The Perinatal Periods of Risk Approach

Phase 2 Analytic Methods

CityMatCH Training
www.citymatch.org

Phase 1 is NOT enough. Phase 2 analyses are REQUIRED to determine which risk factors are most important in YOUR community

Phase 2 Overview

Steps of the Phase 2 Analysis Plan

1. Identify causal pathways or biologic mechanisms for excess mortality
2. Estimate prevalence of risk and preventive factors by type of mechanism
3. Estimate the impact of the risk and preventive factors.

PPOR Phase 2 Analysis Strategy

- Eliminate from consideration factors that are unlikely to be contributing
- Find and target KNOWN factors that are likely to be contributing

Maternal Health and Prematurity Period of Risk

Steps of the Phase 2 Analysis Plan

Step 1. “Causal pathway”

- What causes of death are contributing the most to excess mortality in this period of risk?
- Can “patterns” in mortality disparities help us understand the underlying mechanism for the excess mortality in this period of risk?
Step 1: Identify Causal Pathways or Biologic Mechanisms for Excess Mortality

Cause of VLBW fetal and infant deaths is
- Multifactorial
- Complex
- Inconsistent
- Varies by training

ICD-10 Cause of Death Codes are not very helpful

Maternal Health/Prematurity Period

A Tale of Two Cities

<table>
<thead>
<tr>
<th>Nonicu City</th>
<th>Tinybaby City</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 births</td>
<td>1,000 births</td>
</tr>
<tr>
<td>10 VLBW deaths</td>
<td>10 VLBW deaths</td>
</tr>
</tbody>
</table>

For both cities, the "Blue Box" mortality rate is 10 deaths per thousand live births.

HOW CAN WE HELP THESE CITIES?

What is the difference between these two cities . . . Let's take a closer look

<table>
<thead>
<tr>
<th>Nonicu City</th>
<th>Tinybaby City</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 births</td>
<td>1,000 births</td>
</tr>
<tr>
<td>10 VLBW births</td>
<td>100 VLBW births</td>
</tr>
<tr>
<td>10 VLBW deaths</td>
<td>10 VLBW deaths</td>
</tr>
</tbody>
</table>

We were missing an important fact. The number of VLBW births sets these two cities apart.

What does this difference mean?

<table>
<thead>
<tr>
<th>Nonicu City</th>
<th>Tinybaby City</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 VLBW births</td>
<td>100 VLBW births</td>
</tr>
<tr>
<td>10 VLBW deaths</td>
<td>10 VLBW deaths</td>
</tr>
</tbody>
</table>

The mortality rate for a baby born VLBW in Nonicu City is 100%

The mortality rate for a baby born VLBW in Tinybaby City is 10%

HOW CAN WE HELP THESE TWO CITIES?

Nonico City needs to improve survival rates for VLBW babies. “Birthweight specific mortality” is their problem. If the mortality rates specifically for the VLBW babies could be decreased, their overall infant mortality rate would improve.

Tinybaby City needs to reduce the number of VLBW babies. “Birthweight distribution” is their problem. If the birthweights were distributed so that more of the babies are born bigger, their overall infant mortality rate would improve.

Kitagawa’s formula tells us which city we resemble . . . and what we need to focus on

Birthweight Distribution: 7%
Birthweight Specific Mortality: 93%
Each cause has a list of risk factors.

**Birthweight Distribution (VLBW Births)**
- Smoking
- Prenatal care
- Race
- Maternal age
- Parity
- Multiple Preg.
- SES/Education
- Birth Interval
- Maternal HTN/Diabetes
- Etc.

**Birthweight-Specific Mortality**
- Gestational age
- Referral system
- Perinatal care
- NICU system
- Mat. complications
- Neonatal conditions
- Pay source
- Etc.

Kitagawa’s formula uses algebra to partition excess mortality into:

1. Birthweight distribution
2. Birthweight specific mortality

\[
\sum_{i} \left( \frac{(P_{i1} + P_{i2})}{2} \times (M_{in} - M_{2x}) \right) + \left( \frac{(M_{i1} + M_{2x})}{2} \times (P_{i1} - P_{2x}) \right)
\]

- An excel sheet at [www.citymatch.org](http://www.citymatch.org) will do these calculations for you, if you give it some local data.

