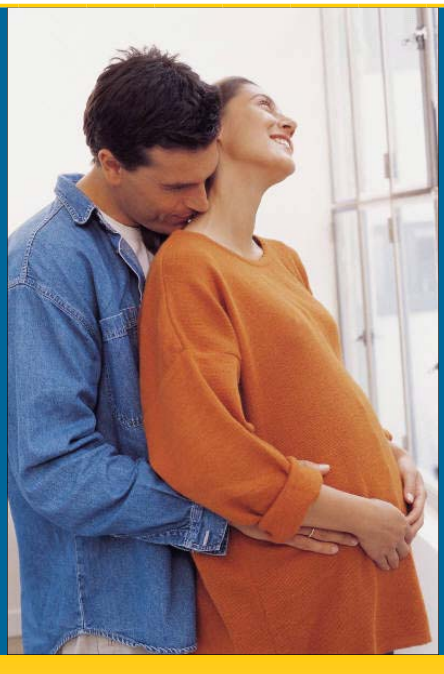
Perinatal Periods of Risk



A Community Approach to Address Fetal and Infant Mortality in Maricopa County

Maricopa County
Department of Public Health

Perinatal Periods of Risk: A Community Approach to Address Fetal and Infant Mortality in Maricopa County

PRODUCED BY
MARICOPA COUNTY DEPARTMENT OF PUBLIC HEALTH

DIVISIONS OF
EPIDEMIOLOGY & DATA SERVICES
&
MATERNAL, CHILD & FAMILY HEALTH

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Document Information

This document is located on the Maricopa County Department of Public Health website; http://www.maricopa.gov/public_health/epi. Questions pertaining to the data in this document should be addressed to the Division of Epidemiology and Data Services at epidemiology@mail.maricopa.gov. Questions pertaining to the community component or Maricopa County's maternal and child health programs should be directed to Rose Howe, Family Health Partnerships Manager at rosehowe@mail.maricopa.gov or 602-372-1441.

Section I. Executive Summary

The Perinatal Periods of Risk approach to fetal and infant mortality (PPOR) is a method to analyze standard vital registration records (births, infant deaths, and fetal deaths) that is based on a prevention framework. The goal is to prioritize and target prevention and intervention efforts in those areas where they may be most effective. Based on birth weight and age of death, the PPOR approach partitions fetal and infant deaths into four areas that correspond to specific intervention points in the health care continuum. These four components have different causes of death, risk factors, and corresponding interventions.

- The "maternal health and prematurity" category corresponds to the mother's health prior to and between pregnancies, health behaviors, and perinatal care.
- The "maternal care" category corresponds to prenatal care, high risk obstetric care, and the referral system.
- The "newborn care" category corresponds to perinatal management, perinatal systems, and pediatric surgery.
- The "infant health" category consists of many environmental factors such as sleep position, breast-feeding, injury prevention, and the prevention of infectious diseases.

The approach additionally provides an estimate of the amount of fetal and infant mortality that is preventable (excess mortality), by comparing the feto-infant mortality rates in select population groups to a reference group that has low mortality rates. The identification of risk factors is then based on the population groups and categories with high excess mortality.

The data consist of births, fetal deaths, and infant deaths in Maricopa County during the period 1996 through 2000. The areas of analysis are Maricopa County, the South Phoenix area, and the Maryvale area. Although the first phase of data analyses was presented in the 2003 *Maternal and Child Health Needs Assessment* [1], it is also included here to provide a complete profile. The second phase of data analyses (identification of risk factors) is presented, along with a brief history of the corresponding community activities to date.

A second component of the PPOR approach consists of community mobilization. Community support and input are integral to the PPOR process. The community helps clarify the data and is the motivating force for initiating change and sustaining these efforts. Community partners and maternal and child health care stakeholders are identified and engaged at the beginning of the PPOR process for collaboration and to facilitate a sustained effort to reduce mortality.

Community Mobilization

To increase support and awareness of the PPOR process, there have been more than 600-targeted contacts made through individual contacts and community presentations to coalitions, consortia, institutions, community residents, providers, and elected officials. Presentation of the data analysis results were made to the Maryvale and South Phoenix communities, the Maternal and Child Health Advisory Group for the County Prenatal Block Grant, the Alliance for Innovations in Health Care, as well as to other public health groups. After the presentations, community participants discussed the feto-infant mortality findings specific to their area and identified feasible interventions that would address the risk factors for poor birth outcomes. Recommendations have been organized around five areas of intervention with the *It's a Baby's Life* steering committee in Maryvale and the South Phoenix Healthy Start Consortium coordinating efforts to address these priority areas:

- Socio-economic environment
- Health of women prior to and between pregnancies (interconceptional)
- Health of mother during pregnancy
- Access to health care
- Infant health (South Phoenix only)

Recommendations for interventions selected by the community groups in response to PPOR findings include an increase in the following:

- Tobacco cessation programs
- Awareness and availability of annual medical exams for women who are not pregnant and do not have insurance
- Teen sex awareness education
- Female support groups to decrease social isolation and increase resources
- Programs to improve "fathering" practices
- Interconceptional curricula and marketing campaigns to increase healthy behaviors
- School-based pregnancy health outreach services
- Awareness of why prenatal care is important and early identification of prematurity risks
- Infant development education programs

The findings presented in this report provide an opportunity for community members, health and social services providers, and policy makers to work together to develop community interventions for improving the health of women and infants in Maricopa County.

Key Findings

Maricopa County

Phase I

- The total feto-infant mortality rate (F-IMR) from 1996 through 2000 was 8.5 deaths (per 1,000 live births and fetal deaths).
- The excess F-IMR during the period was 2.7 deaths (per 1,000 live births and fetal deaths), suggesting that **32% of the fetal and infant deaths were potentially preventable.**
- The highest excess group-specific rate was "maternal care," while the second highest rate was "maternal health/prematurity."
- **The excess F-IMR for women under the age of 20 (5.9) was more than twice the excess rate for those women who were 20 or more years of age** (2.2 deaths per 1,000 live births and fetal deaths), although the absolute numbers of births and deaths were smaller.
    - For women less than 20 years old, the highest rate was "maternal health/prematurity" followed by "infant health."
    - For women 20 or more years of age, the highest rate was "maternal care."
- **Education, a risk factor amenable to modification, showed the largest impact on feto-infant mortality rates consistently across all areas. The excess F-IMR for women with a high school education or less (7.1) was 18 times higher than the excess F-IMR for women with some education beyond high school** (0.38 deaths per 1,000 live births and fetal deaths). The highest rate for those women with less education was in the "maternal care" category.
- **Non-Hispanic African Americans had the highest excess F-IMR (8.2) of all race/ethnic groups**, followed by Non-Hispanic Native Americans (4.3), Hispanics (3.5), and Non-Hispanic Whites (1.9)[1].
- **Each race/ethnicity showed a different pattern across the excess feto-infant mortality map suggesting that programs might consider targeting these groups differently.**
    - African American's highest rate was in the "maternal health/prematurity" category, followed by the "infant health" category.
    - Native American's highest rate was in the "infant health" category, followed by the "maternal care" category.
    - For Hispanics, the "maternal health/prematurity" and "maternal care" categories were equally high.
    - White's highest rate was in the "maternal health/prematurity" category, followed by the "maternal care" category.

[1] For the remainder of this report, the term "African American" refers to non-Hispanic African Americans; "Native American" refers to non-Hispanic Native Americans; "White" refers to non-Hispanic Whites.

Phase II

Risk factors predicting negative pregnancy outcomes were identified through logistic regression analysis for all Maricopa County births and fetal deaths. These risk factors were used in all smaller area analyses (i.e., Maryvale and South Phoenix). The two tables that follow identify these general factors and the specific populations targeted for interventions in Maricopa County.

MARICOPA COUNTY: RISK FACTORS PREDICTING NEGATIVE PREGNANCY OUTCOMES

Negative Pregnancy Outcomes			
Maternal Health and Prematurity		**Maternal Care**	**Infant Health**
Very Low Birth Weight Birth	**Very Low Birth Weight Fetal or Infant Death**	**Higher Birth Weight Fetal Death**	**Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)**
	Mother's education is a high school degree or less	Mother's education is a high school degree or less	Mother's education is a high school degree or less
Mother African American			Mother African American or Native American
Mother a teenager			Mother a teenager
Too few prenatal care visits	Too few prenatal care visits	Inadequate prenatal care	Too few prenatal care visits
Smoking during pregnancy			Smoking during pregnancy
Less than 15 lbs. weight gain during pregnancy			
Lack of social support and SES advantages (unmarried mother)			
Previous preterm baby; Premature or small-for-gestational-age baby		Premature or small-for-gestational-age baby	
Multiple birth			
	Service level of delivery hospital		
	Congenital anomalies		
	Fever during labor		
	Precipitous labor		
	Newborn assisted ventilation		
	Cord prolapse		
		Maternal Diabetes	
		Placenta previa/abruptio	
		Breech/malpresentation	
		Cord prolapse	

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1,500 grams (3.3 lbs.) and higher birth weight is 1,500 grams or more.

MARICOPA COUNTY: POPULATION GROUPS WITH SIGNIFICANT RISK FACTORS TO BE TARGETED FOR INTERVENTIONS.

	Negative Pregnancy Outcomes			
	Maternal Health and Prematurity		Maternal Care	Infant Health
Populations	**Very Low Birth Weight Birth**	**Very Low Birth Weight Fetal or Infant Death**	**Higher Birth Weight Fetal Death**	**Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)**
Teenage Mothers	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.			Too few prenatal care visits.
Mothers with a High School Degree or Less Education	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby. Smoking.	Too few prenatal care visits. Service level of delivery hospital. Fever during labor and delivery. Newborn assisted ventilation.	Inadequate prenatal care. Premature or small-for-gestational-age baby.	
African American Mothers	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby. Smoking.			Too few prenatal care visits. Smoking
Native American Mothers			Inadequate prenatal care. Premature or small-for-gestational-age baby. Maternal diabetes.	Too few prenatal care visits.

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1,500 grams (3.3 lbs.) and higher birth weight is 1,500 grams or more.

Maryvale

Phase I

- The total feto-infant mortality rate from 1996 through 2000 was similar to the county's rate, 8.8 deaths per 1,000 live births and fetal deaths.
- The excess feto-infant mortality rate during the period was 3.0 deaths (per 1,000 live births and fetal deaths), suggesting **that 34% of the fetal and infant deaths were potentially preventable.**
- The highest excess group-specific rate was "maternal health/prematurity," while the second highest rate was "maternal care."
- The excess death rate did not vary by age group (women under the age of 20 versus women 20 years of age and older) and the pattern of results for the two maps was similar.
- **The excess F-IMR for women with a high school education or less was 4.6,** while there was essentially no excess for women with some education beyond high school. For the lower education group, the highest group-specific rate was in the "maternal health/prematurity" category.
- **Although the overall excess F-IMR was almost identical for Hispanic (2.9) and non-Hispanic White (2.8) women, the pattern of mortality across the prevention map differed.** Hispanic women's highest rate was "maternal health/prematurity" and non-Hispanic White women's highest rate was "maternal care."

Phase II

The following table identifies risk factors for the targeted population in Maryvale in accordance with the countywide predictive risk factors and the Phase I findings in Maryvale.

MARYVALE NEIGHBORHOOD POPULATIONS WITH SIGNIFICANT RISK FACTORS TO BE TARGETED BY INTERVENTIONS.

Population	Very Low Birth Weight Birth	Very Low Birth Weight Fetal or Infant Death	Higher Birth Weight Fetal Death	Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)
Women with a High School Degree or Less Education	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.		Inadequate prenatal care. Premature or small-for-gestational-age baby	

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1,500 grams (3.3 lbs.) and higher birth weight is 1,500 grams or more. African American women in Maryvale had high excess mortality rates but the numbers were statistically too small to examine in Phase II analyses. Please see Maricopa County results to target African American mothers in Maryvale.

South Phoenix

Phase I

- The total feto-infant mortality rate from 1996 through 2000 was 10.6 deaths (per 1,000 live births and fetal deaths), which was higher than the county rate.
- The excess feto-infant mortality rate during the period was 4.8 deaths (per 1,000 live births and fetal deaths), suggesting that **45% of the fetal and infant deaths were potentially preventable.**
- The highest excess group-specific rate was "maternal health/prematurity," while the second highest rate was "maternal care."
- The excess death rate was higher for women 20 or more years of age (5.0) than for women under the age of 20 (4.1), however, this finding is opposite from the expected and the sample size was small for the younger women. For both groups, the highest rate was "maternal health/prematurity."
- **The excess F-IMR for women with a high school education or less (6.4) was six times higher than the excess rate for women with some education beyond high school** (1.0). For the lower education group, the highest excess group-specific rates were in the "maternal health/prematurity" and "maternal care" categories.
- **African Americans and Native Americans were analyzed as a single group in Phase I because the numbers were small and the patterns were similar. This group had an excess F-IMR of 7.7, which was higher than the excess F-IMR for Hispanics (4.3).**
    - The African/Native American women's highest excess group-specific rate was in "infant health."
    - Hispanic women's highest excess rate was in "maternal health/prematurity."

Phase II

The table on the following page identifies risk factors for the targeted populations in the South Phoenix area in accordance with the countywide predictive risk factors and the Phase I findings in the area.

Phase II: Additional data for South Phoenix Only

Pregnancy Risk Assessment Monitoring System (PRAMS) data from South Phoenix show additional risk factors for negative outcomes in this area. These data are not linked to individual deaths and the reference group was not surveyed, so the findings cannot be used to compare the reference group with any specific groups at risk.

- Low vitamin use
- Low breast-feeding rate
- High percentage of babies not put to sleep on their backs
- Having little social support as measured by the high percentage who did not have anyone to lend them $50, to help if mom was ill, to talk their problems with, or to give them a ride in an emergency.
- High rates of social stressors (moving, loss of job, domestic violence, etc.)
- High rates of specific barriers to prenatal care use (no transportation, no babysitter, no money or insurance, etc).
- Crowded living quarters.

SOUTH PHOENIX AREA POPULATIONS WITH SIGNIFICANT RISK FACTORS TO BE TARGETED BY INTERVENTIONS.

	Negative Pregnancy Outcomes			
	Maternal Health and Prematurity		Maternal Care	Infant Health
Populations	**Very Low Birth Weight Birth**	**Very Low Birth Weight Fetal or Infant Death**	**Higher Birth Weight Fetal Death**	**Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)**
South Phoenix Overall	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits. Fever during labor and delivery.	Inadequate prenatal care. Maternal diabetes. Premature or small-for-gestational-age baby.	
Teenage mothers	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.			Few prenatal care visits.
Mothers 20 or more years of age	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits.	Inadequate prenatal care. Maternal diabetes. Premature or small-for-gestational-age baby.	
Mothers with a high school degree or less	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits.	Inadequate prenatal care. Premature or small-for-gestational-age baby.	
Hispanic Mothers	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits. Fever during labor and delivery.	Inadequate prenatal care. Maternal diabetes. Premature or small-for-gestational-age baby.	

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1,500 grams (3.3 lbs.) and higher birth weight is 1,500 grams or more. African American and Native American women in South Phoenix had high excess mortality rates but the numbers were statistically too small to examine in Phase II analyses. Please see Maricopa County results to target these two groups of mothers in South Phoenix.

Section II. Perinatal Periods of Risk Overview

The Virginia G. Piper Charitable Trust provided a grant to MCDPH to partially support the use of the Perinatal Periods of Risk (PPOR) approach in Maricopa County and the Phoenix neighborhoods of Maryvale and South Phoenix. MCDPH, the PPOR practice collaborative, the Healthy Mothers Healthy Babies Coalition and South Phoenix Healthy Start collaborated to implement this project.

Perinatal Periods of Risk (PPOR) [1, 2, 3] is a multidisciplinary approach to understanding the complex issues contributing to fetal and infant mortality. The PPOR approach provides direction for prioritizing and targeting prevention and intervention efforts to reduce mortality at specific points in the health care services continuum. The approach translates natality, mortality, and morbidity data into useful information for health workers, policy makers, and communities. There are two equally important components to the approach: a) analyzing data to identify intervention areas in the health care system during the perinatal time period, and b) community mobilization to facilitate a sustained effort to reduce fetal and infant mortality.

Dr. Brian McCarthy and colleagues in the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) Collaborating Center in Perinatal Care developed the framework for PPOR and applied the approach in developing and developed countries. Research to validate the approach in U.S. cities began in 1997 as a collaborative effort among City**M**at**CH**, University of Nebraska Medical Center, CDC, National March of Dimes, and the Health Resources and Services Administration: Maternal and Child Health Bureau (HRSA/MCHB). Maricopa County participated as one of 15 original urban areas. Based on the research results, the data analyses and the approach to community mobilization were refined and City**M**at**CH** is leading the effort to disseminate the information.

