Statistical Brief

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Perinatal Periods of Risk (PPOR): A Useful Tool for Analyzing Fetal and Infant Mortality

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Introduction

Perinatal Periods of Risk (PPOR) analysis is an approach to investigating and monitoring causes of fetal and infant deaths. This conceptual tool, developed by Dr. Brian McCarthy at the Centers for Disease Control and Prevention (CDC), provides a framework for mapping fetal-infant mortality by birth weight and age at death.

Fetal deaths are stillbirths and infant deaths are deaths less than one year of age to babies born alive. The PPOR methodology includes only fetal deaths of 24 or more weeks gestation. Most states receive reports of fetal deaths only if they are 20 or more weeks gestation.

PPOR analysis is often carried out for a specific county or other local geographic area. Data on fetal and infant deaths can be used to mobilize communities by identifying areas to be targeted for investigation. By investigating the mortality numbers in detail, areas for further analysis can be identified. Given limited resources, this process can also help in prioritizing strategies for prevention efforts.

Improving fetal-infant mortality rates requires the involvement and mobilization of many sectors in the community. When the various partners have been involved at an early stage, they have more ownership and stake in the process. This also leads to the development of better understanding of the problem and can lead to successful consensus-building regarding possible solutions.

The purpose of this paper is to introduce health professionals in North Carolina to the PPOR methodology and to stimulate interest in the examination of additional regional and local data. We looked at statewide data for a three-year period, 2000-2002.

Results

Table 1 maps fetal-infant mortality by birth weight and age at death for 2000-2002. The overall infant mortality rate was 9.9 per 1,000 fetal deaths and live births. There are four major components that comprise this rate, namely deaths related to Maternal Health and Prematurity, Maternal Care, Newborn Care, and Infant Care. These components define broad areas where interventions to reduce fetal-infant mortality might be targeted. These components take into account both the time of death and weight at delivery.

Fetal deaths that are for 24 weeks or greater gestation and weighing 500-1,499 grams, along with the neonatal and postneonatal deaths that weigh 500-1,499 grams at delivery, constitute the Maternal Health and Prematurity subgroup. Neonatal deaths are infant deaths occurring at less than 28 days of age, and postneonatal deaths are infant deaths at 28-364 days of age. The fetal deaths with gestational age of 24 weeks or more and delivery weight more than 1,500 grams make up the Maternal Care

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Table 1: PPOR Data for 2000-2002: NC Statewide Data for Births and Fetal-Infant Deaths

(Rates per 1,000 are shown in parentheses)

Birth Weight	Fetal Deaths	Neonatal Deaths	Postneonatal Deaths	Total Deaths	Live Births
500-1,499 grams	550	818	178	***Maternal Health/ Prematurity*** 1,546 (4.3)	5,892
1,500+ grams	***Maternal Care*** 842 (2.4)	***Newborn Care*** 478 (1.3)	***Infant Health*** 666 (1.9)	1,986	348,741
Total	1,392	1,296	841	3,532 (9.9*)	356,025

*Rate is per 1,000 live births plus fetal deaths.

Table 2: PPOR Data for 2000-2002: Live Births and Fetal-Infant Deaths for Reference Group

(Rates per 1,000 are shown in parentheses)

Birth Weight	Fetal Deaths	Neonatal Deaths	Postneonatal Deaths	Total Deaths	Live Births
500-1,499 grams	91	161	32	***Maternal Health/ Prematurity*** 284 (2.3)	1,384
1,500+ grams	***Maternal Care*** 171 (1.4)	***Newborn Care*** 122 (1.0)	***Infant Health*** 104 (0.8)	397	121,242
Total	262	283	136	681 (5.5*)	122,626

*Rate is per 1,000 live births plus fetal deaths.

Table 3: PPOR Data for 2000-2002: Excess Fetal-Infant Deaths, North Carolina Statewide

	Actual Rate	Reference Group Rate	Excess Rate	# Excess Fetal-Infant Deaths
Overall Rate	9.9	5.5	4.4	1,567
Maternal Health Prematurity	4.3	2.3	2.0	712
Maternal Care	2.4	1.4	1.0	356
Newborn Care	1.3	1.0	0.3	107
Infant Health	1.9	0.8	1.1	392

Note: Fetal Deaths & Live Birth = 356,025

category. The neonatal and postneonatal deaths for live births over 1,500 grams birth weight make up the Newborn Care and Infant Health categories. The tables show the rate per 1,000 and the numbers of events in each category.

