The Perinatal Periods of Risk Approach

Introduction & Phase 1 Analytic Methods

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2015 HRSA MCH EPI Course

PPOR was adapted from a Periods of Risk model developed by Dr. Brian McCarthy with the World Health Organization, and used in developing countries.

Initial Development by the PPOR Work Group
- CityMatCH / CDC
- Public Health Seattle- King County
- Boston Public Health Commission
- Hawaii State Department of Health

Advantages of the PPOR Approach
- Easy to understand and use.
- Makes full use of a small number of events.
- Identifies gaps and disparities.
- Helps communities target resources for prevention activities.
- Helps mobilize the community to action.
“PPOR” is about:

- Adding **new tools** to help solve very old problems
- Translating data into **action**
- **Changing** the way we do business

**6 Basic Stages:**
**Perinatal Periods of Risk Approach**

- **Stage 1:** Assure Analytic and Community Readiness
- **Stage 2:** Conduct Analytic Phases of PPOR
- **Stage 3:** Develop Strategic Actions for Targeted Prevention
- **Stage 4:** Strengthen Existing / Launch New Prevention Initiatives
- **Stage 5:** Monitor and Evaluate Approach
- **Stage 6:** Sustain Stakeholder Investment and Political Will

**Community Readiness**
*What does it mean?*

- Champions, Leadership and Adequately Trained Staff that:
  - Understands the feto-infant mortality problem
  - Understands the work plan
  - Commits to providing resources for the investigation
  - Commits to providing resources for community collaboration
  - Gives priority and champions the initiative
PPOR Analytic Readiness

What does it mean?

- Strong leadership agreement & support
- Adequately trained analytic staff
- Adequately trained communication staff
- Analysis team including program staff
- Sufficient staff hours
- Data access/quality
- Minimum number of events

Infant Mortality Definitions

**Traditional Infant Mortality Rate** “IMR,” is deaths before first birthday per thousand live births in the same year.

\[ \text{IMR} = \frac{\text{deaths} \times 1,000}{\text{births}} \]

This can be done for any subpopulation. For example, the White IMR would be white deaths before first birthday per thousand white live births in the same year.
Cohort Definitions

Ideally, we use a **BIRTH COHORT**. 
Counts births in one year, and watch those babies until they reach their first birthday (must wait until the end of the following year) to count all of the deaths that occur.

Often, we use a **DEATH COHORT**. 
Counts births in one year, and count all deaths in the same year. This is a timely and easy way to approximate the true mortality rate above.

Alaska Infant Mortality Rates, 1990-2012

What do PPOR analytic methods bring “to the table”
Importance of Fetal Deaths

One difference between PPOR and traditional analysis is that PPOR includes fetal deaths, an important part of the picture.

PPOR examines deaths in 2 major risk dimensions simultaneously:

- Age at death
- Weight at birth

Age Dimension Of PPOR Analysis
Birthweight Dimension of PPOR

- Very Low Birthweight = less than 1500 grams (3.3 pounds)
- Low Birthweight = less than 2500 grams (5.5 pounds)
A 7.5-pound baby weighs 3,400 grams

PPOR ANALYTIC METHODS
Analytic Preparation Steps

1. Acquire access to the three required vital records computer files
2. Prepare vital records files and required data elements
3. Assess data quality
4. Assess study sample size

Analytic Preparation Steps
1. Required Vital Records Files
   - Fetal death certificate files (24+ wks, 500+ grams)
   - Infant death certificate files (500+ grams)
   - Live birth certificate files (500 + grams)
   - Linked birth & infant death certificate files are needed to find birth information for the infants who died
   - Spontaneous and induced abortions are NOT included (although more of these event than above)
Analytic Preparation Steps
3. Assess Data Quality

- Serious bias can be introduced if >5-10% of births, deaths, and fetal deaths are missing key data items such as birthweight, age at death, and maternal characteristics.

- Imputation (educated guessing) can help when key data are missing. For example, if gestational age >=31 weeks we impute birthweight >=1500 grams.

Analytic Preparation Steps
4. Required Number of Deaths

- At least sixty deaths overall and at least ten deaths in each period of risk, for each population being studied.

- May combine up to 5 years to reach adequate number of deaths (no more, due to changes in medical practice).

- Phase 2 analyses require even more deaths.

