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Why Maternal Mortality matters?

- **Infant Mortality Rate (IMR)**: number of infant deaths per 1,000 live births

- **Maternal Mortality Ratio (MMR)**: number of maternal deaths per 100,000 live births

Maternal Mortality Study Group

Established in 1987 by:

- CDC’s Division of Reproductive Health
- American College of Obstetricians and Gynecologists (ACOG)
- State health departments
Case Definitions

Pregnancy-associated death = the death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of cause.

Pregnancy-related death = the death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by her pregnancy or its management, but not from accidental or incidental causes.

Not-pregnancy-related death = the death of a woman while pregnant or within 1 year of termination, due to a cause unrelated to pregnancy.

Michigan Maternal Mortality Background

Michigan Maternal Mortality Study (MMMS) Initiated in 1950 as a collaborative effort among:
- Michigan Department of Community Health,
- Committee on Maternal and Perinatal Health of the Michigan State Medical Society and
- Chairs of the Departments of Obstetrics and Gynecology of the Medical Schools in Michigan
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Currently: Michigan Maternal Mortality Surveillance (MMMS) is:
- Michigan Department of Community Health (MDCH)’s program
- Bureau of Epidemiology and Bureau of Family, Maternal and Child Health share the responsibilities
- Committee on Maternal and Perinatal Health of the Michigan State Medical Society - committed and strong partner

Maternal Mortality in Michigan 1987-1996 data

- Maternal Mortality Ratio (MMR) = 7.5 (pregnancy-related)
- Black / White ratio = 6.3*

Objectives

1. To update the existing 1990-1998 Michigan maternal mortality report
2. To understand the leading causes of maternal deaths: pregnancy and non-pregnancy related

Data sources

Cases identified and reported to MDCH by:
- Hospitals
- Medical examiners
- Office of Vital Statistics
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- Hospitals
- Medical examiners
- Office of Vital Statistics

New electronic maternal mortality linked file of 1999-2002 deaths was created in 2003: recently updated with 2003 data

Maternal mortality linked file

Death certificates of women of reproductive age (10 to 45 years) were linked to live births certificates

Added records:
- Maternal deaths for which pregnancies ended in a fetal death were identified from the hospital reporting to MDCH
- Pregnancy-related deaths not identified by previously mentioned sources, such as deaths due to ectopic or molar pregnancies, were identified by using ICD10 “O” codes from death certificates
## Results

### Maternal Mortality Cases

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal deaths with live births</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By time from delivery:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- within 42 days</td>
<td>61</td>
<td>49</td>
<td>61</td>
<td>60</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>(27.9%)</td>
<td>(26.2%)</td>
<td>(26.2%)</td>
<td>(21.7%)</td>
<td>(35.6%)</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>36</td>
<td>45</td>
<td>47</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>(72.1%)</td>
<td>(73.5%)</td>
<td>(73.8%)</td>
<td>(78.3%)</td>
<td>(64.4%)</td>
</tr>
<tr>
<td>Other cases with fetal deaths or identified by ICD 10 “O” codes</td>
<td>13</td>
<td>12</td>
<td>9</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(92.1%)</td>
<td>(90.9%)</td>
<td>(95.7%)</td>
<td>(78.3%)</td>
<td>(65.6%)</td>
</tr>
<tr>
<td>Total number of cases</td>
<td>74</td>
<td>61</td>
<td>70</td>
<td>66</td>
<td>69</td>
</tr>
<tr>
<td>MMR</td>
<td>55.4</td>
<td>45.7</td>
<td>51.4</td>
<td>49.5</td>
<td>52.8</td>
</tr>
</tbody>
</table>
### Maternal Mortality by Race

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>White</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of cases</td>
<td>50</td>
<td>34</td>
<td>41</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>MMR</td>
<td>47.7</td>
<td>32.3</td>
<td>38.9</td>
<td>34.0</td>
<td>36.3</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of cases</td>
<td>21</td>
<td>25</td>
<td>28</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>MMR</td>
<td>88.1</td>
<td>103.9</td>
<td>119.2</td>
<td>125.9</td>
<td>102.8</td>
</tr>
<tr>
<td><strong>Black/White Ratio</strong></td>
<td>1.8</td>
<td>3.2</td>
<td>3.1</td>
<td>3.7</td>
<td>2.8</td>
</tr>
</tbody>
</table>


