

Perinatal Periods of Risk Model: An Examination of Infant Mortality Disparities in the Twin Cities 1990 – 1998

A joint project of the Minneapolis Department of Health and Family Support and the Saint Paul-Ramsey County Department of Public Health

I. Executive Summary

The Perinatal Periods of Risk (PPOR) is a method for examining infant and fetal deaths to help communities focus prevention strategies. This innovative strategy is being used widely by city and state health departments and Healthy Start programs around the country. It is supported by the Centers for Disease Control, the March of Dimes, the World Health Organization, and CityMatch (an organization specializing in urban maternal and child health issues).

The PPOR methodology provides new insight to infant and fetal deaths in two important ways. First, it includes fetal deaths, which is not a regular practice when examining infant deaths, yet is an important perinatal health indicator. Second, PPOR divides the overall fetal – infant death rate into four periods aimed at prevention: Maternal Health/Prematurity, Maternal Care, Newborn Care, and Infant Health. While traditional infant mortality assessment techniques use categories of neonatal and postneonatal deaths to get at potential prevention strategies, PPOR takes this to a more sophisticated level. Based on which periods have the highest rates for the population of interest, and highest excess rates when compared to a reference population (with the lowest death rates), communities can determine strategies and further investigation focused on those periods.

This report describes the results for Minneapolis and St. Paul with a specific focus on racial disparities. This project was done as an ongoing assessment activity for Twin Cities Healthy Start (TCHS). TCHS is an outreach and case management program aimed at reducing infant mortality and poor birth outcomes in Minneapolis and St. Paul among African American and American Indian women and their infants. The main finding is that the highest rates for all races in Minneapolis and St. Paul occur in the earliest and latest of the four prevention periods. Maternal Health/Prematurity is the first period, which includes infant and fetal deaths with birthweights less than 1500 grams. Prevention of deaths in this category would focus on the mother's health prior to pregnancy and early in pregnancy as well as factors related to premature birth. The Infant Health category includes postneonatal infant deaths with birthweights of at least 1500 grams. Prevention strategies for deaths occurring in this category would focus on factors related to the infant's health after the first month (this may include some causes of death that were conditions acquired in the perinatal period).

The two periods with the highest death rates are those which are influenced the most by social and behavioral risk factors whereas the categories with the lowest rates seem to be when the mother and newborn has the most interaction with the medical system. This indicates that the excess infant and fetal deaths in Minneapolis and St. Paul might best be prevented through comprehensive case management of social and behavioral risks as well as interventions targeting women prior to pregnancy. Recommendations include systems level changes for a variety of agencies involved in the perinatal health system.

As with previous infant mortality findings about the Twin Cities, these findings are more pronounced for African American and American Indians. In addition, this report

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Abbey Sidebottom, Minneapolis Department of Health and Family Support, 612 673-3931
Sharon Borg, Saint Paul – Ramsey County Department of Public Health, 651 266 2435
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examines some differences in trends in African American mortality rates in Minneapolis compared to St. Paul.

II. What is the Perinatal Periods of Risk (PPOR) methodology?

PPOR categorizes deaths by age at death and birthweight (Figure 1) into four prevention clusters: Maternal Health/Prematurity, Maternal Care, Newborn Care, and Infant Health. These terms reflect the area where primary prevention efforts would be most effective for deaths occurring during those categories.

Figure 1: Perinatal Periods of Risk Categories

| | Fetal deaths ≥ 24 weeks | Neonatal infant deaths 1-27 days | Post neonatal infant deaths 28 –365 days |
|------------|-------------------------------------|--|--|
| 500-1400 g | Maternal Health/ Prematurity | | |
| 1500 + g | Maternal Care | Newborn Care | Infant Health |

CityMatch recommends having at least 60 cases per sub group examined before rates are used. Thus certain population groups we would like to examine are omitted. A few groups with fewer than 60 cases are included in this report (the number of cases is indicated on the tables). Live births with birthweights less than 500 grams and fetal deaths occurring before 24 weeks are excluded from the analysis. This is done to improve the quality of the data being used.

This type of analysis is unique because it combines two key dimensions of infant mortality: age at death and birthweight. Frequently these two are examined separately. Age at death is a traditional way to divide infant deaths into neonatal and postneonatal categories potentially associated with different causes of death (endogenous and exogenous causes respectively). However with advances in perinatal care, the relationship between the age at death and the two general categories of cause is not as accurate. Birthweight is the strongest predictor at birth of a child’s survival. So by adding birthweight with age the PPOR creates more focused periods of risk. This approach is also unique because it combines fetal deaths with infant deaths to get a more comprehensive picture of poor birth outcomes and maternal health.

It is important to note that the PPOR uses linked birth and death data sets. This is the “gold standard” method of infant mortality rate calculations. This method tracks a group of infants born in a particular year (birth cohort) to see if they die within the next 12 months. This method means the data available for analysis is often several years old. To

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get more recent estimates, health departments will often calculate infant mortality by using aggregate births and deaths from the same calendar year (without linking the deaths to an actual birth). The two methods may provide different results.