**Kitagawa Worksheet Data Entry**

### Table 1: Target Population

<table>
<thead>
<tr>
<th>Birthweight</th>
<th>Omaha Nebraska</th>
<th>Number of Live Births</th>
<th>Number of Infant Deaths 24+ wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-499</td>
<td></td>
<td>39</td>
<td>37</td>
</tr>
<tr>
<td>500-749</td>
<td></td>
<td>55</td>
<td>36</td>
</tr>
<tr>
<td>750-999</td>
<td></td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>1,000-1,249</td>
<td></td>
<td>82</td>
<td>8</td>
</tr>
<tr>
<td>1,250-1,499</td>
<td></td>
<td>101</td>
<td>3</td>
</tr>
<tr>
<td>1,500-1,999</td>
<td></td>
<td>372</td>
<td>7</td>
</tr>
<tr>
<td>2,000-2,499</td>
<td></td>
<td>1,081</td>
<td>22</td>
</tr>
<tr>
<td>2,500+</td>
<td></td>
<td>21,438</td>
<td>62</td>
</tr>
</tbody>
</table>

**Urban Healthy Start PPOR Data 1997-1999**

<table>
<thead>
<tr>
<th>Urban Healthy Start Area</th>
<th>Reference</th>
<th>Opportunity Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.7</td>
<td>2.1</td>
<td>8.6</td>
</tr>
<tr>
<td>3.5</td>
<td>2.7</td>
<td>3.6</td>
</tr>
<tr>
<td>2.7</td>
<td>3.5</td>
<td>.85</td>
</tr>
<tr>
<td>3.8</td>
<td>.85</td>
<td>.61</td>
</tr>
<tr>
<td>.85</td>
<td>2.3</td>
<td>1.9</td>
</tr>
<tr>
<td>.61</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>20.8</td>
<td>4.4</td>
<td>15.8</td>
</tr>
</tbody>
</table>

**Urban Healthy Start Area 1997-1999, Kitagawa Partitioning of Excess Mortality in the MH/P Period of Risk**

- Birthweight Distribution 73%
- Birthweight Specific Mortality 27%
Maternal Health/Prematurity Period
Kitagawa Analysis (Birthweight under 1500 grams)
African Americans in Example City vs U.S. Reference Group

- Birthweight Distribution
- Birthweight Specific Mortality

Example City can focus on causes for “TOO MANY VLBW BIRTHS”

Birthweight Distribution (VLBW Births)
- Prenatal care
- Race
- Maternal age
- Parity
- STD/Bacterial Vag.
- Multiple Preg.
- SES/Education
- Birth Interval
- Maternal HTN/Diabetes
- ETC.

Birthweight Specific Mortality
- Gestational age
- Referral system
- Perinatal care
- NICU system
- Mat. complications
- Neonatal conditions
- Pay source
- ETC.

Maternal Health/Prematurity

Step 2: Analysis plan depends on result of Kitagawa.

Steps 2 and 3 proceed as in the infant health period (see Phase 2, Infant Health Period)

Women at highest risk of premature labor:

- Women who have had a previous preterm birth
- Women who are pregnant with twins, triplets or more
- Short cervical length or presence of fetal fibronectin in vaginal secretions can indicate higher risk

© 2011 March of Dimes Foundation. The March of Dimes is a non-profit organization recognized as tax-exempt under Internal Revenue Code section 501(c)(3).
Medical conditions
- Diabetes
- Infections (urinary, vaginal, STD, dental)
- High blood pressure and preeclampsia
- Clotting disorders (thrombophilia)
- Bleeding from the vagina
- Certain birth defects in the baby
- Being pregnant with a single fetus after in vitro
- Being underweight before pregnancy
- Obesity
- Less than 6 to 9 months from delivery to next conception

Demographic factors
- African-American women
- Women younger than 17 and older than 35
- Women who have a low income

Medical prevention
- The hormone progesterone (17P) is recommended by ACOG for women with previous preterm birth.
- Antibiotic treatment appears to help prolong pregnancy in women with premature rupture of the membranes.
- Cerclage may help reduce the risk of preterm delivery in some women
- Tocolytic drugs often delay delivery for about 48 hours

© 2011 March of Dimes Foundation. The March of Dimes is a non-profit organization recognized as tax-exempt under Internal Revenue Code section 501(c)(3).
I couldn’t take time off from work
I had no one to take care of my children
The doctor or my health plan would not start care earlier
I had no way to get to the clinic or doctor’s office
I had too many other things going on
I couldn’t get an appointment when you wanted one.
I didn’t want anyone to know I was pregnant
I didn’t have my Medicaid card
I didn’t have enough money or insurance to pay for your visits

