



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



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.

Phase 2 Overview

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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?

Phase 2 Overview

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Maternal Health/Prematurity Period

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



A TALE OF TWO CITIES



NONICU CITY	TINYBABY CITY
1,000 births	1,000 births
10 VLBW deaths	10 VLBW deaths

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

NONICU CITY	TINYBABY CITY
1,000 births	1,000 births
10 VLBW births	100 VLBW births
10 VLBW deaths	10 VLBW deaths

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



WHAT DOES THIS DIFFERENCE MEAN ?

NONICU CITY	TINYBABY CITY
10 VLBW births	100 VLBW births
10 VLBW deaths	10 VLBW deaths
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%



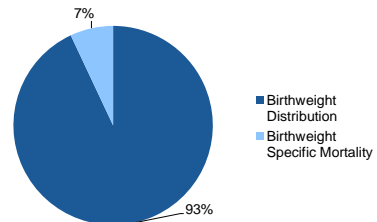
HOW CAN WE HELP THESE TWO CITIES?

NONICU 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





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

$$\sum_n \left(\left(\frac{(P_{1n} + P_{2n})}{2} \times (M_{1n} - M_{2n}) \right) + \left(\frac{(M_{1n} + M_{2n})}{2} \times (P_{1n} - P_{2n}) \right) \right)$$

- ◆ an excel sheet at www.citymatch.org will do these calculations for you, if you give it some local data



KITAGAWA WORKSHEET DATA ENTRY

Table 1: Target Population

Enter →	Urban County		
Omaha Nebraska	Number of Live Births	Number of Infant Deaths	Number of Fetal Deaths 24+ wks
Birthweight			
0-499	39	37	10
500-749	55	36	13
750-999	70	15	10
1,000-1,249	82	8	8
1,250-1,499	101	3	4
1,500-1,999	372	7	9
2,000-2,499	1,081	22	10
2,500+	21,438	62	29

Phase 2 MHP period

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- Go to Kitagawa Spreadsheet



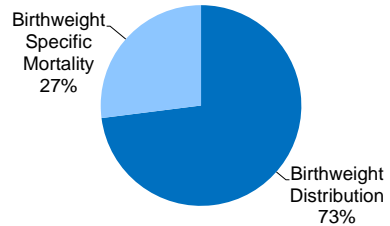
Urban Healthy Start PPOR Data 1997-1999

Urban Healthy Start Area		Reference		Opportunity Gap
10.7		2.1	=	8.6
3.8	2.7	3.6		
		.85	.85	.61
		2.3	1.9	3.0
20.8	-	4.4	=	15.8



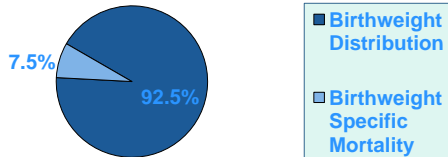
Urban Healthy Start Area 1997-1999,

Kitagawa Partitioning of Excess Mortality in the MH/P Period of Risk





Maternal Health/Prematurity Period
 Kitagawa Analysis (Birthweight under 1500 grams)
 African Americans in Example City vs
 U.S. Reference Group



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.

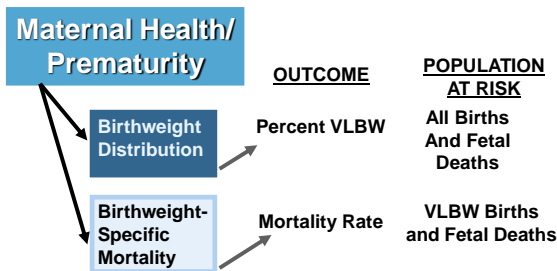
Birthweight- Specific Mortality

- ◆ 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).