“Opportunity Gaps” are an important part of the PPOR methodology. These are measures of the potential for reduction in infant and fetal deaths in the community, or an estimate of “preventable deaths”. The opportunity gaps are calculated with the simple formula: target population rate – the reference group rate = excess mortality rate. These are calculated for each of the periods. Recommendations can then target periods of risk that contribute the most to the “opportunity gaps”. The reference group reflects the characteristics associated with the best outcomes. CityMatch recommends using white women over age 20 with a high level of education (13+ years) because they tend to have the best birth outcomes as a group.

After determining the periods of risk that contribute most to the “opportunity gaps” more detailed examinations of deaths in those periods can be conducted. In this analysis we chose to look at the cause of death to help focus potential prevention strategies and to examine the differing trends found for African American infants in the two cities.

III. What do we already know about infant mortality in the Twin Cities?

- Infant Mortality and related determinants and contributing factors (such as low birthweight, births to teens, lack of early prenatal care) are worse in Minneapolis and St. Paul than the state overall.
- Minneapolis and St. Paul have large racial disparities for IMR and other indicators between African Americans and American Indians, compared to whites. In general, pregnant American Indian and African American women in Minneapolis and St. Paul are less likely to receive early or adequate prenatal care, are more likely to give birth to a low birthweight infant and/or a premature infant, than white women.
- American Indian and African American women are over twice as likely to be single mothers.
- American Indian infants are more likely to die in the postneonatal period (28- 365 days) compared to the neonatal period. Unfortunately both periods have been higher among American Indians than other races for many years. However, recent estimate data from 1999 and 2000 indicates a large decrease in American Indian infant mortality for both periods.
- African American infants are more likely to die in the neonatal period (day 1 to 27) compared to the postneonatal period.
- There has been a slight increase since 1994 in the proportion of African American and American Indian women receiving prenatal care in the first trimester but there are still large gaps between these two races and white women.
- Racial disparities are also quite wide for STI’s with the highest rates among African American adolescents.

- TCHS conducted two separate assessments to examine attitudes and experiences with prenatal care for African American and American Indian women in the Twin Cities. These studies found that among women who do not receive prenatal care, some reasons include feelings of discrimination or judgement from medical providers (either experienced themselves or stories they have heard from others), and being scared to go due to drug or alcohol problem. Women who did have good experiences in prenatal care said it was often because they had a relationship with the physician prior to the pregnancy, and/ or the physician was culturally/ racially similar to them and/ or female.
- Project LID, a case review of infant deaths in Hennepin and Ramsey counties found a high prevalence of a number of contributing risk factors. Fifteen percent of the mothers in our study experienced domestic violence either during pregnancy or during the life of the child, 11% experienced homelessness, and 27% used tobacco, alcohol or drugs. Generally, many of the Project LID mothers were women who were lacking a social support system. These cases gave prime examples of the need for outreach and care coordination to help women address both their social and medical risk factors.

IV. What does the PPOR indicate for Minneapolis and St. Paul?

Figure 2 illustrates the PPOR results for Minneapolis and St. Paul for racial groups and reference population for 1990-1998 (table in appendix 1 contains same data as well as overall fetal-infant rates). Generally the fetal-infant morality rates are highest among American Indian and African American infants with Hispanics having the third highest rates. The rates of Asian/Pacific Islanders are very similar to those of whites. White teens have higher rates compared to older white women. However, African American teens have lower rates compared to women age 20 or older.

When racial groups are compared to the reference population for opportunity gaps, the rate of fetal-infant mortality among African Americans is nearly 2 ½ times higher than that of the reference population. The American Indian fetal-infant morality is over 3 times higher than the reference population. The two periods that contributed most to the total excess deaths are the Infant Health and Maternal Health/Prematurity periods.

Nearly all population groups examined show Infant Health as the primary period contributing to the excess rates over the reference population (Table 1). The amount of contribution of the Infant Health period to total excess deaths ranged from 37% to 78% with the highest being among African American teens. Figure 2 illustrates that the rate for the Infant Health period is far higher among American Indians than any other race. With a rate of 9.68 for this period, American Indians have an excess of slightly over 8 deaths per 1,000 live births (excess rate of 8.11) just in this one period. This period accounts for 59% of the excess deaths among American Indians in the Twin Cities.

Maternal Health/ Prematurity is generally the second highest contributing area to the excess death rate with the amount of contribution to the excess rate ranging from 22% to 43%. For African Americans this area ranks first, contributing 43% to their excess deaths. In fact, for African Americans the top two periods contribute about the same to their excess death rate with the Infant Health period accounting for 42%.

Table 1: Top contributors to excess rates in Minneapolis and St. Paul

| | First ranked prevention area with percent contribution to excess rate | Second ranked prevention area with percent contribution to excess |
|-------------------------|--|--|
| All Races | Infant Health (41%) | Maternal Health/Prematurity (35%) |
| Teens of all races | Infant Health (59%) | Maternal Health/Prematurity(37%) |
| Whites | Infant Health (37%) | Maternal Health/ Prematurity (27%) |
| White teens | Infant Health (60%) | Maternal Health/ Prematurity (22%) |
| African Americans | Maternal Health/ Prematurity (43%) | Infant Health (42%) |
| African American teens* | Infant Health (78%) | Maternal Health/ Prematurity (36%) |
| American Indians | Infant Health (59%) | Maternal Health/ Prematurity (23%) |
| Asian /Pacific Islander | Infant Health (46%) | Newborn Care (37%) |
| Hispanic | Maternal Health/ Prematurity (50%) | Infant Health (32%) |

* These two add to more than 100% as the other two categories are actually negative meaning the African American teen rates for the other two categories are less than the reference population.