Reasons for not getting PNC as early as wanted

Urban County Black, PRAMS

Maternal Health/Prematurity Period
Step 3: Estimate the impact of risk and preventive factors

◆ IS THE FACTOR MODIFIABLE?
◆ Community capacity, existing programs
◆ Funding, staffing
◆ Available evidence-based interventions

Maternal Health/Prematurity Period
Step 3: Estimate the impact of risk and preventive factors

Some analytic options:

Population Attributable Risk (& the adjusted PAR obtained using regression)
Regression (if the number of deaths and quality of data are sufficient) logistic or Poisson regression modeling

---

Adjusted Odds Ratio of characteristics associated with VLBW in Blacks

---

Maternal Health/Prematurity Period
Step 3: Estimate the impact of risk and preventive factors

Adjusted Odds-Ratio

Race/Ethnicity Risk Factors Adjusted Odds-Ratio
Whites/Non-Hispanics Plurality/Multiple Births 39.555
Mother’s weight gain 2.640
Mother’s education 1.430
Mother’s tobacco use 1.77

White Hispanics Plurality/Multiple Births 38.32
Birth weight gain 2.56
Inadequate Health care 0.613
Birth Mother’s Age 2.477

African-American Plurality/Multiple Births 21.674
Birth weight gain 2.345
Inadequate Health Care 0.700

---

PAF example using Alternative expression for PAF formula:

\[ PAF = \frac{P \cdot RR - 1}{1 + P \cdot RR - 1} \]

where

\[ P = \text{probability that risk factor is present, i.e. prevalence of risk factor} \]

\[ RR = \text{Risk Ratio} \]

\[ (\text{risk of bad outcome among high risk group divided by risk of bad outcome among low risk group}) \]

FOR ESTIMATION PURPOSES,
An adjusted RR from published research may be more appropriate than local risk data.
Smoking and Prematurity
Population Attributable Fraction

If the prevalence of heavy smokers among pregnant women (from PRAMS data) is 10%
\[ P = 0.10 \]

From the article \( \text{RR} \approx 2.9 \), so \( \text{RR} - 1 \approx 1.9 \)
\[ P \times (\text{RR} - 1) / (1 + P \times (\text{RR} - 1)) \]

Becomes approximately
\[ 0.10 \times 1.9 / (1 + 0.1 \times 1.9) = 0.157 \]

meaning that prematurity would decrease by approximately 16% if all heavy smokers could become nonsmokers.

Urban Healthy Start – Pop. Attributable Risk for VLBW

<table>
<thead>
<tr>
<th>Factor</th>
<th>PAR</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous Preterm Delivery</td>
<td>16.0%</td>
<td>136.9 (59.0-341.7)</td>
</tr>
<tr>
<td>Pregnancy Related Hypertension</td>
<td>11.8%</td>
<td>4.8 (3.1-7.3)</td>
</tr>
<tr>
<td>Inadequate PNC and Eclampsia or Hypertension (Chronic or pregnancy induced)</td>
<td>8.3%</td>
<td>3.7 (1.6-7.6)</td>
</tr>
<tr>
<td>Chronic Hypertension</td>
<td>6.7%</td>
<td>3.3 (1.5-6.5)</td>
</tr>
<tr>
<td>Med Risk Factors and Inadequate PNC</td>
<td>3.3%</td>
<td>2.5 (1.5-4.0)</td>
</tr>
<tr>
<td>High Parity</td>
<td>1.7%</td>
<td>1.8 (1.3-2.5)</td>
</tr>
<tr>
<td>Smoking</td>
<td>0.4%</td>
<td>1.2 (.79-1.7)</td>
</tr>
<tr>
<td>Inadequate PNC</td>
<td>0%</td>
<td>1.0 (.7-1.4)</td>
</tr>
</tbody>
</table>

Summary of Phase 2 Analysis

STEPS:
1. Identify causal pathways for excess mortality
2. Examine prevalence of risk and preventive factors
3. Estimate impact

STRATEGY:

Eliminate causes unlikely to be contributing

Target causes that are likely to be contributing most

Smoking and Prematurity

  Maternal smoking and causes of very preterm birth.
  Kyrklund-Blomberg NB, Granath F, Cnattingius S.
- In a case-control study on all very preterm births in two regions of Stockholm 1988-1992.
- Compared with non-smokers, adjusted ORs of very preterm birth among moderate smokers (1-9 cigarettes per day) and heavy smokers (> or =10 cigarettes per day) were 1.4 (95% CI 0.8-2.4) and 2.9 (95% CI 1.5-5.7), respectively.