There are two main components of PPOR, the data analytic component and the community mobilization. These components proceed simultaneously, interacting with one another to build a richer understanding of the problem and indicate possible directions for solutions. Although much of the discussion in this document focuses on the data analysis component, community support and input are integral to the PPOR process. The community helps clarify the data and is the motivating force for initiating change and sustaining the efforts. Community partners, mobilizers, and maternal and child health stakeholders are identified and engaged at the beginning of the process for collaboration. Identifying key citizens who are already committed to community improvement is necessary. Community mobilizers may need training on the infant mortality issues in their community, the process of engaging others, the PPOR process, and possibly interpreting and using data. Community mobilizers then conduct numerous one-on-one sessions with other key stakeholders to engage support, build alliances, and educate others about the data. The community participated by evaluating the identified risk factors and strategizing about intervention strategies and policies.

The data analysis component has two phases. In the first phase of the data analyses, fetal and infant mortality (feto-infant mortality) are mapped to four areas that suggest the direction for

prevention/intervention programs, based on the age at death and birth weight of the child. The four areas consist of maternal health and prematurity (e.g., maternal preconception health and perinatal conditions and care), maternal care (e.g., prenatal care), newborn care (e.g., perinatal systems), and infant health (e.g., environmental factors such as sleep position). Typically infant mortality rates are calculated by examining only deaths following live births. In the PPOR approach, fetal deaths with gestation of 24 or more weeks are also examined. Once the feto-infant mortality is mapped to the prevention categories, excess mortality is determined by comparing the mortality rates in the area to a reference group with low feto-infant mortality rates. The amount of excess mortality in each category suggests the extent to which the feto-infant mortality rate can be reduced. Phase II analyses attempt to ascertain potential reasons for the excess mortality in the categories with the highest excess rates. The approach to the analysis depends on the results of Phase I, available data on risk factors, and community information.

Section III. Community Mobilization

Under the direction of the Family Health Partnerships program at MCDPH, there have been over 600 targeted contacts made in Maryvale and South Phoenix to develop support and awareness in their respective communities for PPOR and maternal and child health issues. This has included coalition/consortium meetings, one-on-one contacts, community presentations, outreach activities, and interactions with elected officials. In May 2004, Phase II PPOR data was presented to both of the targeted communities.

It's a Baby's Life project in Maryvale, South Phoenix Healthy Start (SPHS) and MCDPH sponsored community presentations of Phase II PPOR data on May 3 (Maryvale) and 19 (South Phoenix), 2004. Elected officials, Phoenix Councilmen Mattox and Lingner, State Representatives Linda Lopez and Leah Landrum, agreed to be part of these important events. About 60 community members, coalition/consortium members, and other stakeholders attended each presentation and ensuing work sessions. Representatives from various provider offices, government entities, social service agencies, foundations, school districts, higher education institutions, hospitals, and community residents attended the events. Participants worked in small groups to target the broad key areas found to contribute to local fetal/infant mortality disparities:

- Socio-economic environment
- Health of women prior to and between pregnancies (interconceptional)
- Health of mother during pregnancy
- Access to health care
- Infant health (South Phoenix only)

Potential interventions that could be effective within the specific community were identified and prioritized based on most value and impact. Recommended interventions from each group were presented to the full group at each presentation. At both presentations, attendees were asked to complete commitment cards if they were ready to assist the project in lowering fetal/infant mortality and improve birth outcomes. Forty-nine cards were completed with many of them from community residents.

Maryvale

Over the past two years, MCDPH, the Healthy Mothers Healthy Babies Coalition, South Phoenix Healthy Start, and various organizations and community members have joined together to mobilize Maryvale in an effort to empower the community to take on the responsibility of improving birth outcomes. As a result of funding received from St. Luke's Health Initiatives and The Virginia G. Piper Charitable Trust, MCDPH was able to create a part-time position (Community Mobilization Manager) and recruit four Maryvale residents, who were already active in community change efforts, to volunteer. These volunteers are referred to as community mobilizers and have received training in MCH issues and community mobilization. Consequently, many businesses, faith-based organizations, apartment complexes, child care

centers, and schools have received information about PPOR, information on healthy lifestyles and its impact on birth outcomes, and on how to access health care services.

The *It's a Baby's Life* coalition and steering committee have reviewed the intervention strategies suggested at the Maryvale Summit. They have decided to concentrate on community interventions that will improve women's health before, during, and between pregnancies. However, the steering committee also decided that they would identify potential agencies in the community that might consider working on some of the other additional strategies generated at the Summit. As a result of PPOR analyses, potential interventions in Maryvale include tobacco cessation programs, getting non-pregnant women annual exams, teen sex awareness education, various forms of community outreach to women and providers, utilizing media to raise awareness, increasing services in the local neighborhoods, forming liaisons between providers and the community, connecting individual women to numerous services, engaging elected officials to encourage policy development and support, and developing female support groups. MCDPH is providing grant writing assistance so that these interventions will be developed and implemented by community based organizations that serve the Maryvale community.

South Phoenix

Healthy Start is a federally funded infant mortality reduction effort. South Phoenix Healthy Start (SPHS) accepts all high risk families prenatally or postnatally, however SPHS particularly targets African American and Native American families for perinatal health needs and socio-economic challenges. Families are provided intensive case management and health education. Another federally required component is to impact the health care system to improve access and utilization of health care. This is primarily done through a large community consortium. SPHS consortium members have proposed the following priority interventions that as a result of PPOR data analyses:

Healthy Start Early Pregnancy Health Outreach Project to establish a school-based pregnancy health outreach project.

"Healthy You, making Healthy Decisions, making Healthy Babies" project to increase self-worth contributing to a woman's ability to make healthy lifestyle and family planning decisions

Baby Arizona – A Rebirth Announcement to educate, inform, and recruit potential health plan members and providers regarding benefits and utilization issues.

Early Intervention Healthy Start Project for Males to promote positive fatherhood practices, provide leadership and advocacy, and educational activities in Healthy Start families.

"Baby your Baby" project to promote and support practices and resources contributing to healthy infants throughout the community.

In summary, the major community accomplishments in the last year include:

- Over 600 targeted stakeholder contacts
- Several elected officials have become actively committed to using PPOR data to make a difference in their communities
- Six representatives from the community are now leading the *It's a Baby's Life* Coalition.
- Four community residents have become well trained, empowered advocates for MCH issues in their respective communities referred to as mobilizers
- Community-based strategic planning conducted to develop project goals for the South Phoenix Healthy Start program
- Neighborhood organizations have adopted *It's a Baby's Life* as a community sponsored project.
- The *It's a Baby's Life* logo (portrait of a local child) is recognizable throughout the Maryvale community.
- Due to mobilizers' community education and awareness, there has been an increase in demand for prenatal care, therefore more low-cost prenatal care has been made available by Maryvale Hospital and Mountain Park Health Center.

Future efforts include a post-partum bedside survey to be implemented in the Fall of 2004 by the Alliance for Innovations in Health Care. Newly delivered mothers from Maryvale and South Phoenix will be interviewed to gather more data on barriers to care, customer service concerns, and disparity issues. The survey was developed by the Friendly Access program of The Lawton and Rhea Chiles Center for Healthy Mothers and Babies, University of South Florida. The two research questions to be answered by the Friendly Access program when implemented include: 1) Does improving customer service to pregnant women increase access to and utilization of health services, both preventive and curative? 2) Does increasing access and utilization improve certain health indicators? Survey results will be made available in the summer of 2005.

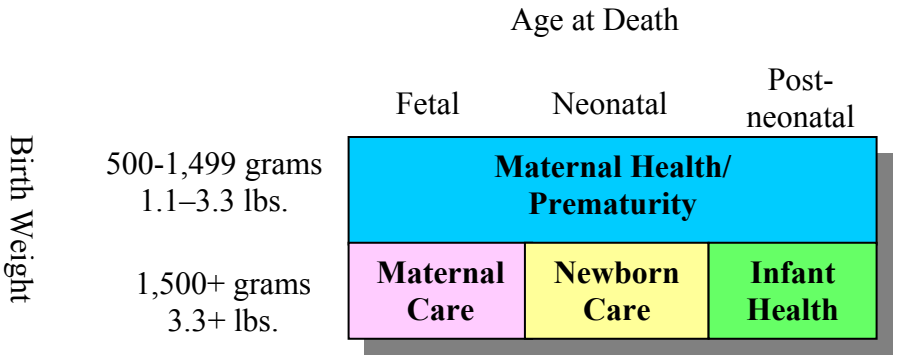
Section IV. Data Analysis Component Overview

Within the data analysis component, there are two phases of analysis. The first phase identifies populations with excess (or preventable) fetal and infant mortality in specific intervention periods during the perinatal period. The second phase focuses on identifying risk factors associated with those populations and intervention periods with excess mortality. A flow chart describing the whole data analysis process and a more detailed description of the methods are located in the methodology section (Appendix A).

Phase I

The first phase of data analysis (Phase I) begins by calculating fetal and infant mortality (feto-infant mortality) [1]. Typically, infant mortality rates are calculated by examining only deaths following live births; however, fetal deaths with a gestation of 24 or more weeks (six months) and a birth weight greater than 500 grams (1.1 lbs.) are also included in the PPOR approach. Therefore, the data do not include spontaneous and induced abortions. The data include linked birth and death certificate data in the county for the combined years of 1996 through 2000. The overall feto-infant mortality rate is mapped to (parceled into) four categories ("maternal health/prematurity", "maternal care", "newborn care", and "infant health"), based on the age at death and birth weight of the child. Figure IV-1 shows the map of feto-infant mortality. The age at death is categorized into three groups: a) fetal deaths are those deaths that occur between 24 weeks gestation and birth, b) neonatal deaths are those deaths that occur between birth and the first 28 days of life, and c) post-neonatal deaths occur between 28 days of life and one year of life. Birth weight is categorized into very low birth weight births (500-1499 grams/1.1-3.3 lbs) and all other births (1,500 grams/3.3 lbs or more) that includes low birth weight, healthy birth weight, and high birth weights.

Figure IV-1. Map of Feto-Infant Mortality

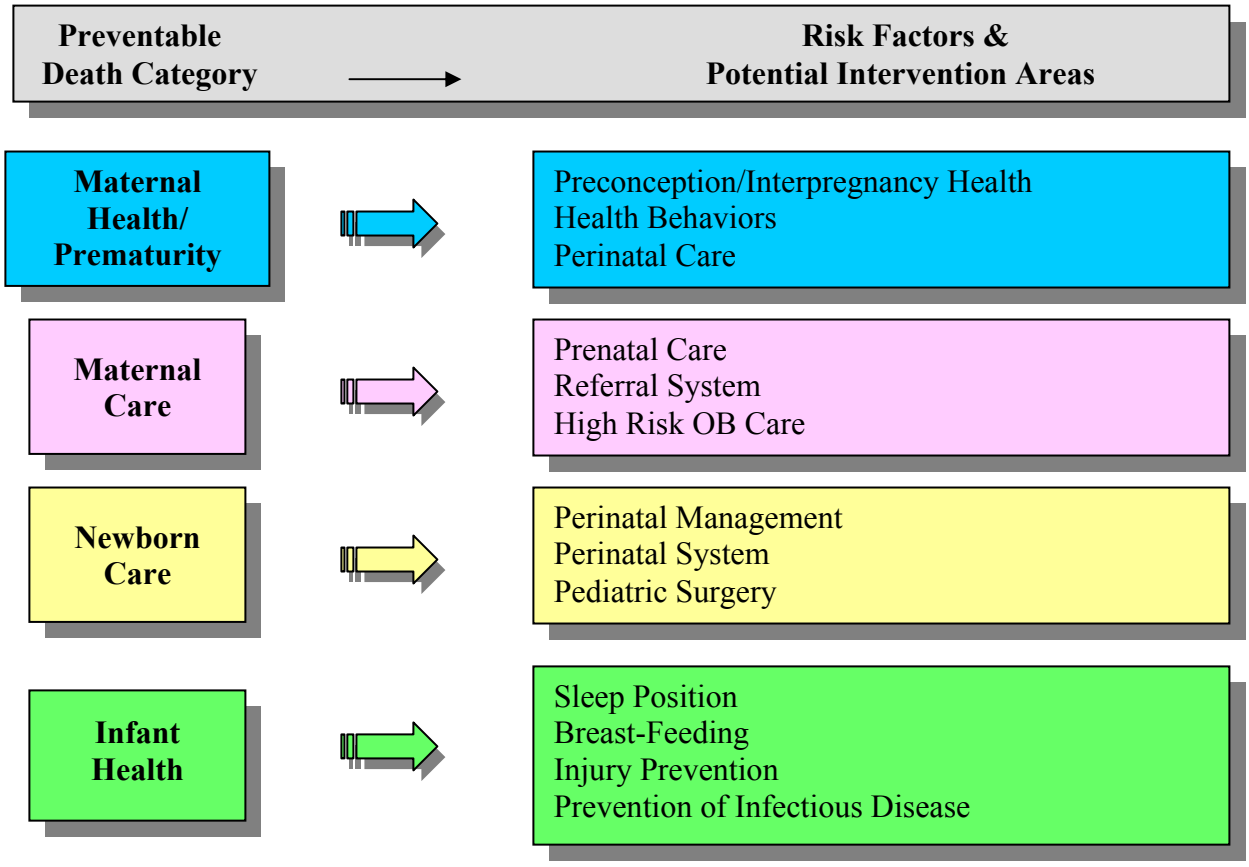


All of the very low birth weight deaths are categorized into the "maternal health and prematurity" group. Fetal deaths with a birth weight of 1,500 grams or more fall into the "maternal care" group. The "newborn care" group consists of neonatal deaths with a birth weight

of 1,500 grams or more. Finally, the "infant health" group consists of post-neonatal deaths with a birth weight of 1,500 grams or more.

The labels for each category within the map suggest the area to focus on for prevention or intervention efforts. In Figure IV-2 each category in the map is shown connected to areas that may be considered for preventive action. If, for example, there is a high mortality rate in the "maternal health/prematurity" category, then interventions may need to focus on the mother's health prior to conception, the mother's overall health behaviors (e.g., smoking or pregnancy intendedness), or perinatal care. Alternatively, a high mortality rate in the "infant health" category would suggest interventions that focus on the babies sleep position to reduce SIDS, the benefits of breast-feeding, access to medical homes, or preventing infectious diseases and injuries.

Figure IV-2. Map Connections to Action



After feto-infant mortality is mapped, the potential for feto-infant mortality reduction is then determined by comparing the mortality rates in the area to the mortality rates in a reference group. The reference group is chosen based on its low feto-infant mortality rate. The reference group for the following analyses is Maricopa County, non-Hispanic White women who are 20 or more years of age and have some education beyond high school. The difference between the area's rate and reference group's rate is considered "excess" mortality and can be described as an

"opportunity gap." The approach assumes that the whole population should be able to experience the same low feto-infant mortality rate as any group within the population.

By partitioning feto-infant mortality into these components and determining the amount of excess (preventable) mortality, efforts to reduce mortality can be focused on those components that contribute the most to excess feto-infant mortality rather than general prevention efforts.

Phase II

Phase II analyses attempt to ascertain potential reasons for the excess mortality in the categories with the highest excess rates. The approach to the analysis depends on the results of Phase I, available data on risk factors, and community information. If, for example, the Phase I analysis indicates a high excess mortality rate in the "maternal care" category, then Phase II analysis may attempt to determine whether the population received adequate prenatal care. Phase II helps to clarify risk factors for efficient and effective intervention targeting. Each potential area of excess ("maternal health and prematurity", "maternal care", "newborn care", and "infant heath") has a slightly different analysis method in Phase II. Although the analyses of each category begin differently, all of the analyses eventually focus on risk factors to be targeted for intervention by the community.

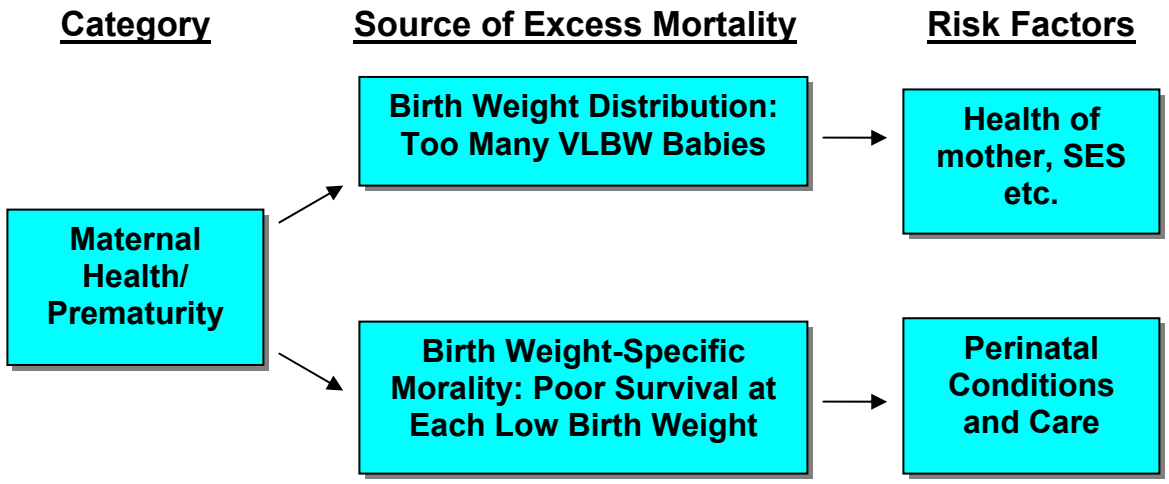
Maternal Health and Prematurity

The deaths attributed to "maternal health and prematurity" are very low birth weight deaths of any age, as determined in Phase I. If the excess mortality is related to maternal health and prematurity, then the first step is to determine whether the deaths are due to a lower birth weight distribution or due to birth weight-specific mortality [4]. These two pathways tend to have different risk factors and causes of death, so different interventions may be necessary.