Additionally the Hispanic population shows the same top two priority areas but with reverse priority pattern with the Maternal Health / Prematurity period as the primary contributor to excess deaths (at 50%) and Infant Health as the second contributor at 30%. Asians are the only group to not have the same top two priority areas. For this population, Infant Health is the top area (46%) with Newborn Care contributing 37% to the total excess death rate.

Analysis was done on two time periods (1990-1993 and 1994-1998) to determine if the periods of risk change over time. Total fetal-infant mortality rates decreased for the overall population and for whites and African Americans (the only racial groups with enough data to break into two time periods). The biggest drop was in the African American fetal-infant rate (from 17.14 to 13.50). The period with the biggest decrease is the Newborn Care period. This went from 2.77 to 2.01 for all races and from 3.71 to 2.19 among African Americans. The Maternal Health/ Prematurity period increased among whites but decreased among African Americans. Even after these changes, African Americans still have much higher rates in this period (data available in Appendix 2).

V. How do PPOR results differ between the two cities?

Figures 3 and 4 provide the PPOR results by race and reference group for Minneapolis and St. Paul separately. We cannot compare the two cities on American Indians,

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Hispanics or Asian/ Pacific Islanders since the numbers were too small to examine them in each city separately.

Similarities between the two cities include large disparities in fetal-infant mortality rates between racial groups as well as when racial / age groups are compared to a reference population. A second similarity is that for nearly all race/age groups examined the two periods of risk contributing most to the excess mortality (and overall mortality) are the Infant Health and Maternal Health/ Prematurity periods.

When the cities are compared on their total fetal-infant mortality rates, the rates for Minneapolis are higher for the total population and for whites. But, the overall fetal-infant mortality rate for African Americans is higher (by about 1 infant death per 1000 live births) in St. Paul. The Infant Health rate among African Americans in Minneapolis is about 2 points higher (5.9 vs. 3.91) compared to St. Paul, but the Maternal Health / Prematurity rate in St. Paul is slightly over two points higher than that of Minneapolis (7.16 vs. 5.04).

Another area of difference between the two cities is found among teens. In Minneapolis the rate of death in the Infant Health period is much higher for teens than it is in St. Paul (7.04 compared to 3.21).

Rates for the two cities appear to have changed quite differently over the 1990's. The total-fetal infant mortality rate for all races combined went down in Minneapolis but stayed the same in St. Paul. The rate for whites went down slightly in St. Paul and by more (1 death per 1000 live births) in Minneapolis. However, the St. Paul rates are still lower for whites.

African American deaths are where the two cities seem to differ most when examined over time. In Minneapolis, the total fetal-infant mortality rate for African Americans had a large decrease (from 17.82 to 12.34, a 30% decrease). All four of the periods of risk contributed to this decrease. In St. Paul, however, the total-infant mortality rate for African Americans increased by 0.5 deaths per 1000 live births. Two periods in St. Paul had a decrease (Maternal Health / Prematurity and Maternal Care) while two periods had increases with the biggest increase in the Infant Health area (from 2.78 to 4.69).

Looking at the changes over time seems to indicate that there could be systematic differences between the two cities (Figures 5 and 6). In Minneapolis, rates fell in all four periods for African Americans. In St. Paul, rates fell in the first two categories and increased in the last two for African Americans. In fact, all races combined, whites, African Americans and Asian/Pacific Islanders all experienced increasing rates in the Infant Health Category in St. Paul. In Minneapolis White rates for the first two categories increased slightly while they were decreasing in St. Paul.

One hypothesis for the different trends for African American deaths in the two cities is the potential effect of the influx of immigrant and refugee populations from Africa.

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Minneapolis has experienced a higher proportion of African immigrants who would fall into the same racial category of Black or African American in the state's vital statistics surveillance system. Because these populations are generally healthy (low levels of behavioral risk factors such as smoking and drinking compared to US born populations), they may be improving the average statistics for Minneapolis blacks.

This hypothesis can be tested because the state collects information on the country of origin of the mother. Analysis comparing infant mortality rates for US born mothers and foreign -born mothers (both categorized as African American) in Minneapolis does indicate that infants born to foreign-born mothers have a lower infant mortality rate (8.31 vs. 10.64) however the numbers are too small to impact the overall rates (the overall rate is 10.37). So this is not a large enough influence to cause the differences seen between the two cities.

Cause of death for African Americans in each city were examined by period of risk. Initially it appears that there may be a difference in the two cities for SIDS deaths since 50% of African American infant deaths in the Infant Health category in St. Paul are SIDS deaths compared to 32% in Minneapolis. However, when all deaths are included (not just one period of risk) SIDS deaths account for the same proportion (18-19%) of all African American infant deaths.

VI. What are the program and policy recommendations implied by our local data?

Excess deaths, those deaths estimated to be preventable, in Minneapolis and St. Paul are occurring in the extreme (very early and very late) perinatal periods known as Maternal Health/ Prematurity and Infant Health. Factors thought to impact these two periods and potential interventions are listed below (Heaman et al, 2002). These recommendations are general recommendations from the PPOR methodology; their appropriateness to address infant mortality may differ by specific context and would need to be examined in the context of service delivery gaps.

