers, clinicians and stakeholders
• Created analytical dataset of birth and hospital discharge data and successfully applied CDC algorithm
• Participated in national SMM conversation, including recent efforts to revise the algorithm and translate codes into ICD-10
• Contributed to development of SAS macro for calculating SMM, used by HRSA
• Developed cost estimation method that is being tested across Health Department for other analyses
• Invited to review quality of existing SMM indicators and transition to ICD-10 codes
Successes (continued)

• Re-invigorated and informed work around maternal health (e.g. Women’s Health Suites)
• Focused on equity and persistent disparity across known risk factors
• Produced city’s first SMM surveillance report
• Disseminated the report via community gatherings, meetings, webinars, conferences, press, partner listservs and newsletters
• Cornerstone of the Birth Equity Initiative
Project Resources

• Dedicated funding

• Staffing
  – Principal investigator
  – Clinical advisor
  – Project director and two data analysts

• Agency commitment and support
  – Housed within the Bureau of Maternal, Infant and Reproductive Health
  – Ongoing enhanced surveillance of pregnancy-associated mortality
Unanswered questions

• Women’s perspective on experience and drivers?
• Why the disparity?
• What are the long term impacts? Impact on future pregnancies?
• Broader societal costs associated with an SMM? Long term medical costs?
<table>
<thead>
<tr>
<th>Maternal morbidity</th>
<th>ICD -9- CM Codes</th>
<th>Diagnosis code</th>
<th>Procedure code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Acute renal failure</td>
<td>584, 669.3</td>
<td></td>
<td></td>
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<tr>
<td>2. Cardiac arrest/ventricular fibrillation</td>
<td>427.41, 427.42, 427.5</td>
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<tr>
<td>3. Heart failure during procedure or surgery</td>
<td>669.4x, 997.1</td>
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<td>4. Shock</td>
<td>669.1, 785.5x, 995.0, 995.4, 998.0</td>
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<tr>
<td>5. Sepsis</td>
<td>038.0-038.9, 995.91, 995.92</td>
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<td>6. Disseminated intravascular coagulation</td>
<td>286.6, 286.9, 666.3</td>
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<td></td>
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<tr>
<td>7. Amniotic fluid embolism</td>
<td>673.1</td>
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<tr>
<td>8. Thrombotic embolism</td>
<td>415.1x, 673.0, 673.2, 673.3, 673.8</td>
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<tr>
<td>9. Puerperal cerebrovascular disorders</td>
<td>430, 431, 432.x, 433.x, 434.x, 436, 437.x, 671.5, 674.0, 997.2, 999.2</td>
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<tr>
<td>10. Severe anesthesia complications</td>
<td>668.0, 668.1, 668.2</td>
<td></td>
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<tr>
<td>11. Pulmonary edema</td>
<td>428.1, 518.4</td>
<td></td>
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<tr>
<td>12. Adult respiratory distress syndrome</td>
<td>518.5, 518.81, 518.82, 518.84,799.1</td>
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<tr>
<td>13. Acute myocardial infarction</td>
<td>410.xx</td>
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<td>14. Eclampsia</td>
<td>642.6x</td>
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<td>15. Sickle cell anemia with crisis</td>
<td>282.62, 282.64, 282.69</td>
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<tr>
<td>17. Internal injuries of thorax, abdomen, and pelvis</td>
<td>860.xx—869.xx</td>
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<tr>
<td>18. Aneurysm</td>
<td>441.x</td>
<td></td>
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<tr>
<td>20. Hysterectomy</td>
<td>68.3-68.9</td>
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<td>21. Ventilation</td>
<td>93.90, 96.01-96.05, 96.7x</td>
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<td>22. Operations on heart and pericardium</td>
<td>35.xx, 36.xx, 37.xx, 39.xx</td>
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<td>23. Cardio monitoring</td>
<td>89.6x</td>
<td></td>
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<tr>
<td>24. Temporary tracheostomy</td>
<td>31.1</td>
<td></td>
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<tr>
<td>25. Conversion of cardiac rhythm</td>
<td>99.6x</td>
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Press Coverage (as of July 28, 2016)


• City Limits article: http://citylimits.org/2016/07/26/when-new-moms-get-sick-race-and-hospitals-matter/
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$9,357

$15,714

HOSPITAL BIRTHS WITH NO SMM  HOSPITAL BIRTHS WITH SMM

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