- A lower birth weight distribution indicates that the group of interest has more very low birth weight births than the reference group. Very low birth weight is a risk factor for death. If, for example, African Americans have more very low birth weight births than the reference group, then the deaths are due to a lower birth weight distribution. When the maternal health/prematurity deaths are mainly associated with the birth weight distribution, the associated risk factors tend to relate to the mother's health, behavior, social and economic situation.
- Birth weight-specific mortality indicates poorer survival at each birth weight relative to the reference group. For example, if the small African American babies are less likely to survive than the small babies in the reference group, this is birth weight-specific mortality. When the high excess maternal health/prematurity deaths are mainly associated with a higher birth weight-specific mortality, then the risk factors tend to relate to the medical care provided to the mother and infant before, during, and immediately after the birth.

Figure IV-3 show these two pathways graphically.

Figure IV-3. Diagram of the Analysis Paths to Maternal Health/Prematurity Excess Death



After determining the source of the mortality and its associated risk factors (according to previous research and literature), two questions are asked:

1) Are there differences between the group of interest and the reference group in the distribution of these risk factors?
2) Are these risk factors associated with death or very low birth weight in this population?

To answer these questions, risk factors are identified and the risk factor distributions for the reference group and the group of interest are compared. Univariate and adjusted logistic regression analyses are conducted to identify the risk factors that predict the outcome in this population. The outcome is very low birth weight when the excess deaths are due to the birth weight distribution. When the excess deaths are associated with birth weight-specific mortality, the outcome is death among the very low birth weight births and fetal deaths.

For some categories, the causes of death are examined as part of the analysis; however, examination of the causes of death is not informative for "maternal health and prematurity" deaths "…because the causes of death for fetal deaths are not well reported and the causes of death for infants in this very low birth weight range are multifactorial, inconsistently reported, and unreliable for comparison when multiple hospitals and physicians are responsible for reporting" [4].

Maternal Care

The deaths attributed to "maternal care" are the larger birth weight (>1,500 grams) fetal deaths. To examine these excess deaths in more detail, risk factors are identified and the risk factor distributions for the reference group and the group of interest are compared. Univariate and adjusted logistic regression analyses are conducted to identify the risk factors that predict these fetal deaths in this population. As with "maternal health/prematurity," causes of death are not informative.

Infant Health

Infant health deaths comprise the larger babies (at least 1,500 grams) who die later in infancy (from 28 days to one year). Further exploration of the deaths in the "infant health" category begins with a cause of death analysis because different risk factors will be important for different causes of death [5]. For example, the risk factors for infections are different from the risk factors associated with injuries. The CDC published an analysis of post-neonatal mortality in which specific causes of death are grouped into broader, causally associated categories [6]. These were the categories used for this analysis. The risk factor analyses follow the same methods as the categories (e.g., "maternal health/prematurity") except that the risk factors are specific to the main causes of death.

Newborn Care

Deaths attributed to the "newborn care" category include larger babies (at least 1,500 grams) who die between birth and 28 days of life. Additional analyses of the newborn care category also follow a cause of death categorization. The analyses proceed similarly to the "infant health" category.

The following sections include the PPOR Phase I and Phase II analyses for all of Maricopa County (Section V), Maryvale (Section VI), and South Phoenix (Section VII). Phase I was presented in the 2003 Maternal and Child Health Needs Assessment [1]; it is presented here again for completeness.

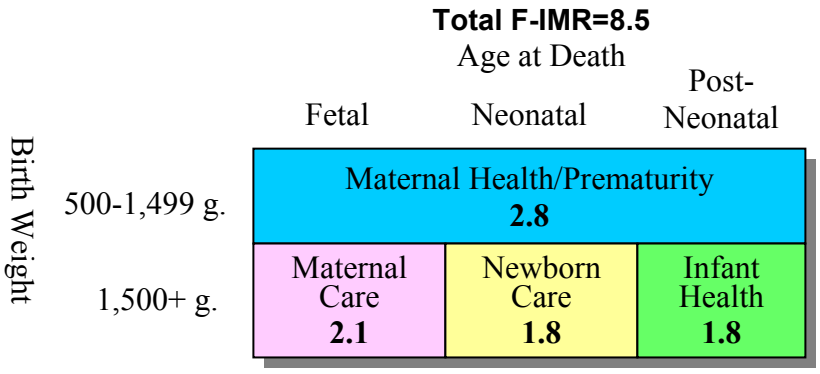
Section V. PPOR: Maricopa County Results

Phase I: Feto-Infant Mortality

During the period from 1996 to 2000, there were a total of 1,925 fetal and infant (feto-infant) deaths and 226,259 live births and fetal deaths in Maricopa County. The corresponding total feto-infant mortality rate (F-IMR) in the county was 8.5 deaths per 1,000 live births and fetal deaths. This means that for every 1,000 recognized pregnancies with 6 months or more gestation, 8.5 resulted in either a fetal death or the death of a baby.

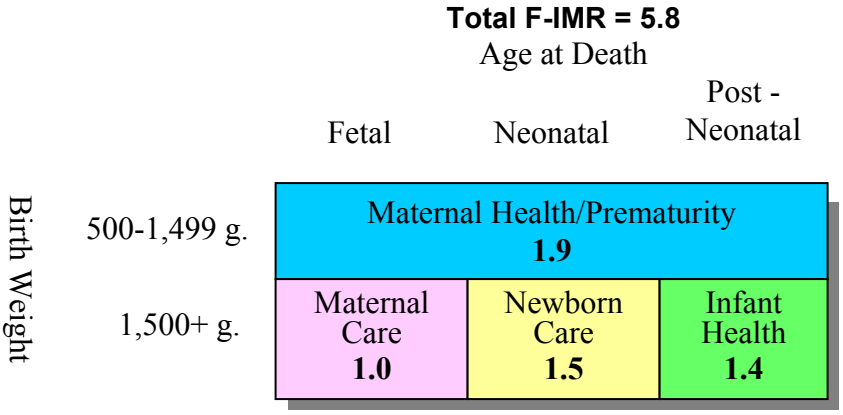
Figure V-1 shows the county's PPOR "map" for the years 1996 through 2000 combined. The map shows the overall F-IMR divided into four cells that suggest the prevention/intervention for the deaths in that group. The mortality rates in the four cells sum to the total feto-infant mortality rate. The highest group-specific feto-infant mortality rate of 2.8 deaths per 1,000 live births and fetal deaths occurred in the "maternal health and prematurity" category. In other words, "maternal health/prematurity" contributed 2.8 deaths to the total rate of 8.5 deaths. The second highest group-specific F-IMR was 2.1 in the "maternal care" category. The F-IMR was 1.8 for both the "newborn care" and "infant health" categories.

Figure V-1. Map of Maricopa County's Feto-Infant Mortality Rate (1996-2000)



During the same time period, 1996 to 2000, the reference group (consisting of Maricopa County, non-Hispanic White women who were at least 20 years of age and had some education beyond high school) had a total F-IMR of 5.8 deaths per 1,000 live births and fetal deaths. There were a total of 571 feto-infant deaths and 98,823 live births and fetal deaths during the period among this group. Figure V-2 shows the reference group's map of feto-infant mortality. Similar to the Maricopa County map, the highest group-specific F-IMR was in the "maternal health/prematurity" category (1.9 deaths per 1,000 live births and fetal deaths).

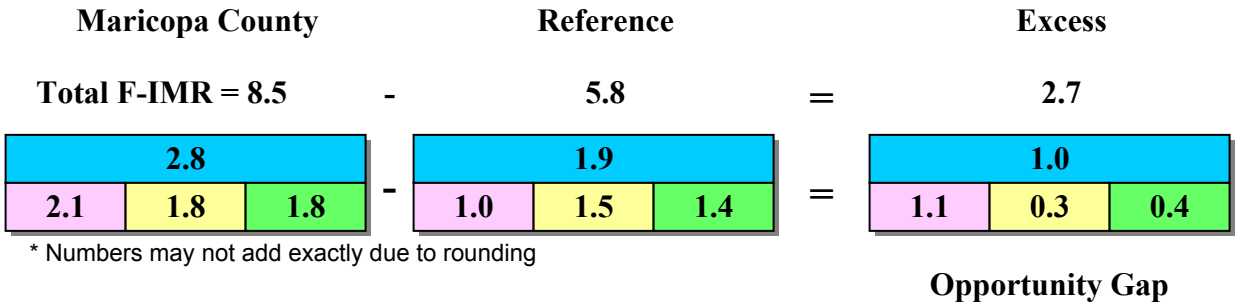
Figure V-2. Map of the Reference Group's Feto-Infant Mortality Rate (1996-2000)
(Maricopa County White Women who were 20 or more years of age and had some education beyond High School)



Excess (Preventable) Feto-Infant Mortality

Figure V-3 shows the excess feto-infant mortality in the county, as well as the method to obtain the excess. The map on the far left is the county's F-IMR map (same as Figure III-1). The middle map is the reference group's F-IMR map (same as Figure III-2). The map on the far right is the excess F-IMR for the county. Subtracting the reference group's F-IMR (5.8) from the county's F-IMR (8.5) yielded an excess (preventable) F-IMR of 2.7 deaths per 1,000 live births and fetal deaths. The excess F-IMR can be described as an "opportunity gap" and shows disparities within the population. The amount of excess mortality suggests the extent to which the F-IMR could be theoretically reduced in the county. If the F-IMR did not differ across groups, then there would have been 2.7 fewer feto-infant deaths per 1,000 live births and fetal deaths in the county during the period 1996 to 2000.

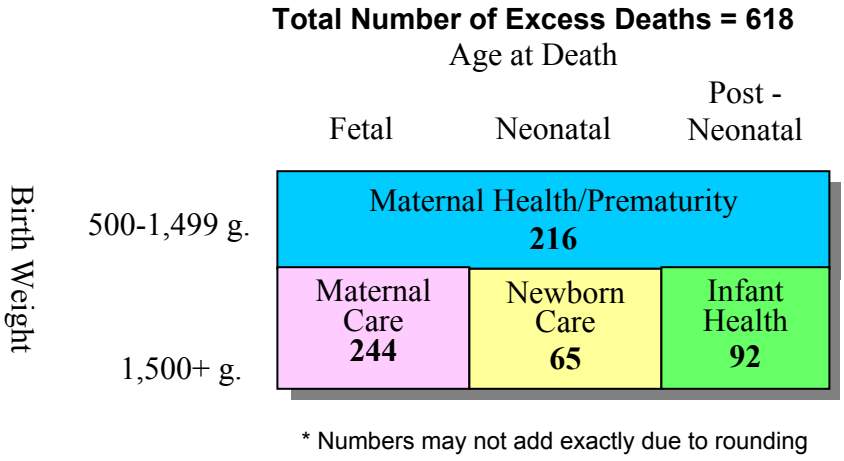
Figure V-3. Maricopa County Opportunity Gap (Excess Feto-Infant Mortality Relative to the Reference Group) Potential for Reduction



The same method was applied to each of the prevention/intervention cells to determine which areas had the highest excess rates. Both the county and the reference group showed the highest F-IMR in the "maternal health and prematurity" category; however, the highest excess group-specific rate was in the "maternal care" category (excess rate of 1.1 deaths per 1,000 live births

and fetal deaths). The lowest excess F-IMR rate occurred in the "newborn care" category with 0.3 deaths per 1,000 live births and fetal deaths.

Figure V-4. Maricopa County Potential for Reduction: Excess Rates Expressed as Number of Deaths



If the whole county's F-IMR was similar to the reference group's F-IMR, there would have been 618 fewer feto-infant deaths in the five-year period than actually occurred. See Figure V-4 for the translation of excess rates into number of excess deaths during the five-year period. Of those 618 feto-infant deaths, 216 were in the "maternal health/prematurity" category, 244 were in the "maternal care" category, 65 were in the "newborn care" category, and 92 were in the "infant health" category. These excess deaths represented 32.1% of the feto-infant mortality in Maricopa County during the period 1996 through 2000.

These findings suggest that successful prevention and intervention efforts focused on "maternal care" and "maternal health/prematurity" should yield larger reductions in the overall excess feto-infant mortality rate than focusing on other points in the health care continuum. Although there is room for improvement in all areas, some categories contribute fewer deaths to the overall excess rate than other areas, for example, "newborn care."

Excess Feto-Infant Mortality for Selected Population Groups

The excess rates were also examined by population groups to determine which groups contributed more to the excess feto-infant mortality. Risk factors within each population group can affect feto-infant mortality. This knowledge allows prevention efforts to be further focused on those population groups with higher mortality rates.

Maternal age was categorized into two groups: women under 20 years old (teenagers) and women 20 or more years of age. Figure V-5 shows the excess feto-infant mortality rate map for women less than 20 years of age and women 20 or more years of age. For teenagers, there were a total of 360 feto-infant deaths and 30,941 live births and fetal deaths. For women 20 or more

years of age, there were a total of 1,563 feto-infant deaths and 195,207 live births and fetal deaths. The excess F-IMR for women less than 20 years of age (5.9 deaths per 1,000 live births and fetal deaths) was more than twice the excess rate for those women who were 20 or more years of age (2.2 deaths per 1,000 live births and fetal deaths).

For teenagers, the highest excess group-specific rates were in the "maternal health/prematurity" and the "infant health" categories. In contrast, the highest group-specific excess rates for the older women were in the "maternal health/prematurity" and "maternal care" categories. Although the "maternal care" category was the highest group-specific excess rate for older women, the rate was still not as high as the "maternal care" category for younger women (their third highest rate). Prevention efforts targeting "infant health" in Maricopa County need to be distributed, taking into consideration high rates in one population and a high number of deaths in the other population. Although the excess rate in the "infant health" category was higher for teenagers (rate of 1.5 versus 0.2), the number of feto-infant deaths for women 20 or more years of age was higher (360 versus 1,563 feto-infant deaths).

Figure V-5. Maricopa County Excess Feto-Infant Mortality Rate (Number of Deaths) by Age Group (1996-2000)

< 20 years old (rate=5.9, N=181)

Maternal Health/Prematurity **2.41 (75)**		
Maternal Care **1.16 (36)**	Newborn Care **0.83 (26)**	Infant Health **1.46 (45)**

= > 20 years old (rate=2.2, N=435)

Maternal Health/Prematurity **0.72 (141)**		
Maternal Care **1.06 (208)**	Newborn Care **0.20 (40)**	Infant Health **0.24 (47)**

Figure V-6. Maricopa County Excess Feto-Infant Mortality Rate (Number of Deaths) by Education Group (1996-2000)

< = 12 years (rate=7.1, N=465)

Maternal Health/Prematurity **2.47 (162)**		
Maternal Care **3.12 (205)**	Newborn Care **0.52 (34)**	Infant Health **0.99 (65)**

> 12 years (rate=0.38, N=59)

Maternal Health/Prematurity **0.13 (20)**		
Maternal Care **-0.03 (-4)**	Newborn Care **0.14 (22)**	Infant Health **0.14 (22)**

The level of maternal education was dichotomized into two groups: women with a high school degree or less education (<=12 years) and women with any education beyond high school (>12 years). There were a total of 844 and 952 feto-infant deaths and 65,524 and 154,567 live births

and fetal deaths for women with a high school education or less and women with some education beyond high school, respectively. The excess rate of feto-infant deaths varied considerably with maternal education level (see Figure V-6). The excess F-IMR for women with a high school degree or less education (7.1 deaths per 1,000 live births and fetal deaths) was 18 times higher than the excess F-IMR for women with some education beyond high school. It is important to point out that education is an antecedent factor for other measures such as income levels, access to care, and behavioral patterns and a proxy measure for socioeconomic status (SES). Therefore, increasing the population's education level would not necessarily decrease all the risk factors for feto-infant mortality but it would help to improve outcomes dependent on incomes, behaviors, and access to care. For women with a high school education or less, the "maternal care" (3.1 deaths per 1,000 live births and fetal deaths) and "maternal health/prematurity" (2.5 deaths per 1,000 live births and fetal deaths) categories showed the highest excess F-IMRs.

Because educational level and age are related in that the younger, teenage mothers are less likely to have some education beyond high school, age and educational level were analyzed together. Table V-1 shows the excess feto-infant mortality rates for the combination of the educational level and age of the mother. Women who were 20 or more years of age and had some education beyond high school had the lowest excess F-IMR (0.29 deaths per 1,000 live births and fetal deaths). The total excess rate for teenagers with some education beyond high school was seven times the size of the rate for the older women with higher education (2.3 deaths per 1,000 live births and fetal deaths). The excess rates for women with a high school education or less were similarly high regardless of the age of the mother: The rate for teenagers was 7.0 deaths per 1,000 live births and fetal deaths and the rate for women 20 or more years of age was 7.1 deaths per 1,000. Although the excess mortality for teenage mothers with some education beyond high school was high, the excess F-IMR for women with a high school degree or less education was higher among both teenagers and older women.