Maternal Health

- Factors affecting adequate growth and development of the fetus
- Influenced by broad determinants of health such as income, social status, education, physical environment, health services
- Maternal age, parity, pregnancy spacing, nutritional status, stress, smoking, drug and alcohol use, chronic health conditions, and access to primary health care.
- Interventions aimed at decreasing preterm birth (potentially modifiable risk factors include smoking, substance abuse, low rate of weight gain during pregnancy, anemia, urogenital infections, strenuous work, domestic violence, stress and inadequate prenatal care).

Infant Care

- Factors that influence the health of infants after the neonatal period (first 28 days)
- Immunizations, breastfeeding promotion and support, community services, injury prevention and control, high-risk infant follow-up.
- SES factors such as income, maternal education.

A more general interpretation of the current findings that most preventable deaths are occurring in the very early and very late periods is that these two periods may be those most impacted by social and behavioral risk factors and their impacts on medical factors. The two middle periods appear to be those when women and their infants are interacting most with the medical system as well as where most of the maternal and child health resources are directed. Heaman et al in their analysis of Manitoba deaths conclude, “the smallest opportunity gaps are in the areas of Maternal Care and Newborn Care, suggesting that the health care system is functioning fairly well in these areas”.

The findings of the Minneapolis and St. Paul PPOR are very similar to those of other PPOR projects in the US as well as an analysis done in Canada. An application of the PPOR methodology to Manitoba by Heaman et al (2002) found greatest excesses in the Maternal Health and Infant Care categories. Additionally, the CityMatch website (www.citymatch.org) highlights examples from other cities (Boston, Seattle, Honolulu) with similar findings.

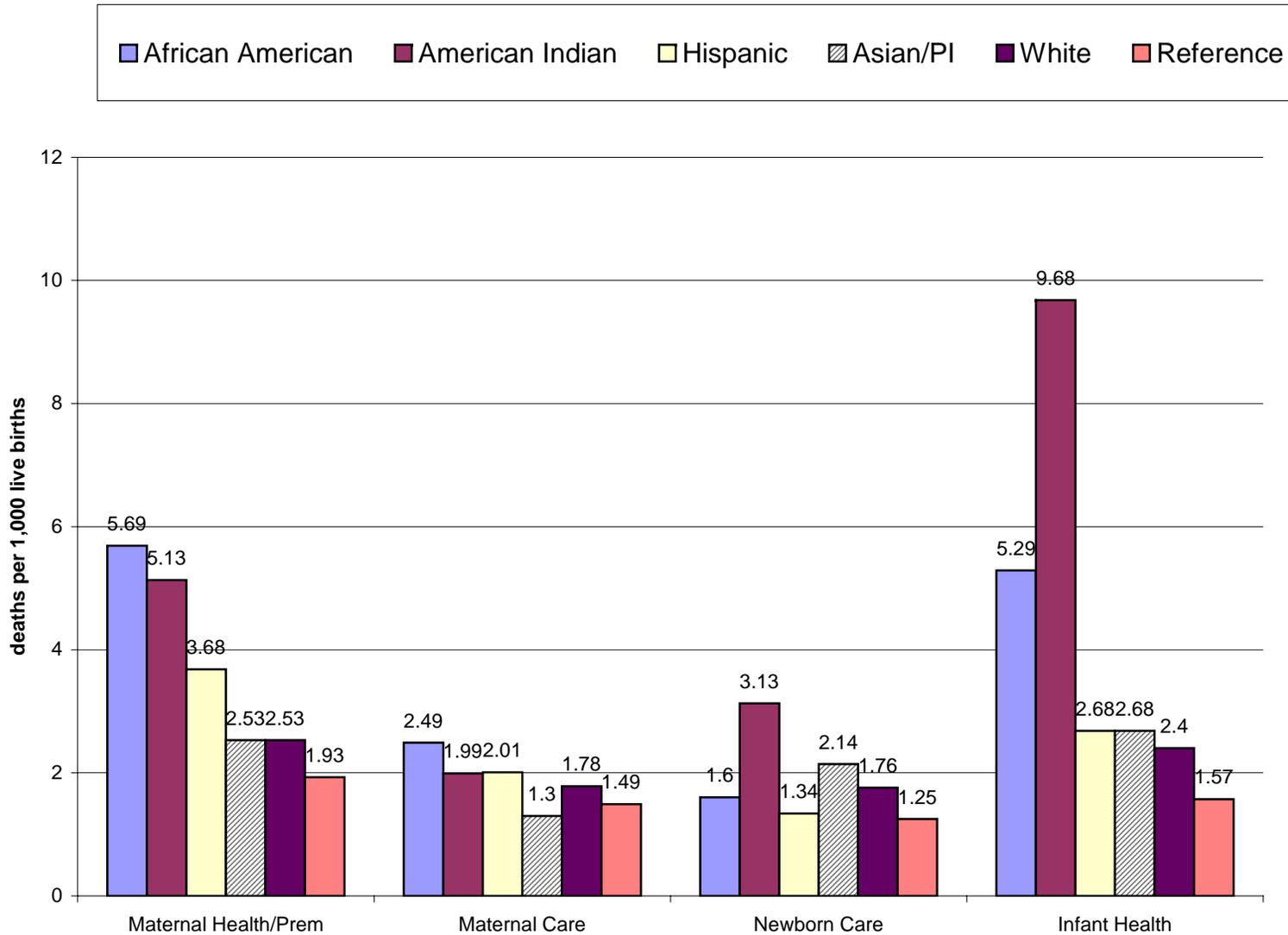
In addition to consistency of the current findings with other PPOR projects, these findings and their related recommendations fit with two other local studies using different methodologies. Project LID conducted infant mortality case reviews in Hennepin and Ramsey counties. One of the key recommendations of the project was for more comprehensive assessment and care coordination of social and behavioral risks.