### Maternal Mortality by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
<th>MMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20 years</td>
<td>25</td>
<td>37.0</td>
</tr>
<tr>
<td>20-29 years</td>
<td>151</td>
<td>43.4</td>
</tr>
<tr>
<td>30-39 years</td>
<td>138</td>
<td>59.1</td>
</tr>
<tr>
<td>40+ years</td>
<td>21</td>
<td>150.6</td>
</tr>
</tbody>
</table>

5 cases with unk age.
Maternal Mortality by ICD10 Codes

58 cases with “O” ICD10 code (pregnancy-related codes):
- 32 White / MMR = 6.2
- 24 Black / MMR = 20.7
\{ Black/White Ratio = 3.3 \}

282 cases with other ICD10 codes (pre-existing medical conditions, accidents, intentional self harm, assaults):
- 165 White / MMR = 31.8
- 101 Black / MMR = 87
\{ Black/White Ratio = 2.7 \}


1. Motor vehicle accidents: 15.9%
2. Cardiac diseases: 10.6%
3. Assaults: 10.3%
4. Malignant neoplasm: 9.4%
5. Obstetric acute complications (e.g. shock, amniotic embolism): 4.7%
6. Intentional self-harm: 4.4%
7. Mental and behavioral disorders (drug overdose): 3.2%
8. Hypertension during pregnancy (all stages): 3.2%
9. Accidental poisoning: 3.2%
10. Intracerebral hemorrhage: 2.6%
11. Cardiomiopathy in puerperium: 2.3%
12. Asthma: 2.3%

72.3% of all cases
Most prevalent causes by interval from delivery 1999-2003 data

0-42 days:
1. Intracerebral hemorrhage: 16.3%
2. Cardiac diseases: 11.3%
3. Hypertension during pregnancy: 10%

43-365 days:
1. Motor vehicle accident: 22.4%
2. Malignant neoplasm: 13.3%
3. Assaults: 12.4%

Pregnancy outcomes associated with maternal deaths by race 1999-2003 data

<table>
<thead>
<tr>
<th></th>
<th>Very preterm (&lt;32 wks)</th>
<th>Moderate Preterm (32-36 wks)</th>
<th>Total preterm (&lt;37 wks)</th>
<th>Term (37+ wks)</th>
<th>Other / unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>White</strong></td>
<td>7 (3.5%)</td>
<td>26 (13.2%)</td>
<td>33 (16.8%)</td>
<td>113 (57.4%)</td>
<td>51 (25.9%)</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td>7 (5.6%)</td>
<td>15 (12%)</td>
<td>22 (17.6%)</td>
<td>63 (50.4%)</td>
<td>40 (32%)</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15 (4.4%)</td>
<td>41 (12.1%)</td>
<td>56 (16.5%)</td>
<td>187 (55%)</td>
<td>97 (28.5%)</td>
</tr>
</tbody>
</table>
Impact on MMMS Reviewed process

Cases reported by different sources / Linked file

Sort cases and prepare materials for review

Non-Injury

Injury

MMMS Medical Review Committee
Recommendations for prevention strategies

MMMS Injury Committee
Recommendations for prevention strategies

Case review findings:
- entered in MMMS database
- summarized by Medical & Injury Committee Chairs

MMMS Interdisciplinary Committee
Translate Recommendations to actions

Analysis of MMMS data / Annual Report
**MMMS Strategies / Activities**

- Findings disseminated through publications, grand rounds, presentations
- New MMMS database is being tested
- Recommendations to be translated into actions
- Maternal morbidity is being further analyzed by using the Hospital Discharge data linked with live births
- Serious life-threatening complications of pregnancy are being further explored for potential monitoring systems

**Conclusions**

- Newly created maternal mortality file identified violent deaths as the leading cause
- Expanded and complex review of all maternal deaths
- MMMS database developed: source for further analysis of maternal deaths
**Strengths / Limitations**

- Linkage process: an effective method to identify and track cases in a state such as Michigan where maternal mortality reporting is not mandatory
- Missing information
- Misclassification of deaths causes
- Underestimated maternal deaths due to misclassification: lack of relation between a woman's pregnancy and her death

**Public Health Implications**

- An expanded maternal mortality surveillance is needed to:
  - assess the problems and better understand the maternal deaths causes
  - develop targeted prevention strategies that may have greater population impacts
- Ongoing assessment and evaluation of the surveillance process: key for improvement
Acknowledgments

- Members of both, Medical and Injury Committee
- MDCH staff

Thank You !!!

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