Table V-1. Maricopa County Excess Feto-Infant Mortality Rate (Excess Number of Deaths) by Maternal Age and Education

	< 20 Years Old		=> 20 Years Old	
	<= 12 Years Education	> 12 Years Education	<= 12 Years Education	> 12 Years Education
	Excess	Excess	Excess	Excess
Total	7.00 (47)	2.28 (21)	7.13 (318)	0.29 (42)
Maternal Health/ Prem.	2.82 (59)	0.76 (7)	2.28 (102)	0.10 (15)
Maternal Care	1.68 (35)	-0.17 (-2) [+]	3.81 (170)	-0.02 (-3)
Newborn Care	0.84 (18)	0.57 (5)	0.37 (16)	0.12 (18)
Infant Health	1.67 (35)	1.12 (10)	0.68 (30)	0.09 (13)
Fetal Deaths & Live Births	20,971	9,187	44,529	144,431

[+] Small n; less than 10 deaths in the cell.

Figure V-7 shows the county's excess feto-infant mortality map for race/ethnic groups. Race/ethnicity in the U.S. society can be a proxy measure for many risk factors such as socioeconomic status, living conditions, cultural and behavioral patterns, and life stressors. The number of feto-infant deaths and the number of live births and fetal deaths, respectively, was 118 and 8,466 for non-Hispanic African Americans, 63 and 6,246 for non-Hispanic Native

Americans, 798 and 86,380 for Hispanics, and 903 and 117,751 for non-Hispanic Whites.[2] The overall excess feto-infant mortality rate was highest among African Americans (8.2 deaths per 1,000 live births and fetal deaths), followed by Native Americans (4.3 deaths per 1,000 live births and fetal deaths), Hispanics (3.5 deaths per 1,000 live births and fetal deaths), and then Whites (1.9 deaths per 1,000 live births and fetal deaths).

Figure V-7. Maricopa County Excess Feto-Infant Mortality Rate (Number of Deaths) by Race/Ethnicity (1996-2000)

	Total	MH/P	MC	NC	IH
Hispanic	3.46 (299)	1.39 (120)	1.38 (119)	0.40 (35)	0.29 (25)
African American	8.16 (69)	3.58 (30)	0.97 (8)	0.86 (7)	2.75 (23)
Native American	4.31 (27)	0.87 (5)	1.52 (9)	0.26 (2)	1.66 (10)
White	1.89 (223)	0.57 (67)	0.86 (101)	0.16 (19)	0.30 (36)

Note. "Total" is the overall excess F-IMR, "MH/P" refers to maternal health and prematurity; "MC" refers to maternal care, "NC" refers to newborn care, and "IH" refers to infant health.

Each race/ethnicity showed a different pattern of findings across the excess feto-infant mortality map suggesting that programs should consider targeting these groups differently. The highest group-specific rates for African Americans were in the "maternal health/prematurity" (3.6) and "infant health" (2.8) categories. "Infant health" (1.7) was the highest group-specific rate for Native Americans. Native American's second highest rate was in the "maternal care" category (1.5). The highest group-specific rates for Hispanics and Whites were in the "maternal care" (1.4 and 0.9, respectively) and "maternal health and prematurity" (1.4 and 0.6, respectively) categories.

The excess F-IMRs for each race/ethnicity by education are shown in Table V-2 and by age in Table V-3. Note that the number of deaths in many of the cells in the tables for African American and Native American women was statistically small. Therefore, these rates could change dramatically over time without indicating any statistically meaningful change. The rates are shown to point out that the patterns are similar. Teenagers in each race/ethnicity had higher rates of excess feto-infant mortality than women 20 or more years of age among mothers of all races/ethnicities. In some cases the difference was more dramatic than other cases (e.g., a larger difference between teenagers and older women who were White and a smaller difference between teenagers and older women who were Hispanic). The largest differences in excess rates were for women with a high school degree or less education versus women with some education beyond high school among each race/ethnicity.

[2] For the remainder of the report, the term "African American" refers to non-Hispanic African Americans; "Native American" refers to non-Hispanic Native Americans; "White" refers to non-Hispanic Whites.

Table V-2. Feto-Infant Mortality Excess Rate by Maternal Race/Ethnicity and Education

	White		Hispanic	
	<= 12 Years Education	> 12 Years Education	<= 12 Years Education	> 12 Years Education
	Excess	Excess	Excess	Excess
Total	13.09	0.16	5.03	0.26
Maternal Health/ Prem.	4.08	0.04	1.93	0.15
Maternal Care	5.96	0.01	2.24	-0.15
Newborn Care	0.86	0.04	0.43	0.28
Infant Health	2.19	0.06	0.43	-0.02
Fetal Deaths & Live Births	13,146	103,133	47,293	35,963

	African American		Native American	
	<= 12 Years Education	> 12 Years Education	<= 12 Years Education	> 12 Years Education
	Excess	Excess	Excess	Excess
Total	13.26*	5.47	15.76*	6.60*
Maternal Health/ Prem.	5.85	2.28	3.60+	2.03+
Maternal Care	2.58+	0.12+	5.85	0.76+
Newborn Care	0.77+	0.65	1.80+	1.52+
Infant Health	4.05	2.42	4.50	2.28+
Fetal Deaths & Live Births	2,206	6,047	2,221	3,941

+ Small n; less than 10 deaths in the cell.
* Small N; less than 60 deaths total.

Table V-3. Feto-Infant Mortality Excess Rate by Maternal Race/Ethnicity and Age

	White		Hispanic	
	< 20 Years	=> 20 Years	< 20 Years	=> 20 Years
	Excess	Excess	Excess	Excess
Total	7.01	1.41	4.46	3.19
Maternal Health/ Prem.	2.55	0.39	2.13	1.19
Maternal Care	1.06	0.83	1.12	1.44
Newborn Care	1.20	0.06	0.55	0.36
Infant Health	2.21	0.13	0.66	0.20
Fetal Deaths & Live Births	10,006	107,686	17,573	68,775

	African American		Native American	
	< 20 Years	=> 20 Years	< 20 Years	=> 20 Years
	Excess	Excess	Excess	Excess
Total	10.56*	7.53	8.44*	3.27*
Maternal Health/ Prem.	4.91	3.23	2.10+	0.56
Maternal Care	1.21+	0.90	2.12+	1.37
Newborn Care	0.19+	1.04	1.66+	-0.09+
Infant Health	4.25	2.35	2.56+	1.43
Fetal Deaths & Live Births	1,775	6,687	1,266	4,972

+ Small n; less than 10 deaths in the cell.
* Small N; less than 60 deaths total.

Phase II: Risk Factor Analyses

In Phase II, the analyses focus on potential risk factors for those areas with excess mortality (preventable deaths). In order to conduct the Phase II analyses, there need to be large enough numbers of births and deaths in the group with excess mortality and the preventable death rate needs to be large enough in order for the statistical methods used to be reliable. If the number of births and deaths are too small or the rate of preventable death is too small, the statistical techniques may produce inaccurate results. Therefore, the minimum number of total fetal and infant deaths in a group (e.g., teenagers) had to be at least 60 and the excess mortality rate within a category (e.g., infant health) for that group had to be 1.5 or greater [4]. A table showing the number of fetal and infant deaths, the rate of death per 1,000 live births and fetal deaths, and the excess rate when compared to the reference group appears in Appendix B.

Table V-4 shows the Maricopa County summary of groups with excess fetal and infant death rates by category from the Phase I analyses. The groups and categories that met the criteria for further analyses are shown with a check mark (✓). Appendix C shows the same table with the excess mortality rates for all groups. For the "maternal health and prematurity" category, women with a high school education or less, teenagers, and African American women met the criteria for further analyses. For the "maternal care" category, analyses concentrate on women with a high school education or less and Native American women. "Infant health" category analyses concentrate on teenagers, African Americans, and Native Americans. The "newborn care" category did not meet the criteria for further analyses in any of the groups examined.

Table V-4. Summary of Population Groups with Excess Mortality by Category from the Phase I Results that will be Examined in Phase II (Groups with Check Marks).

Maricopa County Group	Maternal Health & Prematurity	Maternal Care	Newborn Care	Infant Health
All mothers				
< 20 years old	✓			✓
≥ 20 years old				
≤ 12 years Education	✓	✓		
>12 years Education				
White				
Hispanic				
African American	✓			✓
Native American		✓		✓

Maternal Health and Prematurity

Very low birth weight (<1,500 grams) fetal and infant deaths that occur between 24 weeks of gestation (pregnancy) and one year of life comprise the deaths attributed to "maternal health and prematurity." In general, there are two paths to the "maternal health and prematurity" excess death rate. The first potential path is a higher frequency of very low birth weight (VLBW) births (an unfavorable low birth weight distribution) in a group compared to the reference group.

VLBW births are at a higher risk of death than higher birth weight births so a population group with more VLBW births (an unfavorable low birth weight distribution) would probably have a higher mortality rate than a population group with fewer VLBW births. When the "maternal health/prematurity" deaths are mainly associated with the birth weight distribution, the associated risk factors tend to be related to the mother's health, behavior, social and economic situation.

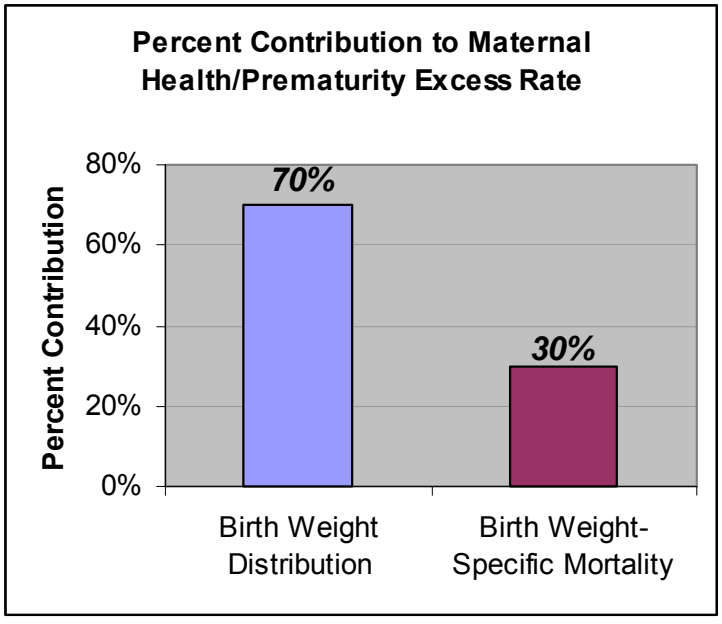
The second potential path is that there are more babies dying at each birth weight in a group compared to the reference group. This is birth weight-specific mortality. When the excess "maternal health/prematurity" deaths are mainly associated with higher birth weight-specific mortality, then the risk factors tend to be related to the medical care provided to the mother and infant before, during, and immediately after the birth. The PPOR approach suggests examining the risk factors associated with the birth weight-specific mortality pathway whenever 40% or more of the "maternal health/prematurity" excess death rate is attributable to this contributing pathway. It is likely easier to change risk factors related to birth weight-specific mortality and medical care than those associated with an unfavorable birth weight distribution [4].

Consequently, the first step in describing the reasons for the excess "maternal health and prematurity" death rate is determining whether this excess is due to more VLBW babies or more babies dying at each birth weight. The contribution of each pathway was determined using the formula developed by Kitagawa [4, 7]. Three Maricopa County population groups had high enough excess fetal and infant death rates attributed to "maternal health/prematurity" to further examine:

- Women under the age of twenty
- Women with a high school education or less
- African American women

Contributing Pathways to the "Maternal Health and Prematurity" Category

Figure V-8. Maricopa County Teenagers



For teenagers, Figure V-8 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant mortality rate in the "maternal health and prematurity" category. Appendix D (Table D-1) shows the rate and percent contribution of the birth weight distribution and birth weight-specific mortality to the overall excess rate by birth weight categories. Seventy percent of the "maternal health and prematurity" excess rate was due to the birth weight distribution. In other words, most of the difference between teenagers and the reference group in

the death rates of very low birth weight babies occurred because teenagers had more very low birth weight babies than the reference group. Therefore, further analyses will focus on those risk factors that may affect birth weight.

Figure V-9. Maricopa County Women with a High School Education or Less.

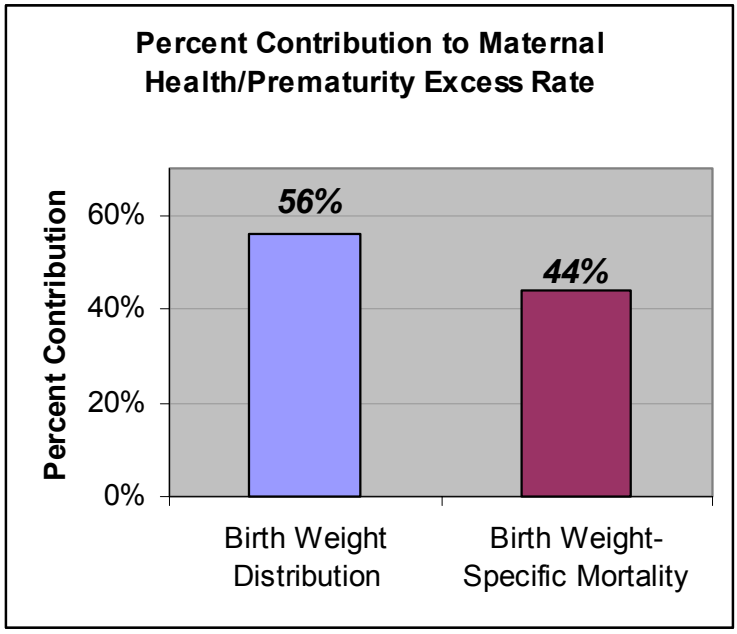
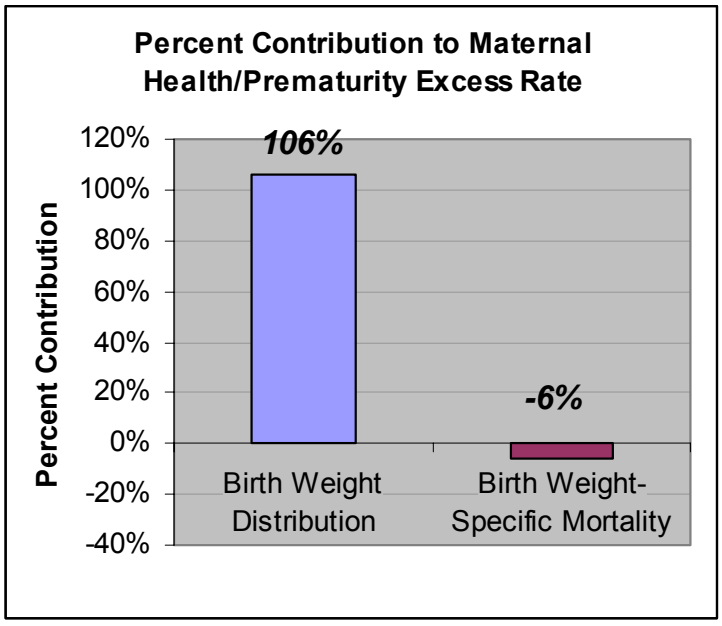


Figure V-9 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant death rate attributed to "maternal health and prematurity," for women with a high school education or less. Appendix D (Table D-2) shows the rate and percent contribution of the birth weight distribution and birth weight-specific mortality pathways to the overall excess mortality rate by birth weight categories. For women with a high school education or less, more than half (56%) of the "maternal health/prematurity" mortality rate was due to the birth weight distribution pathway. The contribution of the birth weight-specific mortality pathway to the excess rate was 44%. For this population, risk factors associated with both the birth weight distribution and birth weight-specific mortality will be examined later in this report.

Figure V-10. Maricopa County African American Women.



For African American women, Figure V-10 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant mortality rate in the "maternal health and prematurity" category. Appendix D (Table D-3) shows the rate and percent contribution of the birth weight distribution and birth weight-specific mortality pathways to the overall African American excess mortality rate by birth weight categories. Among African Americans, the contribution of the birth weight-specific mortality pathway is much lower than in the reference group. It

contributes a negative percentage (-6%) to the overall "maternal health and prematurity" excess mortality rate. On the other hand, African Americans have a very unfavorable birth weight distribution with more very low birth weight when compared to the reference group. This causes the percentage of the "maternal health and prematurity" mortality contributed by the birth weight distribution to be more than 100% (106%).When these two are added together, the percentage of excess adds to 100%.

In other words, the births to African American women in Maricopa County show better survival at each very low birth weight range than the births to women in the reference group. All of the excess "maternal health and prematurity" death rate in African Americans was due to an unfavorable birth weight distribution. There were more very low birth weight babies in the African American group than in the reference group. Therefore, further analyses focus on those risk factors that may affect birth weight in this population group.