While Project LID only studied the worst cases, those that died, a subsequent qualitative study examined care coordination services for low-income women on a systemic level. Falling Through the Cracks collected qualitative information from 31 perinatal care organizations in the Twin Cities area. The study used the definition of perinatal care coordination as: a process for assessing the needs of pregnant women and their families for particular health and social services, assisting women in obtaining those services, and coordinating those services to avoid gaps and duplication. Results indicate that care coordination services offered by health plans appear to be primarily done over the phone (a strategy that may not reach those most at risk) and focus on medical issues and not the social or behavioral issues that also affect pregnancy.

All three of these studies used different methodologies, each with their own strengths and weaknesses. However, all three point to similar conclusions. These findings generally indicate that women experiencing social and behavioral risk factors may not be receiving enough services/ support prior to pregnancy or after the infant’s first month of life. Some strategies to address these gaps include:

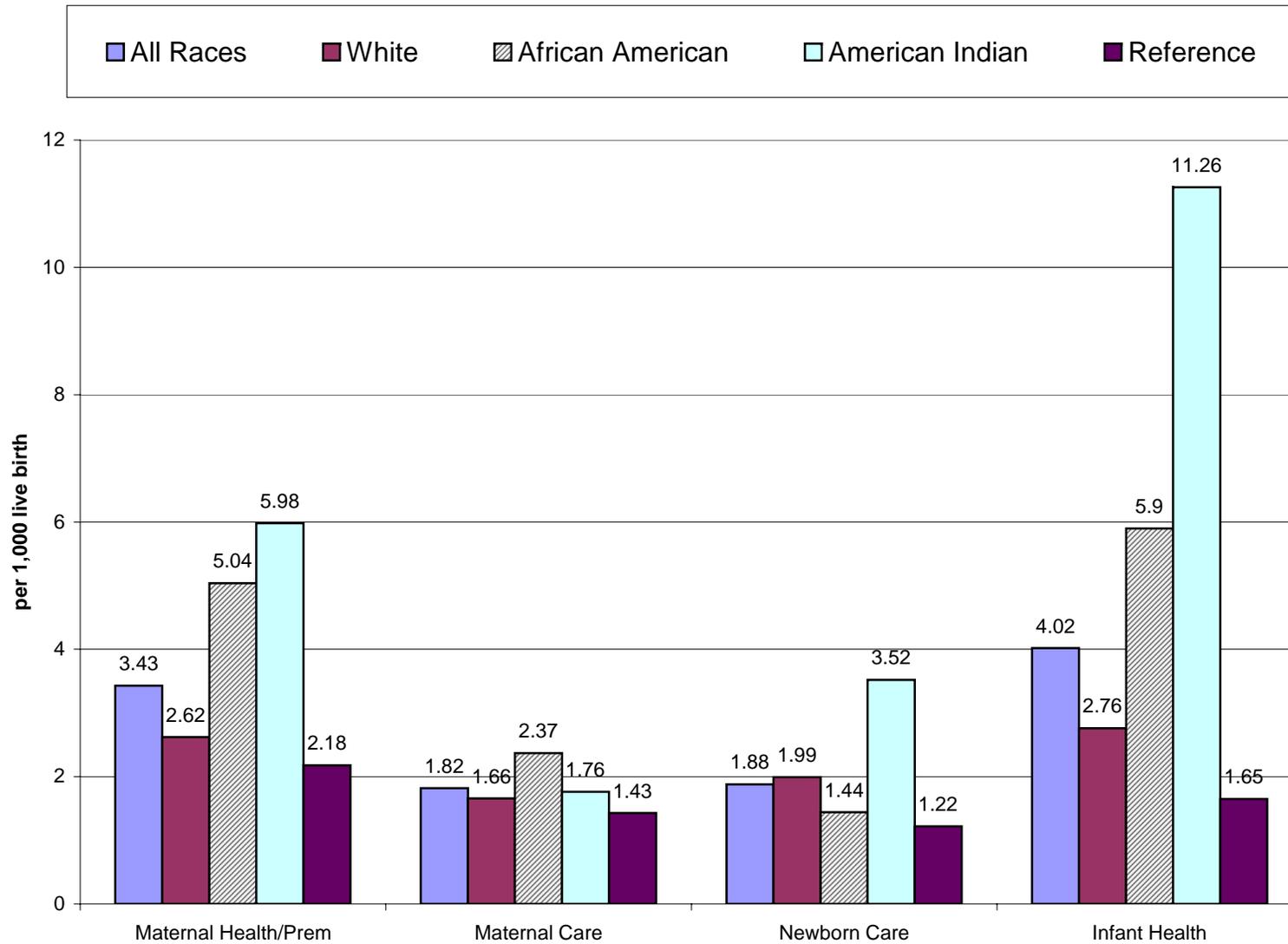
- Increase outreach to women early in pregnancy and between pregnancies with the goal of assessing and addressing their risk factors and getting them into care.
- Increase the capacity of community-based safety-net providers in Minneapolis and St. Paul to conduct in-person risk assessments, follow-up and resource advocacy for socially high-risk pregnant, postpartum, and interconpetual women.
- Increase resources available for the above activities by applying for grant funding and directing public and private health dollars toward these activities.