In the PPOR approach, we compare these death rates to the rates of a reference group. The reference group is made up of white, non-Hispanic women who have 13 years or more of education and who are 20 years or more in age. This reference group is selected because they currently constitute the population with the best birth outcomes. The reference group should represent at least 15 percent of the overall population to be used as a reference group. Table 2 shows the birth outcomes for our reference group.

By comparing the death rates between the reference group and the group under consideration, we can calculate the "excess deaths" in each of the four categories. Comparing the fetal-infant deaths in Table 1 to the reference group deaths in Table 2, we come up with the excess deaths in Table 3. The largest number of excess deaths for North Carolina as a whole during 2000-2002 was in the Maternal Health/Prematurity category. This suggests where intervention efforts should be concentrated. One important difference between the traditional approach of looking at the infant deaths and the PPOR methodology is that the PPOR approach uses the linked birth/infant death file so that all the information that is a part of the birth file can be used too, such as mother's age, mother's education, and birth weight.

Discussion

Fetal-infant mortality is an issue with many dimensions. The causes of death for very low birth weight babies are different than those for the other babies. Most of the very low birth weight deaths are related to prematurity; therefore all the fetal deaths and infant deaths in the 500-1,499 grams weight group are included in the Maternal Health and Prematurity category. The prevention efforts here need to be focused on maternal behaviors before and during pregnancy, such as pre-conceptional health, unintended pregnancy, smoking and drug abuse before and during pregnancy, and specialized perinatal care. Fetal, neonatal, and postneonatal deaths above 1,500 grams at delivery are usually due to different sets of causes; these deaths are included in the categories of Maternal Care, Newborn Care, and Infant Health respectively. There are different risk factors at different infant developmental stages. Therefore, by examining the mortality at different stages of development, one can tailor the interventions to that time period. Under Maternal Care one would look at perinatal care management. Early and continuous prenatal care, referral of high-risk pregnancies, and management of conditions such as diabetes, seizures, and high-risk obstetric care are important elements. For Newborn Care, the prevention and treatment of congenital anomalies and advanced neonatal care would be important. And for Infant Health, we would need to examine SIDS prevention (including sleep position education), breastfeeding promotion, and injury prevention.

Once the excess numbers of deaths have been delineated, one could look further at the relative contributions of birth weight-specific death rates and birth weight distribution. This is known as the Kitigawa analysis. Birth weight is the strongest predictor at birth of an infant's survival. The risk factors that cause low birth weight births and the risk factors that cause mortality at a particular birth weight may be different. Thus the interventions necessary to deal with these different risk factors will vary.

One could use different reference groups for a PPOR analysis. For example, a region-specific reference group, or a reference group for a race other than white, may be more appropriate for some analyses.

The PPOR data presented here are for the state of North Carolina as a whole. Most of the time PPOR analysis has been done for specific counties or subregions of a state. But there are some guidelines on the number of events needed for a meaningful analysis. In general, there should be at least 20 deaths in each of the four PPOR groups to promote statistically valid analyses. This means that the PPOR analysis could not be reliably done for a small county. Grouping counties or grouping years of data is recommended to come up with the needed minimum numbers of deaths. However, it is usually not desirable to group more than three years of data because important temporal trends may be masked if too many years are combined.

The PPOR methodology provides a user-friendly tool to map fetal-infant mortality by birth weight and age at death with the aim of reducing the overall fetal-infant mortality rate. It provides an opportunity to engage community partners early in the process, thereby facilitating consensus. The goal is to reduce fetal-infant mortality and to improve the overall health of infants and mothers. Once the mortality has been mapped and excess deaths identified, the next phase is to target interventions with the goal of making sustainable system changes.

For more information about PPOR, go to the CityMatCH web site : www.citymatch.org/PPOR/.

Reference

Perinatal Periods of Risk Approach: The U.S. Urban Experience. CityMatCH at the University of Nebraska Medical Center. www.citymatch.org/PPOR/.

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