Risk Factors for the "Maternal Health/Prematurity" Birth Weight Distribution Category

In all three Maricopa County population groups with high excess mortality in the "maternal health and prematurity" category (teenagers, women with a high school education or less, and African American women), the analyses suggested that attention should focus on those risk factors that affect the birth weight distribution. As stated earlier, these factors tend to be related to the mother's health, behavior, social and economic situation. The risk factors selected for analysis were suggested by the PPOR practice collaborative [4] based on other populations and previous experience, and were available on the birth certificate. The factors examined include marital status, high parity for age, multiple birth (e.g., twins), prenatal care, prematurity, previous preterm infant, small for gestational age, anemia, pregnancy weight gain, tobacco use, alcohol use, and method of payment for delivery. Additional but unavailable risk factors include sexually transmitted disease, infections such as bacterial vaginosis, drug abuse, pregnancy intendedness, domestic violence, income, and the social capital of the community (SES indicator).

Table V-5 shows the risk factor prevalence comparison of the reference group to Maricopa County teenagers, women with a high school education or less, and African American women. An asterisk (*) next to a number denotes that the number is statistically different from the reference group.

Teenagers had lower levels of risk for several factors: fewer teenagers than women in the reference group smoked during pregnancy, drank alcohol during pregnancy, had previous preterm delivery, and had multiple births such as twins. For other risk factors examined, the prevalence of risk for teenagers was higher than the reference group: unmarried, less than 15 pounds weight gain, small for gestational age, prematurity, late entry into prenatal care and fewer than the recommended prenatal care visits.

Relative to the reference group, fewer women with a high school education or less drank alcohol while pregnant, had a previous preterm delivery, a multiple birth such as twins, or anemia. For all other variables examined, proportionately more women with a high school education or less had the risk factor than among women in the reference group: unmarried, tobacco use, less than

Table V-5. Birth Weight Distribution: Differences in Risk Factor Prevalence (Percent).

Risk Factor	Reference Group	<20 Years Old	<=12 Years Education	African American
	Percent	Percent	Percent	Percent
Age				
< 20 Years Old	0	100	32.08	20.96
20-39 Years Old	97.38	0	67.03	77.35
> 40 Years Old	2.62	0	0.89	1.69
<= 12 Years Education	0	69.48	100	26.64
Race/Ethnicity				
White	100	32.44	20.03	0
Hispanic	0	56.97	72.42	0
African American	0	5.74	3.37	100
Native American	0	4.10	3.39	0
Unmarried	15.71	80.72 *	63.22 *	65.53 *
Tobacco Use	8.68	8.34 *	9.69 *	11.26 *
Alcohol Use	1.27	0.66 *	1.02 *	2.14 *
Pregnancy Weight Gain				
< 15 lbs	5.78	6.90 *	10.53 *	10.42 *
15-40 lbs	72.61	65.40 *	66.65 *	66.51 *
> 40 lbs	21.61	27.70 *	22.82 *	23.06 *
High Parity for Age	13.13	31.52 *	25.24 *	26.94 *
Adequacy of Prenatal Care				
Inadequate	5.21	26.83 *	30.63 *	19.05 *
Intermediate	9.99	11.87 *	11.76 *	10.98 *
Adequate	53.87	35.89 *	30.69 *	40.25 *
Adequate Plus	30.94	25.40 *	26.92 *	29.72 *
Trimester Care Began				
First	91.57	64.05 *	60.56 *	74.30 *
Second	7.00	26.65 *	27.52 *	19.11 *
Third	1.08	6.41 *	7.82 *	3.99 *
No Prenatal Care	0.36	2.88 *	4.10 *	2.60 *
Number of PNC Visits				
No Visits	0.39	2.92 *	4.05 *	2.88 *
1 to 4 Visits	0.94	7.12 *	8.89 *	5.41 *
5 to 9 Visits	10.98	25.65 *	26.08 *	20.24 *
10 or More Visits	87.69	64.30 *	60.98 *	71.46 *
Small for Gestational Age	2.77	4.75 *	4.39 *	7.24 *
Premature	9.54	10.99 *	10.52 *	13.79 *
Previous Preterm	0.53	0.12 *	0.16 *	0.55
Multiple Pregnancy	3.44	1.29 *	1.88 *	3.04 *
Anemia	1.99	1.86	1.50 *	2.17
Method of Payment				
AHCCCS	14.86	72.80 *	76.30 *	56.02 *
Private Insurance	81.16	21.16 *	16.35 *	40.30 *
IHS	0.09	0.68 *	0.58 *	0.12
Self	3.13	3.51 *	5.00 *	2.25 *

Note. The factors that defined the reference group were not tested for statistically significant differences between groups.

* Statistically significant difference, $p < .05$, between the group and the reference group.

15 pounds weight gain, small for gestational age, prematurity, late entry into prenatal care and fewer than the recommended prenatal care visits.

Most of the risk factors were more prevalent among Maricopa County African American women than among reference group women. More African American women were unmarried, smoked tobacco during pregnancy, drank alcohol during pregnancy, gained less than 15 pounds during pregnancy, had high parity for age, small for gestational age baby, premature delivery, previous preterm delivery, late entry into prenatal care and fewer than the recommended prenatal care visits. However, fewer African American than reference group women had multiple births such as twins.

Table V-6 shows the odds of having a very low birth weight birth given each of the risk factors individually and adjusted for other risk factors. The table shows the prevalence (%) of the risk factor/characteristic in Maricopa County, the odds, confidence limits around the odds, statistical significance and an estimate of the population attributable percent. The odds show the likelihood of very low birth weight given the risk factor. The odds are shown for each of the risk factors individually (unadjusted) and holding other risk factors constant (adjusted). The population attributable risk percent (PAR%) is an estimate of the percent of very low birth weight outcomes that would be prevented if the predisposing risk factor was eliminated. Note that some risk factors are modifiable while others are not. For example, a multiple pregnancy (e.g., twins or triplets) may not be a modifiable risk factor, whereas smoking cigarettes during pregnancy is a modifiable risk factor. The risk factors included in the adjusted analyses did not include prematurity (< 37 weeks gestation) because very low birth weight is usually a result of prematurity. In this data, approximately 97% of the very low birth weight births were premature. Appendix F shows the results of these analyses with prematurity included in the model.

Taking into account (or adjusting for) other risk factors, a very low birth weight birth was more likely among women with certain risk factors, maternal characteristics, and demographics. Teenagers were 1.5 times more likely than older women to have a very low birth weight baby. Preventing teenage pregnancy could potentially reduce the overall county rate of very low birth weight by 6.5%.

As shown in Table V-6, very low birth weight was 4.3 times more likely among women who gained less than 15 pounds during pregnancy than those who gained 15 to 39 pounds. Over 20% of the very low birth weight babies could potentially be prevented if women gained more than 15 pounds during pregnancy. Extremely preterm births, however, preclude sufficient weight gain. Even when preterm birth was included as a risk factor for very low birth weight (see Appendix F), insufficient weight gain remained a statistically significant risk factor. Gaining 40 or more pounds during pregnancy was protective. Very low birth weight was a quarter less likely in mothers who gained more than 40 pounds during pregnancy than mothers who gained 15 to 39 pounds.

Table V-6. Birth Weight Distribution: Odds of Delivering a Very Low Birth Weight Baby Among All Live Births.

Risk Factor	Maricopa County Prevalence (%)	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age						
< 20 years	13.67	1.41	1.23, 1.61 *	1.51	1.29, 1.76 *	6.52
20-39 years	84.41	C	C	C	C	
40 or more years	1.91	1.56	1.14, 2.14 *	1.37	0.96, 1.94	
Education <= 12 Years	29.67	1.20	1.08, 1.34 *	0.81	0.70, 0.93 *	
Race/Ethnicity						
White	52.49	C	C	C	C	
Hispanic	38.46	1.06	0.95, 1.18	0.74	0.65, 0.85 *	
African American	3.76	2.03	1.66, 2.49 *	1.23	0.99, 1.54 +	0.86
Native American	2.78	0.97	0.71, 1.33	0.57	0.40, 0.82 *	
Asian/Hawaiian	2.50	0.81	0.56, 1.16	0.85	0.58, 1.23	
Unmarried	37.02	1.51	1.36, 1.67 *	1.31	1.15, 1.50 *	10.29
High Parity for Age	17.33	1.42	1.26, 1.60 *	0.88	0.77, 1.02	
Multiple Birth	2.65	15.35	13.66, 17.25 *	18.61	16.28, 21.26 *	31.81
Prenatal Care Visits						
No Visits	1.91	5.59	4.24, 7.36 *	6.05	4.47, 8.19 *	8.80
1 to 4 Visits	4.18	9.10	7.90, 10.48 *	12.08	10.22, 14.29 *	31.65
5 to 9 Visits	17.96	3.16	2.81, 3.54 *	3.92	3.46, 4.45 *	34.40
10 or More Visits	75.95	C	C	C	C	
Previous preterm	0.35	2.28	1.32, 3.96 *	1.89	1.06, 3.36 *	0.31
Anemia	1.84	0.68	0.44, 1.05	0.48	0.30, 0.76 *	
Weight Gain						
<15 lbs.	7.81	4.33	3.84, 4.88 *	4.28	3.76, 4.87 *	20.39
15-40 lbs.	70.41	C	C	C	C	
> 40 lbs	21.78	0.99	0.86, 1.14	0.74	0.64, 0.86 *	
Tobacco use	7.86	1.93	1.67, 2.23 *	1.41	1.19, 1.66 *	3.12
Alcohol use	1.10	1.50	1.00, 2.24	1.03	0.67, 1.59	
Delivery Payment						
Private Insurance	53.00	C	C	C	C	
AHCCCS	41.34	1.13	1.02, 1.26 *	0.61	0.53, 0.70 *	
IHS	0.44	1.05	0.50, 2.22	0.67	0.30, 1.51	
Self	3.80	1.11	0.84, 1.46	0.69	0.52, 0.93 *	
Small for Gestational Age	3.54	6.84	5.99, 7.80 *	3.85	3.33, 4.45 *	9.16

Note. The Maricopa County prevalence is the percent of the risk factor in live births. PAR% = Estimate of the population attributable risk; the percent of VLBW that could be prevented if the predisposing risk factor were eliminated.
* Statistically significant, $p < .05$.
C = Comparison group.

A very low birth weight outcome was 1.3 times more likely among unmarried women than married women. Eliminating those factors that may make women who are unmarried more susceptible to the poor birth outcome of very low birth weight (e.g., socioeconomic conditions, social and parenting support, unplanned pregnancy) could potentially prevent 10.3% of very low birth weight babies.

Multiple births (e.g., twins) were 18.6 times more likely to be low birth weight than singleton births. Although eliminating multiple births is not a realistic goal, it would reduce very low birth weight births by almost 32%. A poor birth weight outcome was 1.9 times more likely among women who had a previous preterm baby than women who did not (including women who did not have a prior pregnancy). Babies who were small for gestational age (calculated from grams falling in the smallest 5% of the weight distribution in the US [7]) were 3.9 times more likely to be very low birth weight, accounting for approximately nine percent of the very low birth weight births.

Smoking during pregnancy increased the likelihood of having a very low birth weight baby by 1.4 times. Preventing smoking during pregnancy could reduce the number of very low birth weight babies by over 3%. This percentage is low even though the odds of very low birth weight are high with smoking because few women smoked during pregnancy. Alcohol use during pregnancy was not a statistically significant risk factor for very low birth weight; however, it is a risk factor for serious birth defects such as fetal alcohol syndrome. Just over one percent of women indicated that they drank alcohol during pregnancy on the birth certificate.

African American women were more likely to have a very low birth weight baby; however, this was only marginally statistically significant when adjusted for the other potential risk factors. Hispanic women and Native American women were less likely than White women to have a very low birth weight birth. Although this finding may not appear to agree with higher excess rates in the "maternal health and prematurity" category among Hispanics and Native Americans, it may be that some of the excess is attributed to birth weight-specific mortality. None of these three groups, however, had high enough rates (1.5 deaths per 1,000 live births and fetal deaths) to warrant further examination.

Women with anemia were 0.48 times less likely to have a very low birth weight baby than women without anemia. Maternal iron deficiency anemia during the first and second trimesters of pregnancy has been shown to be a risk factor for SGA, preterm delivery and consequently low birth weight [9, 10, 11, 12]. It is unclear why anemia would be a protective factor in these analyses but several possibilities exist. First, the birth certificate does not distinguish between anemia occurring early versus late during pregnancy and studies suggest that anemia beginning in the third trimester does not necessary increase the risk of a poor birth outcome. Second, the birth certificate does not specify that the anemia is associated with iron deficiency and there is some evidence suggesting that anemia without iron deficiency does not necessary increase the risk of a poor outcome. Third, these analyses examine very low birth weight (<1,500 grams) rather than low birth weight (<2,500 grams) which may affect the results. Finally, risk factors on the medical portion of the birth certificate are underreported [13], and it is possible that anemia is differentially reported among different birth weights.

Women who paid for their delivery with AHCCCS were 0.61 times less likely to have a very low birth weight birth than women who paid using private insurance. Adjusted for other risk factors (but not individually), women who paid for their delivery by themselves were 0.69 times less likely to have a very low birth weight baby.

Risk Factors for "Maternal Health/Prematurity" Birth Weight-Specific Mortality Category

In addition to those risk factors that affect the birth weight distribution, analysis of risk factors that may affect birth weight-specific mortality for Maricopa County women with a high school education or less was undertaken. Birth weight-specific mortality risk factors were not examined for the other two groups with high rates of excess mortality in the "maternal health/prematurity" category because the groups did not have 40% or more of excess rate due to the birth weight-specific mortality pathway. This analysis examines risk factors for birth weight-specific mortality for those births and fetal deaths with very low birth weight.

The factors selected for analysis were suggested by the PPOR practice collaborative based on other populations and previous experience [4], and availability on the birth and fetal death certificate. The risk factors examined included maternal age, maternal education, maternal race/ethnicity, hospital perinatal care designation level, prematurity, small-for-gestational-age baby, congenital anomalies (as a group), fever during labor and delivery (indication of infection), placenta previa (abnormal implantation of the placenta so that it tends to precede the baby at delivery) and abruptio placenta (premature separation of the placenta), premature rupture of the membranes, precipitous labor (quick labor lasting less than three hours), dysfunctional labor, fetal malpresentation (e.g., breech), cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered), fetal distress (signs indicating that the fetus is not receiving enough oxygen), maternal diabetes, pregnancy induced hypertension, infant transferred to another facility, mother transferred to another facility, assisted ventilation for the newborn, prenatal care, and method of payment. Additional risk factors that were unavailable for analysis included stage of labor upon hospital admission, Group B strep screen, and prenatal steroids.

A larger percentage (43% versus 22%) of the deaths to women with a high school education or less occurred during the fetal stage, whereas a larger percentage (70% versus 48%) of deaths to women in the reference group occurred during the neonatal stage. The percent of deaths by age at death and the time of is death in relation to labor is shown in Table V-7.

Table V-7. Percent of Very Low Birth Weight Deaths by Age at Death and Time of Death.

Risk Factor N=283	Reference Group	<=12 Years Education	
	Percent	Percent	
Death Time			
Before Labor	18.58	32.86	*
During Labor	0	0.35	
After Labor	77.60	56.54	*
Unknown Time	3.83	10.25	*
Death Age			
Fetal	22.40	43.46	*
Neonatal	69.95	47.70	*
Post-neonatal	7.65	8.83	

Table V-8. Birth Weight-Specific Mortality: Differences in Risk Factor Prevalence (Percent).

Risk Factor	Reference Group Percent	<=12 Years Education Percent	
Age			
< 20 Years Old	0	36.08	
20-39	95.97	61.34	
> 40 Years Old	4.03	2.59	
<= 12 Years Education	0	100	
Race/Ethnicity			
White	100	24.85	
Hispanic	0	64.43	
African American	0	6.71	
Native American	0	3.42	
Hospital Perinatal Designation			
Levels 1 and 2	5.47	8.64	*
Level 2 EQ	3.83	1.58	*
Level 3	90.70	89.66	
Premature	97.60	96.35	*
IUGR/SGA	20.83	17.36	*
Congenital Anomalies [a]	0.57	0.69	
Conditions of Labor/Delivery			
Complication	47.82	42.37	*
Febrile (Fever > 100 Degrees)	0.87	2.82	*
Placenta Previa/ Abruptio	7.41	7.39	
Ruptured Membranes	11.11	9.39	
Precipitous Labor (< 3 Hours)	0.98	0.94	
Dysfunctional Labor	0.33	0.47	
Breech / Malpresentation	25.27	20.07	*
Cord Prolapse	1.63	1.53	
Fetal Distress	10.57	8.57	
Medical Risk Factors			
Diabetes	2.07	2.23	
Pregnancy Hypertension	6.43	4.23	*
Infant Transferred [a]	3.88	4.66	
Mother Transferred [a]	6.84	6.04	
Assisted Ventilation < 30 min. [a]	2.85	3.43	*
Assisted Ventilation > 30 min. [a]	3.65	3.57	
Adequacy of Prenatal Care			
Inadequate	6.39	28.46	*
Intermediate	3.93	7.79	*
Adequate	15.08	15.74	
Adequate Plus	74.59	48.01	*
Trimester Care Began			
First	90.43	66.31	*
Second	7.86	21.64	*
Third	0.57	2.94	*
No Prenatal Care	1.14	9.12	*
Number of Prenatal Visits			
No Prenatal Visits	1.52	10.13	*
1 to 4 Visits	9.49	29.87	*
5 to 9 Visits	34.56	29.10	*
10 or More Visits	54.43	30.90	*
Method of Payment			
AHCCCS	16.65	72.84	*
Private Insurance	78.22	17.42	*
IHS	0.11	0.55	*
Self	3.31	5.76	*

Note. The factors that defined the reference group were not tested for statistically significant differences between groups. a = Data unavailable or irrelevant to a fetal death, so denominator is live births only.
* Statistically significant difference, $p < .05$.