Figure 2: Minneapolis and St. Paul 1990-1998 by period of risk



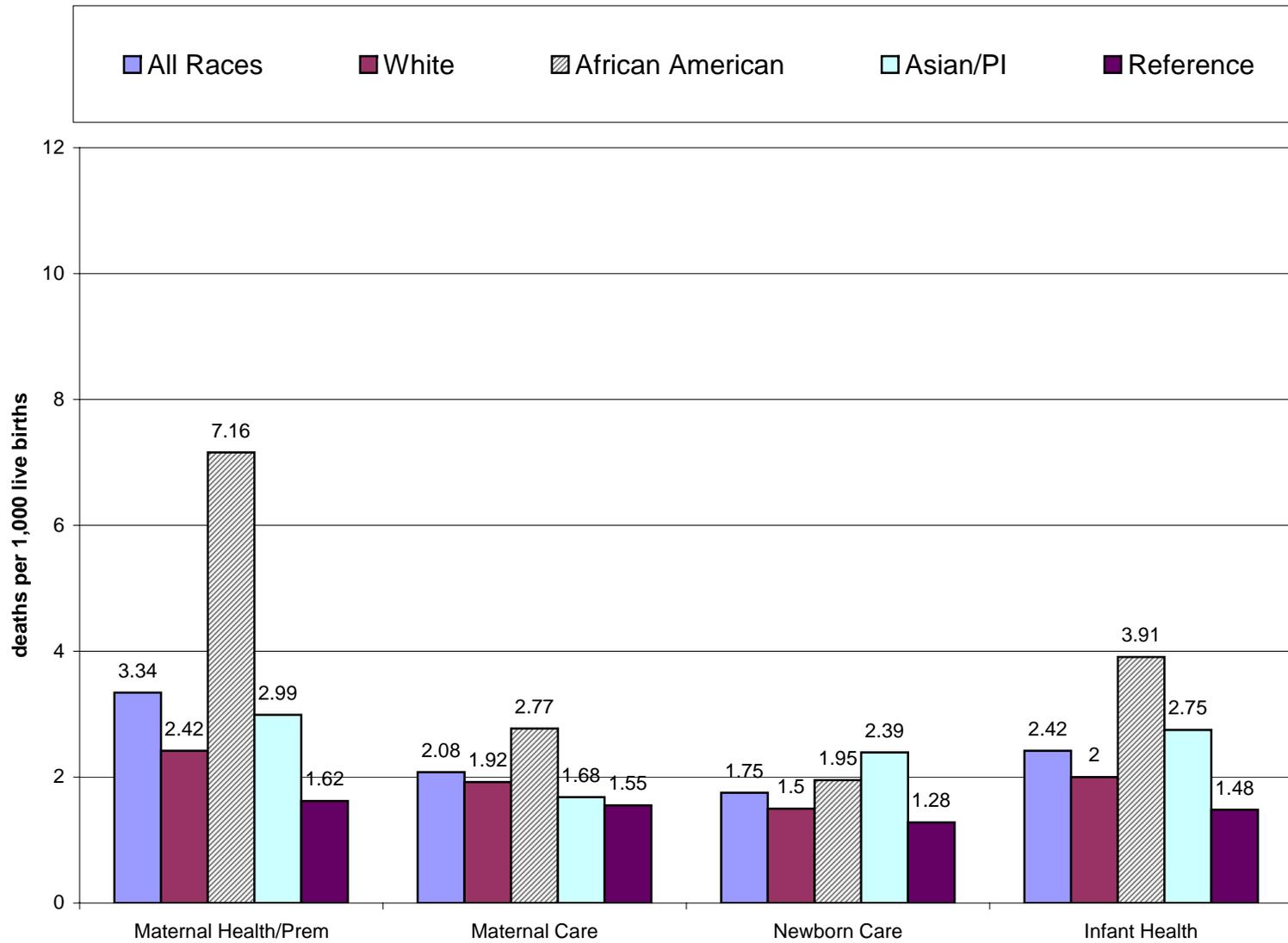
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Figure 3: Minneapolis 1990-1998 by period of risk