Lifestyle factors

- Late or no prenatal care
- Smoking
- Drinking alcohol
- Using illegal drugs
- Exposure to the medication DES
- Domestic violence (physical, sexual or emotional abuse)
- Lack of social support
- Extremely high levels of stress
- Long working hours with long periods of standing
- Exposure to certain environmental pollutants



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

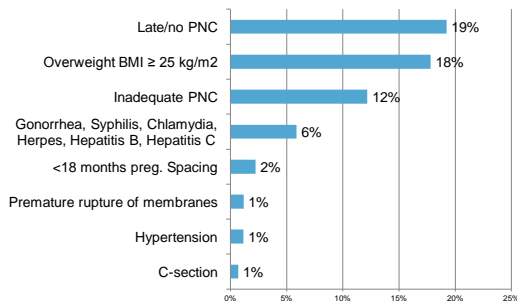


Medical prevention

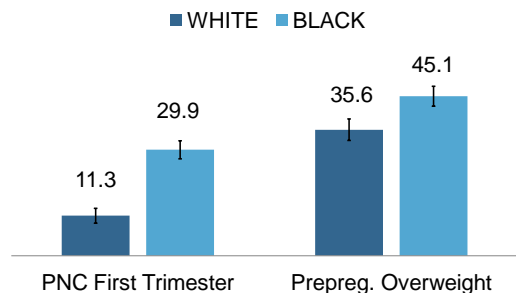
- The hormone progesterone (17P) is recommended by ACOG for women with previous preterm birth.
- Antibiotic treatment appears to help prolong pregnancy in women with premature rupture of the membranes.
- Cerclage may help reduce the risk of preterm delivery in some women
- Tocolytic drugs often delay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

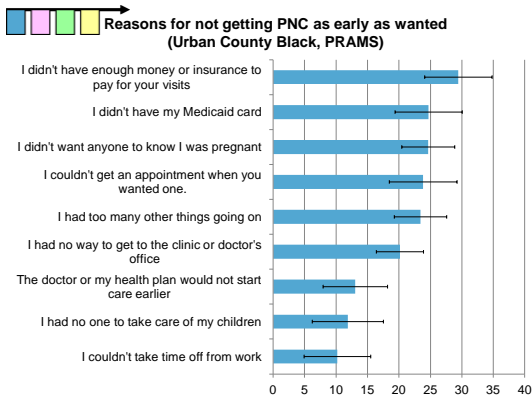


Black "Excess" Prevalence of Risk Factors Related to Prematurity
(Black minus Ref Group --Urban County Vital Records)



PRAMS Racial Disparities (Urban County)





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

Phase 2 Analysis

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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

Phase 2 Analysis

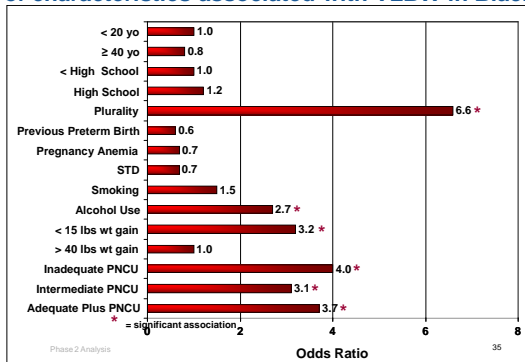
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STEP 3 EXAMPLE: ESTIMATING IMPACT USING REGRESSION ANALYSIS (STRATIFICATION BY RACE IS A GOOD STRATEGY)

Race/Ethnicity	Risk Factors	Adjusted Odds-Ratio
Whites/Non-Hispanics	Plurality/Multiple Births	39.555
	Birth 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	0.612
	Birth Mother's Age	2.477
African-American		
	Plurality/Multiple Births	21.874
	Birth weight gain	2.345
	Inadequate Health Care	0.700

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Adjusted Odds Ratio of characteristics associated with VLBW in Blacks



Phase 2 Analysis

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PAF example using Alternative expression for PAF formula:

$$=P^*(RR-1)/(1+P^*(RR-1))$$

where
P=probability that risk factor is present,
i.e. prevalence of risk factor

RR= Risk Ratio
(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%

$$P = .10$$

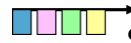
From the article $RR \sim 2.9$, so $RR-1 \sim 1.9$

$$P * (RR-1) / (1 + P * (RR-1))$$

Becomes approximately

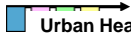
$$.10 * 1.9 / (1 + .1 * 1.9) = .157$$

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



Smoking and Prematurity

- [Acta Obstet Gynecol Scand](#). 2005 Jun;84(6):572-7. **Maternal smoking and causes of very preterm birth.** Kyrklund-Blomberg NB, Granath E, 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.



Urban Healthy Start – Pop. Attributable Risk for VLBW

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



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

Phase 2 Analysis

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