Hospital perinatal care designations indicate the level of service a hospital provides for obstetric and nursery care. These designations help identify which hospitals provide an appropriate level of care for deliveries based on risk factors. Level III hospitals provide the highest level of care for those pregnancies that are at the highest risk for poor outcomes. Although equal percentages of women delivered at hospitals with level III perinatal care designations, more women with a high school education or less delivered at level I and II hospitals while more reference group women delivered at level IIEQ hospitals. See Table V-8.

Women with a high school education or less had fewer premature and small for gestational age babies than women in the reference group. Pregnancy hypertension was less prevalent among women with a high school education or less. They also had fewer complications during labor and delivery overall. Women with a high school education or less had significantly fewer breech or malpresenting deliveries than women in the reference group. A higher percentage of women with a high school education or less were febrile (had a fever of 100 degrees or more) during labor and delivery than women in the reference group. Fever can indicate infection. Women with a high school education or less began prenatal care later and had fewer prenatal care visits than women in the reference group.

Table V-9 shows the odds of a fetal or infant death for each risk factor among the very low birth weight births. It also shows the confidence limits around the odds, statistical significance, prevalence (%) of the risk factor in Maricopa County, and an estimate of the population attributable percent. The odds are shown for each of the risk factors individually (unadjusted) and holding other risk factors constant (adjusted). There were two analyses that adjusted for other risk factors: one among all the birth and fetal data and one with only live births. This was necessary because several risk factors were unavailable for the fetal deaths (i.e., congenital anomalies, transferring the mother to another hospital, and payment for delivery). Additionally, some risk factors were irrelevant for fetal deaths (i.e., transferring the infant to another hospital and assisted ventilation for the infant). The population attributable risk percent (PAR%) is an estimate of the percent of very low birth weight fetal and infant mortality that could be prevented if the predisposing risk factor was eliminated. As stated for the birth weight distribution results, some risk factors are modifiable while others are not.

All other risk factors being equal, a fetal or infant death given very low birth weight was more likely among women with certain risk factors. The only maternal demographic characteristic that was a statistically significant risk factor in these analyses was having a high school education or less. This was only true in the analysis of both births and fetal deaths, possibly because of the higher rate of fetal rather than neonatal death among these women. Women with a high school education or less were 1.8 times more likely than women with higher education to have a fetal or infant death if they had a very low birth weight baby. Over 22% of very low birth weight deaths could possibly be prevented if education and all of the other factors that are associated with education (SES, behavior patterns, access to care, etc.) could be increased.

Women who delivered at a level 2EQ hospital (still a high risk perinatal center) had 2.9 times the risk of a very low birth weight fetal or infant death than women who delivered at a level III hospital. Women who delivered at level I and level II hospitals had even higher risk (3.5 times the risk) of a very low birth weight fetal or infant death compared with women who delivered at level III hospitals. Among only the very low birth weight live births, the chances of death at the hospitals with lower perinatal care certification ratings were only marginally statistically significant ($p < .10$) but in the same direction. The difference may be real but with the smaller sample size of only births rather than births and fetal deaths, the effect was not as detectable (less power to detect an effect with smaller sample size).

Fewer than ten prenatal care visits was an important risk factor for very low birth weight fetal and infant deaths: women with no prenatal care were 1.9 times as likely as women with 10 or more visits to have a very low birth weight fetal or infant death. Women with one to four prenatal care visits had 1.8 times the risk and women with five to nine prenatal care visits had 1.8 times the risk. These effects were also statistically significant when only live births were examined. Ensuring that all Maricopa County women had early and adequate prenatal care could potentially reduce the death among very low birth weight babies by 5 to 20 percent.

The very low birth weight infants with congenital anomalies were 24 times more likely to die than the live births without congenital anomalies (unavailable for fetal deaths). If congenital anomalies could be prevented, then the death of very low birth weight babies following live births could potentially be reduced by 12%.

Table V-9. Birth Weight-Specific Mortality: Odds of Fetal and Infant Death Among Very Low Birth Weight.

Risk Factor	Maricopa County Prevalence %	Unadjusted		Adjusted Births & Fetals[+]			Adjusted Births Only [++]		
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	PAR %	Odds	95% Confidence Limits	PAR %
Age									
< 20 Years Old	16.94	1.42	1.13, 1.78 *	1.02	0.76, 1.36		1.24	0.90, 1.78	
20-39 Years Old	79.63	C	C	C	C	C	C	C	C
40 or More Years Old	3.43	0.95	0.57, 1.59	0.96	0.52, 1.77		0.65	0.30, 1.56	
Education <=12 Years	35.60	2.01	1.66, 2.43 *	1.80	1.39, 2.32 *	22.17	1.26	0.86, 1.64	
Race/Ethnicity									
White	48.69	C	C	C	C	C	C	C	C
Hispanic	38.50	1.34	1.11, 1.63 *	0.81	0.63, 1.04 [+]		1.07	0.74, 1.34	
African American	8.01	0.98	0.68, 1.39	0.83	0.54, 1.29		0.76	0.43, 1.24	
Native American	2.87	1.02	0.58, 1.78	0.67	0.33, 1.35		0.83	0.38, 1.91	
Asian/Hawaiian	2.50	0.46	0.19, 1.10	0.42	0.17, 1.04 [+]		0.68	0.26, 1.70	
Hospital Perinatal Care									
Levels 1& 2	6.90	3.37	2.45, 4.62*	3.46	2.39, 5.01 *	14.51	1.79	0.93, 3.46 [+]	5.17
Level 2EQ	2.60	2.07	1.24, 3.46 *	2.92	1.62, 5.29 *	4.75	2.18	0.99, 4.79 [+]	2.98
Level 3	90.37	C	C	C	C		C	C	C
Premature	96.97	1.09	0.64, 1.87	1.01	0.52, 1.94		2.12	0.61, 7.42	
Prenatal Care Visits									
No Visits	7.06	2.30	1.57, 3.35 *	1.89	1.18, 3.03 *	5.91	2.05	1.21, 3.50 *	6.90
1 to 4 Visits	19.85	2.21	1.70, 2.89 *	1.82	1.34, 2.46 *	14.00	1.7	1.19, 2.42 *	12.20
5 to 9 Visits	32.74	1.88	1.48, 2.38 *	1.81	1.40, 2.34 *	20.96	1.56	1.16, 2.11 *	15.49
10 or More Visits	40.35	C	C	C	C	C	C	C	C
Small for Gest. Age	19.30	0.86	0.68, 1.09	0.80	0.58, 1.10		0.53	0.34, 0.82 *	
Congenital Anomalies [a]	0.61	29.35	6.69, 128.8 *	N/A	N/A	N/A	24.03	4.96, 116.4 *	12.32
Labor Complications	43.95								
Febrile (Fever > 100)	1.63	1.72	0.91, 3.27	2.03	0.98, 4.23 [+]	1.65	2.74	1.27, 5.92 *	2.76
Placenta Previa/Abruptio	7.29	1.12	0.80, 1.57	0.81	0.53, 1.22		0.83	0.51, 1.35	
Labor < 3 Hours	0.88	2.06	0.88, 4.85	2.23	0.80, 6.23		3.09	1.07, 8.90 *	1.81
Dysfunctional Labor	0.28	3.96	0.88, 17.74	3.44	0.51, 23.34		6.59	0.99, 43.83 [+]	
Breech/Malpresentation	22.97	0.98	0.78, 1.20	1.09	0.85, 1.40		1.28	0.96, 1.69 [+]	
Cord Prolapse	1.47	3.19	1.66, 6.11 *	4.10	1.81, 9.26 *	4.36	1.81	0.60, 5.51	
Distress	8.84	0.61	0.42, 0.87 *	0.62	0.41, 0.94 *		0.75	0.48, 1.18	
Diabetes	2.47	0.56	0.28, 1.11	0.57	0.26, 1.26		0.44	0.15, 1.24	
Pregnancy Hypertension	5.21	0.58	0.37, 0.93 *	0.47	0.26, 0.85 *		0.37	0.17, 0.82 *	
P. Membrane Rupture	1.30	0.67	0.48, 0.94 *	0.65	0.45, 0.95 *		0.85	0.57, 1.27	
Infant Transfer [a]	4.38	1.39	0.87, 2.22	N/A	N/A	N/A	0.72	0.33, 1.58	
Mother Transfer [a]	6.46	0.82	0.53, 1.26	N/A	N/A	N/A	0.93	0.58, 1.51	
Ventilator <30 mins [a]	2.99	1.82	1.07, 3.10 *	N/A	N/A	N/A	2.67	1.48, 4.82 *	4.76
Ventilator >30 mins [a]	3.38	2.00	1.22, 3.27 *	N/A	N/A	N/A	2.19	1.22, 3.93 *	3.87
Payment for Delivery [a]									
AHCCCS	43.45	0.53	0.44, 0.64 *	N/A	N/A	N/A	0.72	0.54, 0.97 *	
IHS	0.39	0.66	0.14, 3.19	N/A	N/A	N/A	0.99	0.15, 6.75	
Self Pay	4.25	0.67	0.41, 1.09	N/A	N/A	N/A	0.88	0.49, 1.61	
Private Insurance	48.61	C	C	C	C	C	C	C	C

Note. The Maricopa County prevalence is the percent of the risk factor among very low birth weight births and fetal deaths or the prevalence in only births for those factors denoted with *a*. Two adjusted analyses were conducted: 1) available variables in both the birth and fetal databases (+), and 2) All variables were included so only the live births were used (++). PAR% = Estimate of the population attributable risk or the percent of death among VLBW that could be prevented if the predisposing risk factor were eliminated. a = Data not recorded in the fetal death database from 1996 to 1999 so not included in birth and fetal model models. C = Comparison group. N/A = Not available.

* Statistically significant, $p < .05$.

[+] Marginally significant, $p < .10$ (presented in this table to see similarities/differences when different denominators were used).

birth weight newborns needing assisted ventilation were over 2 times more likely to die than those not needing assisted ventilation.

Precipitous labor (quick labor lasting less than three hours) increased the risk of infant death following a live birth by three. It was not statistically significance in the model that included fetal deaths, possibly because a very small number and proportion of fetal deaths died during delivery. Women who had a fever over 100 degrees (indication of infection) during labor and delivery were 2.7 times more likely to have an infant death following a very low birth weight live birth than women without a fever (marginally significant and in the same direction for the model that included fetal deaths).

A very low birth weight death was 4.1 times more likely following cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered) but this was not statistically significant in the model with births only. The estimate of the percent of attributable mortality due to cord prolapse was only 0.6% because the prevalence of the risk factor was so low. Very low

Fetal distress (signs indicating that the fetus is not receiving enough oxygen) was protective such that the risk of death was 0.62 times less than without fetal distress. This was not statistically significant in the model with only live births. It may be the fact that the distress was noted and measured which prompted medical intervention to be taken that helped the fetus survive. Women with pregnancy hypertension were 0.47 times less likely to have a fetal or infant death than women without pregnancy hypertension (statistically significant in both sets of analyses). It is possible that women with gestational hypertension are more likely to have delivery induced early and thus help the fetus survive. Women with premature membrane rupture were 0.65 times less likely to have a very low birth weight fetal or infant death than women without. This finding was not statistically significant in the model with only live births. Having the Arizona Health Care Cost Containment System (AHCCCS) pay for delivery was protective, such that the risk of death was 0.72 times less likely than private insurance paying for the delivery. Some findings are puzzling and need further examination.

Summary of the Maternal Health and Prematurity Category Results

In Maricopa County, teenagers, women with a high school education or less, and African American women had high excess mortality in the "maternal health and prematurity" category. More than 50% of this excess for each of these groups was related to a disadvantageous birth weight distribution (more very low birth weight babies than in the reference group). Therefore, risk factors associated with the birth weight distribution were examined. In addition, women with a high school education or less had at least 40% of their excess mortality rate due to birth weight-specific mortality (more deaths at each birth weight). Thus risk factors related to birth weight specific mortality were examined for women with a high school education or less.

Several risk factors were deemed important for excess mortality in the "maternal health and prematurity" category. The summary consists of risk factors that met two conditions: a) Maricopa County women with these risk factors were more likely to have a poor birth outcome (very low birth weight or feto-infant mortality) and b) there was a higher prevalence (percent) of the risk factor in the group with the high excess mortality in the "maternal health/prematurity" category than in the reference group. Table V-10 shows those risk factors deemed important by each pathway (birth weight distribution or birth weight-specific mortality) to excess mortality in the "maternal health/prematurity" category.

For the birth weight distribution, the risk factors deemed important for this population consisted of small for gestational age, prematurity, unmarried, smoking, less than 15 lbs. pregnancy weight gain, and few or no prenatal care visits. Smoking does increase the chances of having a very low birth weight baby. Smoking cigarettes was not checked for teenagers in the table because teenagers did not smoke more than the reference group. In each group including the reference group, however, at least 8% of the women smoked during pregnancy. This suggests that there is room to reduce these smoking rates further.

Table V-10. Summary of Important Risk Factors for Deaths in the "Maternal Health/Prematurity" Category.

Birth Weight Distribution (Maternal Health)			
Risk Factors	**Teenagers**	**≤ 12 Yrs Education**	**African American**
IUGR/SGA	✓	✓	✓
Prematurity	✓	✓	✓
Unmarried (social support/SES)	✓	✓	✓
Smoking		✓	✓
Weight Gain < 15 lbs.	✓	✓	✓
Few Prenatal Care Visits	✓	✓	✓
Birth Weight-Specific Mortality (Perinatal Conditions/Care)			
Hospital Service Level		✓	
Few Prenatal Care Visits		✓	
Fever During Labor/Delivery		✓	
Assisted Ventilation		✓	

Note. Check marks indicate the risk factor is important for deaths in the "maternal health/prematurity" category.

Risk factors for perinatal conditions and care were only examined for women with a high school education or less because this was the only group that had at least 40% of their mortality explained by the birth weight-specific mortality path to excess mortality in the "maternal health and prematurity" category. The risk factors consisted of the hospital perinatal care designation, few or no prenatal care visits, a fever during labor or delivery, and the infant needing assisted ventilation for breathing.

Maternal Care

Deaths in the "maternal care" category are higher birth weight (1,500 grams or more) fetal deaths. Although this group consists of larger birth weights in this methodology, birth weights in the 1,500 to 2,500 gram range are still low and birth weights of at least 4,250 grams are considered high birth weight. Both the low and high birth weight babies are at higher risk for complications than those between 2,500 and 4,250 grams. Potential risk factors that may increase the risk of fetal death include maternal infection, maternal injury, delays in obtaining medical care for prenatal care or delivery, delays in recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring [14]. The risk factors selected for analysis that were available on the fetal death certificate included age, education, race/ethnicity, the number of prenatal care visits, the trimester that prenatal care began, adequacy of prenatal care utilization index (APNCUI; describes the adequacy of the timing of prenatal care initiation and the number of visits) [15], hospital perinatal service level, prematurity, small for gestational age, placenta previa (abnormal implantation of the placenta) or abruptio placenta (premature separation of the placenta), fetal malpresentation (e.g., breech), cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered), fetal distress

Table V-11. Maternal Care: Differences in Risk Factor Prevalence (Percent).

Risk Factor	Reference Group	≤12 Years Education		MC Native American	
	Percent	Percent		Percent	
Age < 20 Years	0	31.97		20.32	
Education <= 12 Years	0	100		35.98	
Race/Ethnicity					
White	100	20.04		0	
Hispanic	0	72.43		0	
African American	0	3.33		0	
Native American	0	3.40		100	
Asian	0	0.80		0	
Number of Prenatal Care Visits					
No Visits	0.38	4.00	*	1.83	*
1 to 4 Visits	0.88	8.69	*	8.26	*
5 to 9 Visits	10.82	26.08	*	31.54	*
10 or More Visits	87.91	61.23	*	58.37	*
Trimester Care Began					
First	91.58	60.55	*	64.80	*
Second	6.98	27.57	*	26.26	*
Third	1.08	7.87	*	7.23	*
No Prenatal Care	0.35	4.02	*	1.71	*
Premature	8.79	9.72	*	8.87	
APNCUI					
Inadequate	5.20	30.65	*	26.37	*
Intermediate	10.03	11.79	*	14.29	*
Adequate	54.16	30.83	*	40.46	*
Adequate Plus	30.60	26.73	*	18.89	*
Hospital Perinatal Designation					
Levels 1 and 2	38.84	35.25	*	68.40	*
Level 2 EQ	22.83	6.01	*	3.89	*
Level 3	38.04	58.43	*	26.74	*
IUGR/SGA	2.62	4.32	*	3.25	*
Delivery Complications					
Placenta Previa/Abruptio	1.08	0.74	*	0.97	
Breech/Malpresentation	3.98	2.60	*	3.14	*
Cord Prolapse	0.22	0.14	*	0.11	
Fetal Distress	5.60	6.55	*	8.64	*
Medical Risk Factors					
Diabetes	2.11	1.92	*	7.47	*
Pregnancy Hypertension	2.78	1.59	*	3.83	*

Note. The factors that defined the reference group were not tested for statistically significant differences between the groups. APNCUI = Adequacy of Prenatal Care Utilization Index.
* Statistically significant difference, $p < .05$, between the group and the reference group.