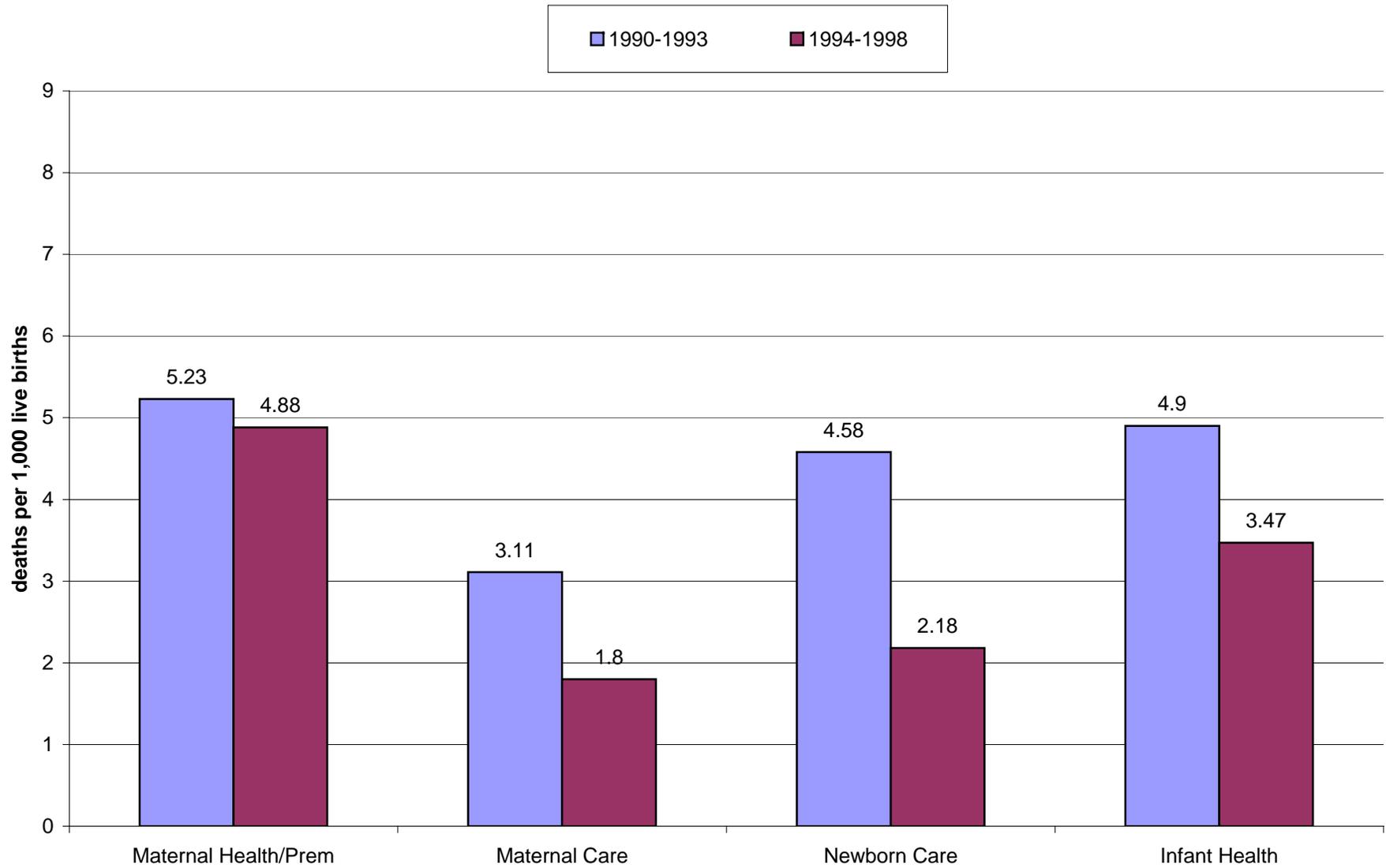
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Figure 4: St. Paul 1990 - 1998 by period of risk



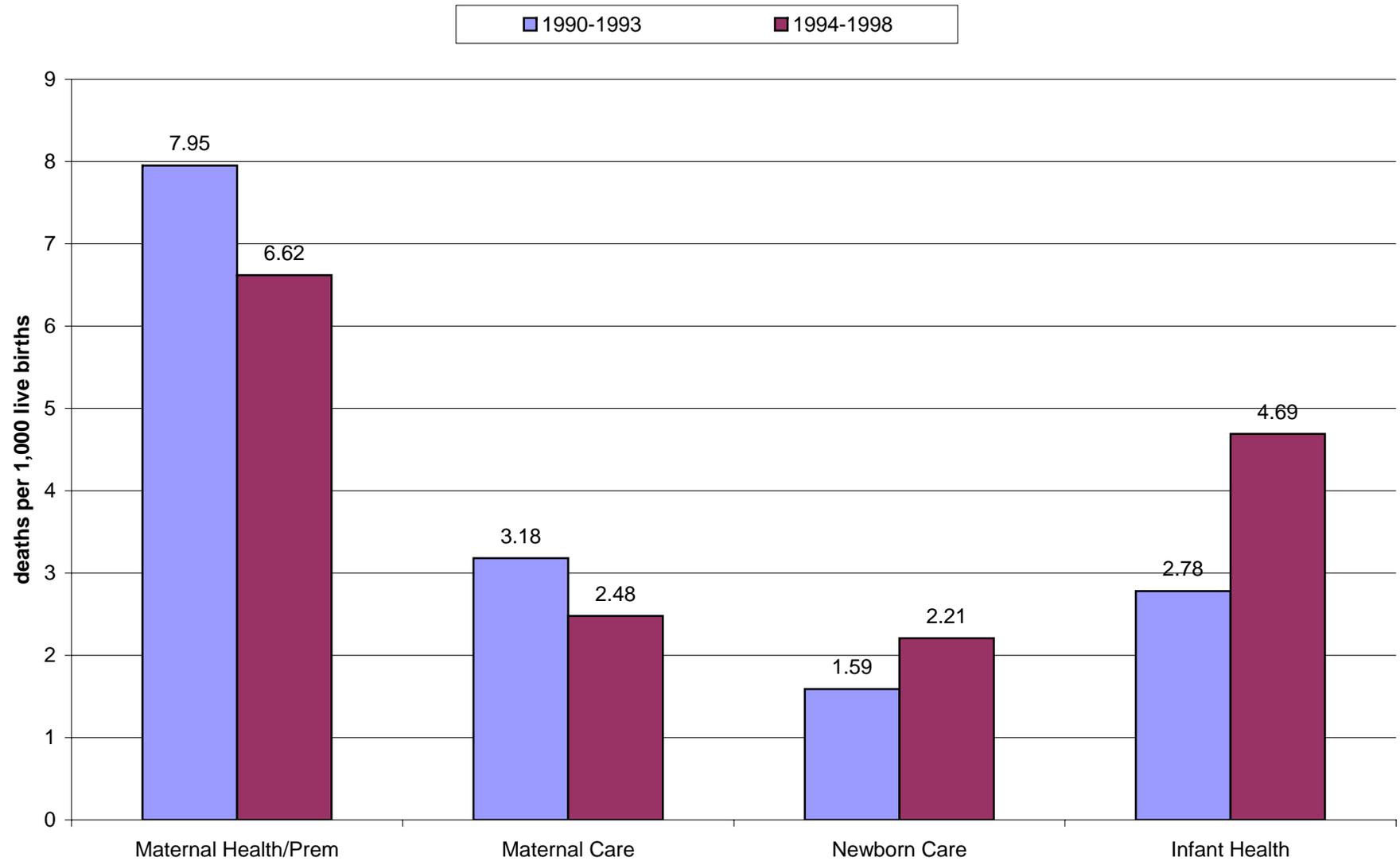
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Figure 5: Trends for African Americans in Minneapolis