What is PPOR Analysis?
Analytic Phases of PPOR

**Phase 1:** Identifies populations and periods of risk with the largest excess mortality.

**Phase 2:** Explains why the excess deaths occurred.

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**Feto-Infant Mortality Map**

- **Age at Death**
  - Birthweight
    - 500-1499 g
      - Fetal (24+ wks)
        - Neonatal
          - Post-neonatal
          - 1
          - 2
          - 3
        - 4
        - 5
        - 6
    - 1500+ g

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**PPOR Maps Fetal & Infant Deaths**

- **Age at Death**
  - Birthweight
    - 500-1499 g
      - Fetal Death
      - Neonatal
      - Maternal Health/Prematurity
      - Infant Health
    - 1500+ g
      - Maternal Care
      - Newborn Care
PPOR directs **ACTION**

- Maternal Health/Prematurity
  - Preconception Health
  - Health Behaviors
  - Perinatal Care
- Maternal Care
  - Prenatal Care High Risk Referral
  - Obstetric Care
- Newborn Care
  - Perinatal Management
  - Neonatal Care
  - Pediatric Surgery
- Infant Health
  - Sleep Position
  - Breast Feeding
  - Injury Prevention

**PPOR ANALYTIC METHODS**

**Phase 1 Steps**

1. Define study population
2. Restrict study population by birthweight and gestational age
3. Calculate numbers and rates for the feto-infant mortality map
4. Compare different time periods, subpopulations and geographic areas

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**Phase 1 Steps**

**1. Defining the Study Population**

- Include mothers who were target area residents at time of the baby’s birth.
- Define the baby’s race/ethnicity according to the mother’s.
- Include multiple gestations.
- Include congenital anomalies.
PPOR Map of Feto-Infant Deaths

Alaska, All Races
2007-2009

63 Maternal Health/ Prematurity
(35 fetal deaths, 62 live births)

Mature Mortality Rate = deaths x 1,000 ÷ births
= 63 deaths x 1000 ÷ 23,282
= 1.9

42 Newborn Care (live births)

103 Infant Health (live births)

265 feto-infant deaths
33,406 live births and fetal deaths

PPOR Map of Feto-Infant Mortality

Alaska, By Race, 2007-2009
(N=number of live births and fetal deaths)

White Fetal-Infant Rate = 5.2
(N=20,309)

1.5
1.1 0.9 1.6

Native Fetal-Infant Rate = 13.2
(N=8,590)

2.1
2.1 1.9 7.1

Maternal Health/ Prematurity

1.7 Maternal Care
1.3 Newborn Care
3.1 Infant Health

Calculating Feto-Infant Mortality Rate

Alaska, All Races
2007-2009

1.9 + 1.7 + 1.3 + 3.1
= 7.9

Period rates add up to overall rate (except for round-off error)
Feto-Infant Mortality Rates

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban White</td>
<td>6.2</td>
<td>4.9</td>
<td>5.0</td>
</tr>
<tr>
<td>Rural White</td>
<td>5.1</td>
<td>6.0</td>
<td>4.9</td>
</tr>
<tr>
<td>Urban Alaska Native</td>
<td>8.9</td>
<td>8.6</td>
<td>5.1</td>
</tr>
<tr>
<td>Rural Alaska Native</td>
<td>13.0</td>
<td>15.7</td>
<td>7.2</td>
</tr>
</tbody>
</table>

STOP HERE ANALYTIC EXERCISE
STOP AT EXCESS MORTALITY

PPOR ANALYTIC METHODS
Additional Phase 1 Steps:
the “Opportunity Gaps”

- Select reference population
- Calculate excess mortality rates and numbers of deaths
- Identify excess mortality gaps
PPOR defines Disparities by estimating the “Opportunity Gap”

- **ASK**: Which women/infants have the “best” outcomes?
- **ASSUME**: All infants can have similar “best” outcomes
- **CHOOSE**: A comparison group(s) (reference group) who already has achieved “best” outcomes
- **COMPARE**: Fetal-infant mortality rates in your target group with those of the comparison group(s)
- **CALCULATE**: Excess deaths (= target – comparison groups). This is your community’s “Opportunity Gap.”

Potential Reference Groups

Choose an easily defined optimal group
- At least 15% of the population
- At least 60 deaths
- Acceptable to the community

U.S. National Reference Group:
- 20 or more years of age
- 13 or more years of education
- Non-Hispanic white women

USA Reference Group 2003-2004

Defined by maternal characteristics
- 20 or more years of age
- 13 or more years of education
- Non-Hispanic white women
- Residents of the US at the time of baby’s birth

<table>
<thead>
<tr>
<th>Total Fetal-Infant Mortality Rate = 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
</tr>
<tr>
<td>1.3</td>
</tr>
<tr>
<td>0.9</td>
</tr>
<tr>
<td>0.8</td>
</tr>
</tbody>
</table>
### Calculating Excess Rates

**Overall population Alaska, 2007-2009**

<table>
<thead>
<tr>
<th>Urban County</th>
<th>Maternal Health/ Prematurity</th>
<th>Maternal Care</th>
<th>Newborn Care</th>
<th>Infant Health</th>
<th>Fetal-Infant Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>all</strong></td>
<td>1.9</td>
<td>1.7</td>
<td>1.3</td>
<td>3.1</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>USA Reference Group</strong></td>
<td><strong>Maternal Health/ Prematurity</strong></td>
<td><strong>Maternal Care</strong></td>
<td><strong>Newborn Care</strong></td>
<td><strong>Infant Health</strong></td>
<td><strong>Fetal-Infant Mortality</strong></td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>1.3</td>
<td>0.9</td>
<td>0.8</td>
<td>5.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Excess Mortality Rate</th>
<th>Maternal Health/ Prematurity</th>
<th>Maternal Care</th>
<th>Newborn Care</th>
<th>Infant Health</th>
<th>Fetal-Infant Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>By Subtraction</td>
<td>-0.1</td>
<td>0.5</td>
<td>0.3</td>
<td>2.3</td>
<td>2.9</td>
</tr>
</tbody>
</table>