(signs indicating that the fetus is not receiving enough oxygen), maternal diabetes, and pregnancy-related hypertension.

Table V-11 compares the prevalence of the risk factors for the reference group with that of women with a high school education or less and Native American women. These two groups had excess feto-infant mortality in the "maternal care" category.

In comparison to the reference group, larger percentages of women with a high school education or less and larger percentages of Native American women began prenatal care later in their pregnancy and had fewer prenatal care visits. This resulted in significantly larger percentages of these two groups of women than reference group women receiving inadequate prenatal care.

Compared with the reference group, a smaller percentage women with a high school education or less and a smaller percentage of Native American women received adequate plus prenatal care (intensive care for high risk pregnancies). Small for gestational age (SGA) babies were more

prevalent among the women with less education and among Native American women than among women in the reference group.

In comparison to the reference group, a larger percentage of Native American women delivered in hospitals with level one or two perinatal care designation levels. Correspondingly, fewer Native American women delivered in level 2EQ or level 3 hospitals which are more equipped to handle high risk pregnancies. Fetal distress was more prevalent among the Maricopa County Native American Women than among the reference group women. In comparison to the reference group, larger percentages of Native American mothers had the medical risk factors of diabetes and pregnancy-related hypertension. Almost 7.5% of the Native American women had diabetes compared with approximately 2% of the reference group women.

Fetal distress was more prevalent among women with a high school education or less than among women in the reference group. A larger percentage of women with a high school education or less delivered at level 3 hospitals (the most equipped hospitals for high risk pregnancies). Several risk factors were less prevalent among women with less education than among women in the reference group: placenta previa/abruptio, malpresentation of the fetus for birth, cord prolapse, maternal diabetes, and maternal hypertension.

Table V-12 shows the prevalence of the risk factor or maternal demographic characteristic among county women with a higher birth weight (> 1,500 grams) fetal death or live birth; the odds of having a fetal death given the risk factor; the confidence limits around the odds; the population attributable risk percent (PAR%) is the percent of higher birth weight fetal deaths that could potentially be prevented if the predisposing risk factor was eliminated. Of course, some risk factors like the education of the mother are modifiable while others such as ethnicity are not.

Women with a high school education or less were almost six times more likely to have a higher birth weight fetal death than women with more education. If women's level of education could be increased along with those factors affected by education, then 59.5% of those deaths in the "maternal care" category could potentially be prevented. Teenagers were 0.66 times less likely to have a death in the "maternal care" category than women aged 20 to 39 years old. Initially, Hispanic women appeared 1.3 times more likely to have higher birth weight fetal death than White women. This excessive risk was not present when the model took other risk factors into account, probably due to education and prenatal care as confounding factors; they end up less likely having a death in the "maternal care" category.

Women who received inadequate prenatal care were 1.6 times more likely to have a higher birth weight fetal death. If women received adequate prenatal care, 8% of the higher birth weight fetal deaths could be prevented. Women who received adequate plus prenatal care (intensive) were 1.8 times more likely to have a death in the "maternal care" category. Adequate plus care would result in a higher rate of mortality than adequate care because pregnancies receiving intensive prenatal care are selected for their high-risk. If the risk factors that made a pregnancy high risk and/or the management of high risk pregnancies could be perfected so that they were not high risk pregnancies, then higher birth weight fetal deaths might be reduced by almost 18%.

Table V-12. Maternal Care: Odds of a Higher Birth Weight (> 1,500 grams) Fetal Death.

Risk Factor	Maricopa County Prevalence (%)	Unadjusted		Adjusted		PAR %
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age						
< 20 Years Old	13.64	1.05	0.81, 1.35	0.66	0.48, 0.89 *	
20-39 Years Old	84.46	C	C	C	C	
> 40 Years Old	1.90	0.88	0.44, 1.78	0.65	0.24, 1.77	
< 12 years Education	29.70	4.13	3.39, 5.03 *	5.95	4.57, 7.74 *	59.50
Race/Ethnicity						
White	52.52	C	C	C	C	
Hispanic	38.48	1.27	1.05, 1.54 *	0.52	0.40, 0.68 *	
African American	3.72	1.07	0.65, 1.76	0.78	0.45, 1.37	
Native American	2.78	1.35	0.81, 2.24	0.95	0.55, 1.62	
Asian	2.50	0.94	0.50, 1.77	0.88	0.41, 1.88	
Premature	9.10	13.34	11.13, 15.99 *	N/A	N/A	
Hospital Perinatal Designation						
Levels 1 and 2	37.85	0.99	0.81, 1.20	1.17	0.93, 1.47	
Level 2 EQ	14.85	0.62	0.45, 0.86 *	0.79	0.53, 1.19	
Level 3	46.94	C	C	C	C	
Small for Gestational Age	3.41	5.20	4.06, 6.67 *	4.52	3.35, 6.09 *	10.71
Delivery Complications						
Placenta Previa/Abruptio	0.92	10.23	7.40, 14.12 *	9.58	6.55, 14.02 *	7.32
Breech/Malpresentation	3.27	2.33	1.65, 3.29 *	1.67	1.09, 2.57 *	2.14
Cord Prolapse	0.18	50.02	35.07, 71.33 *	50.96	32.99, 78.73 *	8.25
Fetal Distress	6.05	1.04	0.72, 1.50	0.71	0.46, 1.12	
Medical Risk Factors						
Diabetes	2.20	2.35	1.56, 3.54 *	2.11	1.28, 3.46 *	2.38
Pregnancy Hypertension	2.27	1.39	0.83, 2.33	1.11	0.51, 2.01	
APNCUI						
Inadequate	15.86	2.52	1.92, 3.29 *	1.55	1.14, 2.30 *	8.04
Intermediate	11.12	1.42	0.99, 2.04	1.28	0.86, 1.88	
Adequate	44.56	C	C	C	C	
Adequate Plus	28.47	2.32	1.83, 2.94 *	1.77	1.36, 2.30 *	17.92
Prenatal Care Visits						
0 Visits	1.88	6.45	4.51, 9.23 *	N/A	N/A	
1 to 4 Visits	4.05	4.51	3.34, 6.09 *	N/A	N/A	
5 to 9 Visits	17.85	2.51	2.02, 3.11 *	N/A	N/A	
10 or More Visits	76.22	C	C	C	C	
Trimester Prenatal Care Began						
First	78.43	C	C	N/A	N/A	
Second	15.84	1.22	0.95, 1.56	N/A	N/A	
Third	3.86	1.23	0.77, 1.96	N/A	N/A	
No Prenatal Care	1.87	0.27	0.07, 1.07	N/A	N/A	

Note. The Maricopa County prevalence is the risk factor percentage among live births and fetal deaths with birth weights > 1,500 grams. PAR% = Estimate of the population attributable risk or the percent of fetal deaths that could be prevented if the predisposing risk factor were eliminated. C= Comparison group. APNCUI = Adequacy of prenatal care utilization index [15].

* Statistically significant, $p < .05$.

The hospitals perinatal care designation level was unrelated to higher birth weight (> 1,500 grams) fetal deaths in the county. Small for gestational age (SGA) babies were 4.5 times more likely to die prior to birth than babies who were not small. If SGA could be prevented, then 10.7% of the higher birth weight fetal deaths could be prevented. Women with conditions of the placenta such as abruptio placenta and placenta previa were 9.6 times more likely to have a

higher birth weight fetal death than women without these risks. Approximately 7.3% of the deaths in the "maternal care" category could potentially be prevented if these conditions could be prevented. A fetal death was 1.7 times more likely when the fetus was in the wrong position for delivery (e.g., breech). If the malpresentation of the fetus could be prevented, 2.1% of the deaths in the "maternal care" category could be prevented. Cord prolapse increased the chances of a higher birth weight fetal death by 51 times and had an estimated population attributable risk percentage of 8.25%. Maternal diabetes increased the odds of a higher birth weight fetal death by 2.1 and eliminating diabetes could potentially reduce these deaths by 2.4%. Fetal distress and pregnancy hypertension were not statistically significant predictors of deaths in the "maternal care" category.

Summary of Maternal Care Category Results

Many risk factors for the higher birth weight fetal deaths are not available on vital records. Information regarding maternal infection, maternal injury, delays in obtaining medical care for delivery, delays in recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring were not readily available for analysis. Of the risk factors analyzed, several predicted the deaths in the "maternal care" category and also were more prevalent in the groups with high excess mortality in the category; these risk factors are shown in Table V-13.

Table V-13. Summary of Important Risk Factors for Deaths in the "Maternal Care" Category

Risk Factors	≤ 12 Yrs Education	Native American
Inadequate Prenatal Care	✓	✓
Small for Gestational Age	✓	✓
Maternal Diabetes		✓
Prematurity	✓	

Note. Check marks indicate the risk factor is important.

The important risk factors that are subject to change included inadequate prenatal care and lower educational level. Women who received adequate levels of prenatal care (as defined by ACOG) and/or had some education beyond high school were less likely to have a higher birth weight fetal death. Diabetes was a risk factor for the Native American women.

Although placenta previa/abruption, breech, and cord prolapse were significant risk factors for a higher birth weight (> 1,500 grams) fetal death, the groups with the excess mortality in the "maternal care" category (Native American women and women with a high school education or less) did not have higher levels of these risk factors than the reference group.

Newborn Care

Phase I analyses indicated that there was not much variability in the "newborn care" category among the different groups of mothers. The excess mortality did not meet the criterion of 1.5 deaths per 1,000 live births and fetal deaths in any of the groups examined. These results suggest that newborn care was not an issue in Maricopa County. Therefore, Phase II analyses of the "newborn care" category were not conducted.

Infant Health

Deaths attributed to "infant health" are those deaths that occur to larger babies (> 1,500 grams) from 28 days to one year of life. The first analysis for excess death in the "infant health" category was an examination of the underlying cause of death [5]. The basis of the classification of the causes of death into larger categories was a classification by the CDC for the purposes of post-neonatal mortality surveillance [5]. The categories were perinatal conditions, congenital conditions, infections, sudden infant death syndrome (SIDS), injuries, ill-defined, and other. See Table V-14 for a brief explanation of each category.

Table V-14. Underlying Cause of Death (COD) Categories Used for Classification of the Deaths Due to "Infant Health" Risk Factors and Causes.

COD Category	Description
Perinatal Conditions	Deaths due to perinatal conditions include those due to maternal factors and complications of pregnancy, disorders of gestation and fetal growth, birth trauma, specific respiratory, cardiovascular and infectious conditions specific to perinatal period, hemorrhagic and hematological disorders of the newborn, and endocrine and metabolic disorders
Congenital Conditions	Birth defects are physical or mental disabilities that may be fatal. A few examples are Spina Bifida, Downs Syndrome, and Cleft Palate but thousands of birth defects are currently known.
Infections	Include respiratory, gastrointestinal, central nervous system, septicemia, and others.
SIDS	The unexpected, sudden death of an infant under one year of age that continues to be unexplained after a complete investigation
Injuries	Consist of homicide, motor vehicle accidents, poisoning, falls, fire, drowning, suffocation, and other unintentional injuries.
Ill-defined	Ill-defined deaths include other symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified.
Other	All other causes of death that do not fit into the classification scheme are included in the other category.

Infant Health Causes of Death

Three groups of women in Maricopa County had high rates of infant mortality attributed to the "infant health" category: Teenagers, African Americans, and Native Americans. The largest underlying causes of death in the three groups were infections and SIDS. These are the same leading causes of death for the county as a whole (see Appendix G). Respiratory infections were the most common group of infections.

Table V-15 shows the number of "infant health" deaths, percent of deaths, and rate of death per 100,000 live births for each cause of death category for the reference group and teenagers. It also shows the excess rate of death to teenage mothers. Note that the rate is per 100,000 rather than per 1,000 for the cause of death analyses. Negative numbers for the excess death rate mean that the group of interest (e.g., teenagers) had fewer deaths from 1996 to 2000 in that category than the reference group. Tables V-16 and V-17 provide the same information for African Americans and Native Americans, respectively. The causes of death tables are based on small numbers of events in a statistical sense; it is important to be aware of how variable these numbers can be without indicating a meaningful change. For example, if the number of SIDS deaths to teenagers reported here (26) were compared to the number over the next five-year period, the number of deaths could range from 17 to 38 without reflecting any statistically significant change (based on

a Poisson distribution 95% confidence interval) [16]. The number of deaths is given in the tables so the absolute size can be taken into account. With that in mind, the only relevant way to compare across groups is to examine the rates.

For Maricopa County teenager mothers, the underlying cause of death with the highest rate was SIDS with 84.3 deaths per 100,000 live births, of which almost 56 per 100,000 live births were excess. The second highest category was infections with approximately 32 excess deaths per 100,000 live births, followed by congenital conditions (17.5/100,000).

Table V-15. Underlying Cause of Death for Infant Health Deaths: Maricopa County Teenagers Compared to the Reference Group

Cause of Death	Reference Group			Less Than 20 Years Old			Excess Rate
	N	Percent of Deaths	Rate per 100,000 Births	N	Percent of Deaths	Rate per 100,000 Births	
Perinatal Conditions	**4**	**2.92%**	**4.05**	**5**	**5.68%**	**16.22**	**12.16**
Congenital Conditions	**21**	**15.33%**	**21.28**	**12**	**13.64%**	**38.92**	**17.64**
Infections	**26**	**18.98%**	**26.35**	**18**	**20.45%**	**58.38**	**32.03**
SIDS	**28**	**20.44%**	**28.37**	**26**	**29.55%**	**84.33**	**55.95**
Injuries	**17**	**12.41%**	**17.23**	**9**	**10.23%**	**29.19**	**11.96**
Ill-defined	**1**	**0.73%**	**1.01**	**0**	**0.00%**	**0.00**	**-1.01**
Other	**40**	**29.20%**	**40.54**	**18**	**20.45%**	**58.38**	**17.84**
Total	**137**	**100.00%**	**138.83**	**88**	**100.00%**	**285.41**	**146.57**
Live Births	98,679			30,833			

Note. Use caution when interpreting rates with less than 10 deaths because they tend to be statistically unreliable.

Figure V-11 graphically shows the "infant health" related mortality rates (per 100,000 live births and fetal deaths) for each cause of death category for higher birth weight (> 1,500 grams) post-neonatal deaths to teenagers.

Figure V-11. Rate of Death by Underlying Cause of Death Category: Maricopa County Women <20 Years Old Compared with the Reference Group

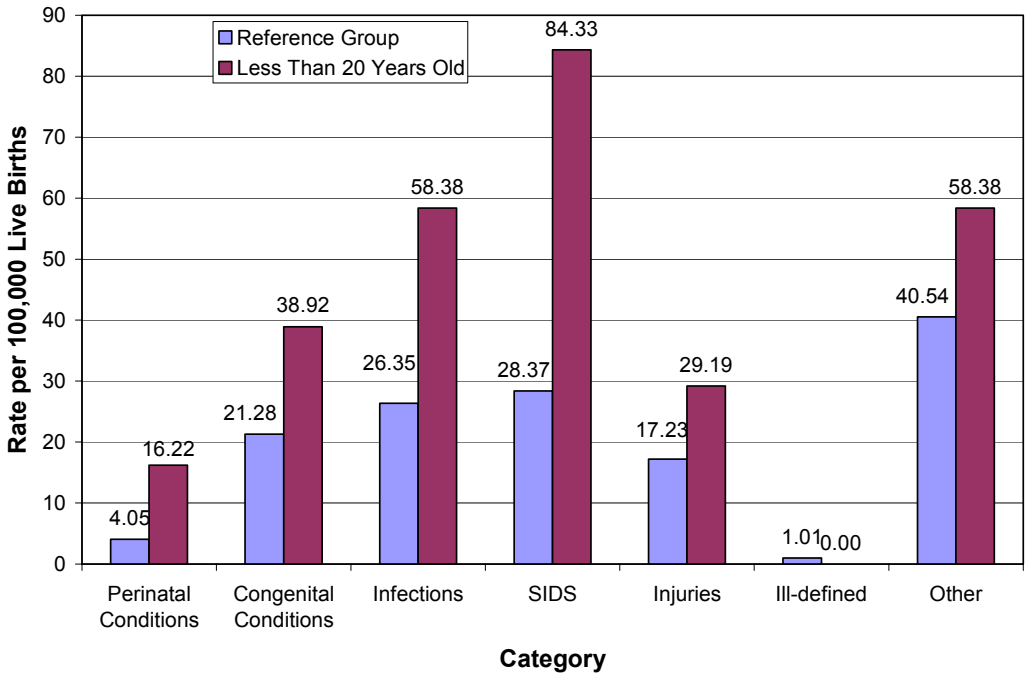


Figure V-12 graphically shows the percent of higher birth weight post-neonatal deaths in each cause of death category for teenagers.