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Figure 6: African American Trends in St. Paul



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Appendix 1: Minneapolis and St. Paul Rates by Prevention Category

| Minneapolis and St. Paul 1990-1998 | Maternal Health/ Prematurity | Maternal Care | Newborn Care | Infant Health | Fetal-Infant Mortality |
|--|---|----------------------|---------------------|----------------------|-------------------------------|
| All Races | 3.39 | 1.94 | 1.82 | 3.31 | 10.45 |
| < 20 | 4.28 | 1.21 | 1.78 | 5.34 | 12.61 |
| ≥ 20 | 3.16 | 1.92 | 1.81 | 2.98 | 9.87 |
| White (non-Hispanic) | 2.53 | 1.78 | 1.76 | 2.40 | 8.48 |
| < 20 (58 cases) | 3.65 | 2.19 | 1.95 | 6.33 | 14.11 |
| ≥ 20 | 2.42 | 1.65 | 1.75 | 2.09 | 7.92 |
| African American (non-Hispanic) | 5.69 | 2.49 | 1.60 | 5.29 | 15.07 |
| < 20 | 4.42 | 0.77 | 0.96 | 6.92 | 13.07 |
| ≥ 20 | 5.93 | 2.83 | 1.82 | 4.72 | 15.31 |
| American Indian (non-Hispanic) | 5.13 | 1.99 | 3.13 | 9.68 | 19.93 |
| Asian/Pacific Islander (non-Hispanic) | 2.53 | 1.30 | 2.14 | 2.68 | 8.65 |
| Hispanic (58 cases) | 3.68 | 2.01 | 1.34 | 2.68 | 9.71 |
| Reference Group* | 1.93 | 1.49 | 1.25 | 1.57 | 6.24 |

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Appendix 2: Minneapolis and St. Paul Combined Trends in Rates by Prevention Category and Proportion of Contribution to Overall Rate

| Minneapolis and St. Paul | Maternal Health/ Prematurity | Maternal Care | Newborn Care | Infant Health | Fetal-Infant Mortality |
|---------------------------------|---|----------------------|---------------------|----------------------|-------------------------------|
| All Races | | | | | |
| 1990 – 1993 | 3.23 (29%) | 2.01 (18%) | 2.77 (25%) | 3.01 (27%) | 11.01 |
| 1994 – 1998 | 3.52 (35%) | 1.88 (19%) | 2.01 (20%) | 2.56 (26%) | 9.98 |
| White | | | | | |
| 1990 – 1993 | 2.31 (26%) | 1.69 (19%) | 2.31 (26%) | 2.49 (28%) | 8.80 |
| 1994 – 1998 | 2.75 (34%) | 1.87 (23%) | 1.76 (22%) | 1.80 (22%) | 8.17 |
| African American | | | | | |
| 1990 – 1993 | 6.02 (35%) | 3.13 (18%) | 3.71 (22%) | 4.29 (25%) | 17.14 |
| 1994 – 1998 | 5.43 (40%) | 2.02 (15%) | 2.19 (16%) | 3.86 (29%) | 13.50 |
| Reference group | | | | | |
| 1990 – 1993 | 1.41 (24%) | 1.41 (24%) | 1.28 (22%) | 1.73 (30%) | 5.82 |
| 1994 – 1998 | 2.38 (36%) | 1.55 (23%) | 1.33 (20%) | 1.33 (20%) | 6.60 |

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