### Feto-Infant Mortality Rates

**Racial/Ethnic subgroups of Alaska, 2007-2009**

<table>
<thead>
<tr>
<th>Racial Groups</th>
<th>Maternal Health/ Prematurity</th>
<th>Maternal Care</th>
<th>Newborn Care</th>
<th>Infant Health</th>
<th>Overall Feto-Infant Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>White</strong></td>
<td>1.5</td>
<td>1.1</td>
<td>0.9</td>
<td>1.6</td>
<td>5.2</td>
</tr>
<tr>
<td><strong>Native</strong></td>
<td>2.1</td>
<td>2.1</td>
<td>1.9</td>
<td>7.1</td>
<td>13.2</td>
</tr>
<tr>
<td><strong>External Reference Group</strong></td>
<td><strong>Maternal Health/ Prematurity</strong></td>
<td><strong>Maternal Care</strong></td>
<td><strong>Newborn Care</strong></td>
<td><strong>Infant Health</strong></td>
<td><strong>Overall Feto-Infant Mortality</strong></td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>1.3</td>
<td>0.9</td>
<td>0.8</td>
<td>5.0</td>
</tr>
</tbody>
</table>

### Excess Feto-Infant Mortality Rates

**Based on USA 2003-2004 reference group**

<table>
<thead>
<tr>
<th>Racial/Ethnic Groups</th>
<th>Maternal Health/ Prematurity</th>
<th>Maternal Care</th>
<th>Newborn Care</th>
<th>Infant Health</th>
<th>Feto-Infant Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>White</strong></td>
<td>-0.5</td>
<td>-0.1</td>
<td>0.0</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Native</strong></td>
<td>0.1</td>
<td>0.8</td>
<td>1.0</td>
<td>6.3</td>
<td>8.2</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>-0.1</td>
<td>0.5</td>
<td>0.3</td>
<td>2.3</td>
<td>2.9</td>
</tr>
</tbody>
</table>
### Calculating Excess Number of Deaths

#### From Fetal-Infant Mortality Rates

**using External Comparison Group**

Alaska, 2007-2009

<table>
<thead>
<tr>
<th>Racial/Ethnic Group</th>
<th>Excess Mortality Rate</th>
<th>Live Births and Fetal deaths</th>
<th>Multiply</th>
<th>Number of Excess Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>0.2</td>
<td>20,309</td>
<td>0.2x20,309 1,000</td>
<td>3</td>
</tr>
<tr>
<td>Native</td>
<td>8.2</td>
<td>8,590</td>
<td>8.2x8,590 1,000</td>
<td>70</td>
</tr>
<tr>
<td>Other/missing</td>
<td>5.4</td>
<td>4,507</td>
<td>5.4x4,507 1,000</td>
<td>24</td>
</tr>
<tr>
<td>All</td>
<td>2.9</td>
<td>33,406</td>
<td>2.9x33,406 1,000</td>
<td>98</td>
</tr>
</tbody>
</table>

### Alaska by Race

**Estimated Excess Number of Deaths by Race**

based on external comparison group 2003-2004

<table>
<thead>
<tr>
<th>Racial/Ethnic Groups</th>
<th>Maternal Health/ Prematurity</th>
<th>Maternal Care</th>
<th>Newborn Care</th>
<th>Infant Health</th>
<th>Feto-Infant Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>-10</td>
<td>-2</td>
<td>0</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>Native</td>
<td>1</td>
<td>7</td>
<td>8</td>
<td>54</td>
<td>70</td>
</tr>
<tr>
<td>Other/missing</td>
<td>5</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>All</td>
<td>-4</td>
<td>15</td>
<td>12</td>
<td>75</td>
<td>98</td>
</tr>
</tbody>
</table>

**Stop here for second half of analytic exercise**
Feto-Infant Mortality Rates in the Internal Comparison Group
(Best Outcomes in Alaska)
Alaska, 2007-2000

- Defined by maternal characteristics
  - 20 or more years of age
  - 13 or more years of education
  - White women
  - Residents of Alaska at time of baby’s birth

Total Fetal-Infant Deaths = 42

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**PPOR** is about impact and results:

- Builds data and epi *capacity*
- Promotes effective data use
- Strengthens essential partnerships
- Fosters integration with other key efforts
- Encourages evidence-based interventions
- Helps leverage resources
- Enables systems change for perinatal health

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**Perinatal Periods of Risk:**
For More Information:
www.citymatch.org
By looking at the numbers in a new way, we can finally understand fetal/infant mortality and its common causes. Only through understanding can we take steps to ensure every child gets a chance at life.