Figure V-12. Percent of Deaths by Cause of Death Category for Maricopa County Women Under 20 Years Old

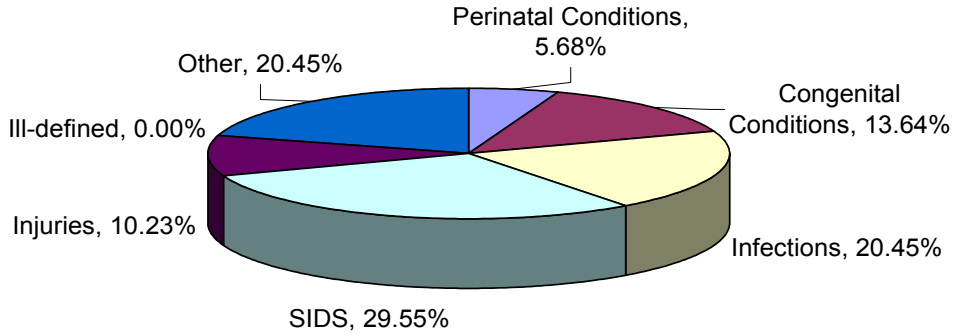


Table V-16 shows the number of "infant health" deaths, percent of deaths, and rate of death per 100,000 live births for each cause of death category for the reference group and Maricopa County African American women. It also shows the excess rate of death to African American mothers.

Table V-16. Underlying Cause of Death for Infant Health Deaths: Maricopa County African Americans Women Compared to the Reference Group

Cause of Death	Reference Group			African Americans			
	N	Percent of Deaths	Rate per 100,000 Births	N	Percent of Deaths	Rate per 100,000 Births	Excess Rate
Perinatal Conditions	**4**	**2.92%**	**4.05**	**1**	**2.86%**	**11.86**	**7.80**
Congenital Conditions	**21**	**15.33%**	**21.28**	**2**	**5.71%**	**23.72**	**2.44**
Infections	**26**	**18.98%**	**26.35**	**10**	**28.57%**	**118.58**	**92.23**
SIDS	**28**	**20.44%**	**28.37**	**9**	**25.71%**	**106.72**	**78.35**
Injuries	**17**	**12.41%**	**17.23**	**5**	**14.29%**	**59.29**	**42.06**
Ill-defined	**1**	**0.73%**	**1.01**	**0**	**0.00%**	**0.00**	**-1.01**
Other	**40**	**29.20%**	**40.54**	**8**	**22.86%**	**94.87**	**54.33**
Total	**137**	**100.00%**	**138.83**	**35**	**100.00%**	**415.04**	**276.20**
Live Births	98,679			8,433			

Note. Use caution when interpreting rates with less than 10 deaths because they tend to be statistically unreliable.

The underlying cause of death with the highest excess rate was infections with almost 92 excess deaths per 100,000 live births. The second highest category was SIDS with approximately 78 excess deaths per 100,000 live births, followed by injuries (41.9/100,000). Figure V-13 graphically shows the "infant health" related mortality rates (per 100,000 live births) for each cause of death category for post-neonatal deaths among African American mothers.

Figure V-13. Rate of Death by Underlying Cause of Death Category: Maricopa County African American Women Compared With the Reference Group

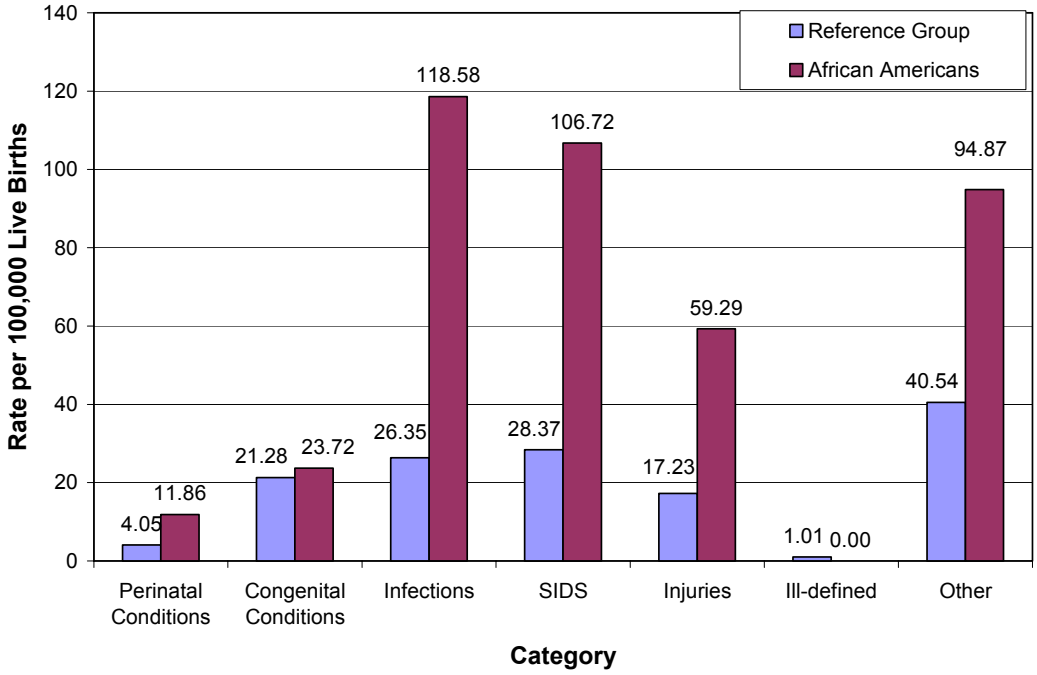


Figure V-14 graphically shows the percent of deaths in each category out of the total deaths for African Americans.

Figure V-14. Percent of Deaths by Underlying Cause of Death for Maricopa County African American Women

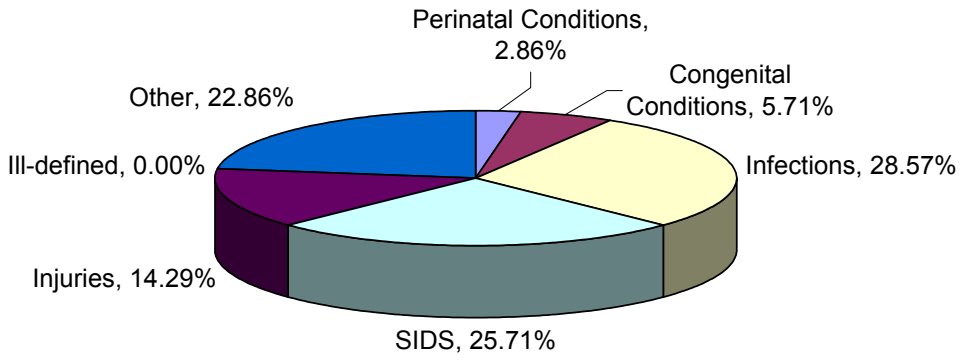


Table V-17 shows the number of "infant health" deaths, percent of deaths, and rate of death per 100,000 live births for each cause of death category for the reference group and Maricopa County Native American women. It also shows the excess rate of death to Native American mothers.

Table V-17. Underlying Cause of Death for the Infant Health Deaths: Maricopa County Native Americans Compared to the Reference Group

Cause of Death	Reference Group			Native Americans			
	N	Percent of Deaths	Rate per 100,000 Births	N	Percent of Deaths	Rate per 100,000 Births	Excess Rate
Perinatal Conditions	**4**	**2.92%**	**4.05**	**1**	**5.26%**	**16.07**	**12.01**
Congenital Conditions	**21**	**15.33%**	**21.28**	**0**	**0.00%**	**0.00**	**-21.28**
Infections	**26**	**18.98%**	**26.35**	**8**	**42.11%**	**128.53**	**102.19**
SIDS	**28**	**20.44%**	**28.37**	**5**	**26.32%**	**80.33**	**51.96**
Injuries	**17**	**12.41%**	**17.23**	**0**	**0.00%**	**0.00**	**-17.23**
Ill-defined	**1**	**0.73%**	**1.01**	**0**	**0.00%**	**0.00**	**-1.01**
Other	**40**	**29.20%**	**40.54**	**5**	**26.32%**	**80.33**	**39.80**
Total	**137**	**100.00%**	**138.83**	**19**	**100.00%**	**305.27**	**166.44**
Live Births	98,679			6,224			

Note. Use caution when interpreting rates with less than 10 deaths because they tend to be statistically unreliable.

The number of deaths attributed to "infant health" risk factors and causes was very small for Native American women; thus the number of deaths, percentages, and rates may show large variability from period to period. The underlying cause of death with the highest excess rate was infections with approximately 102 excess deaths per 100,000 live births. The second highest category was SIDS with almost 52 excess deaths per 100,000 live births. Figure V-15 graphically shows the "infant health" related mortality rates for each cause of death category for post-neonatal deaths among Native American mothers.

Figure V-15. Rate of Death by Underlying Cause of Death Category: Maricopa County Native American Women Compared with the Reference Group

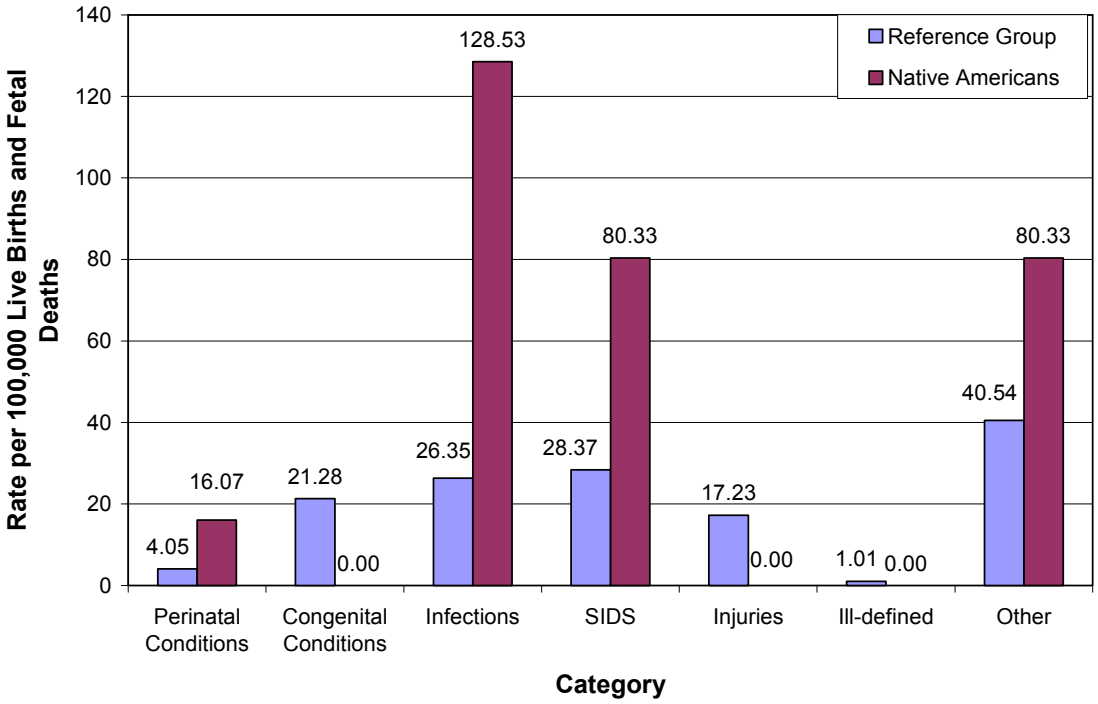
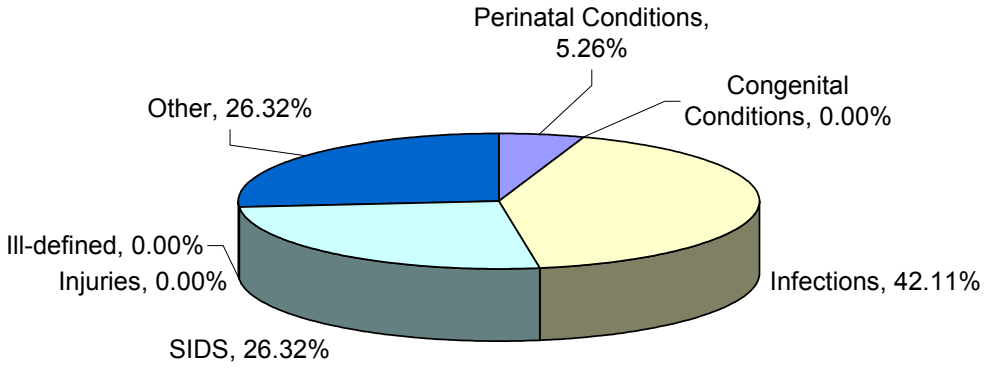


Figure V-16 graphically shows the percent of deaths in each category for Native Americans.

Figure V-16. Percent of Deaths by Cause of Death for Maricopa County Native American Women



Risk Factors for the Deaths in the Infant Health Category

Different causes of death have different potential risk factors and interventions, albeit some risks are important for more than one cause of death. A list of some of the risk factors by cause of death is shown Table V-18. The prevalence of each risk factor (when available) for the reference group, teenagers, African Americans, and Native Americans are also shown. The prevalence of each risk factor for each of the three population groups was compared to the prevalence of the risk factor for the reference group. Statistically significant differences between the group and the reference group are shown with an asterisk (*). Many of the potential "infant health" risk factors are not available on birth or death certificates (indicated by "U" in the table).

Although fewer Maricopa County teenagers smoked cigarettes during pregnancy, drank alcohol during pregnancy, and had diabetes than the reference group, they also had fewer prenatal care visits and ultrasounds. Compared with the reference group, a smaller percentage of Maricopa County African American women had diabetes; a larger percentage reported smoking tobacco during pregnancy and having fewer prenatal care visits. Additionally, a smaller percentage of African American mothers had ultrasounds than reference group mothers. Fewer Native American women residing in Maricopa County than women in the reference group smoked during pregnancy. A larger percentage of Native American women had diabetes and fewer prenatal care visits. A smaller percentage of Native American women had ultrasounds than women in the reference group.

Table V-18. Infant Health: Differences in Risk Factor Prevalence (Percent) by Cause of Death.

COD / Risk Factor	Reference Group	< 20 Years Old	African Americans	Native Americans
Perinatal Conditions				
Smoking	8.68	8.38	11.26 *	5.81 *
High risk follow up	U	U	U	U
Medical/health home	U	U	U	U
Congenital Conditions				
Ultrasound	79.89	63.08 *	68.55 *	77.11 *
Alcohol use	1.27	0.67 *	2.14 *	2.70 *
Drug use	U	U	U	U
Folic acid intake	U	U	U	U
Alpha-feto protein	U	U	U	U
Diabetes	2.11	0.75 *	1.79 *	7.41 *
Genetic counseling	U	U	U	U
Infections				
Medical/health home	U	U	U	U
Smoking / passive smoke	8.68	8.38	11.26 *	5.81
Prenatal care				
No Visits	0.39	2.92 *	2.88 *	1.95 *
1 to 4 Visits	0.94	7.14 *	5.41 *	8.34 *
5 to 9 Visits	10.98	25.65 *	20.24 *	31.53 *
10 or More Visits	87.69	64.29 *	71.46 *	58.17 *
Breast-feeding				
Maternal Age (<20 yrs)	0	100	20.96	20.29
Maternal Education (<=12 yrs)	0	69.58	26.64	35.87
Immunizations	U	U	U	U
SIDS				
Smoking/passive smoke	8.68	8.38	11.26 *	5.81 *
Sleep position	U	U	U	U
Breast-feeding	U	U	U	U
Bedding	U	U	U	U
Death scene investigation	U	U	U	U
Maternal age (<20 yrs)	0	100	20.96	20.29
Maternal Education (<=12 yrs)	0	69.58	26.64	35.87
Injuries				
Bedding	U	U	U	U
Co-sleep	U	U	U	U
Death scene investigation	U	U	U	U
Car seat use	U	U	U	U
Abuse	U	U	U	U
Environment	U	U	U	U
Supervision	U	U	U	U
Ill-Defined				
Autopsy rate	37.24	38.89	47.06	41.46
Death scene investigation	U	U	U	U

Note. The factors that defined the reference group were not tested for statistically significant differences between groups. U=Unknown, data not available.
* Statistically significant difference, $p < .05$, between the group and reference group.

Analyses predicting "infant health" deaths from the risk factors were analyzed by cause of death. Tables V-19 and V-20 show the risk factors for the two leading causes of death, infections and SIDS, respectively. Some causes of death could not be analyzed in this way because the numbers of deaths in these categories were small. Thus only the two leading causes were examined. The unadjusted columns show the results when only one risk factor at a time was examined. The

adjusted columns show the association between the risk factor and death while holding the other risk factors constant.

Table V-19. Infant Health Infections: Odds of Infection as Underlying Cause of Death.

Risk Factor	Maricopa County Prevalence (%)	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age < 20 Years Old	13.92	1.60	0.95, 2.68	1.07	0.59, 1.95	
Education <=12 Years	30.19	2.15	1.39, 3.33 *	2.30	1.31, 4.01 *	28.19
Race/Ethnicity						
White	53.84	C	C	C	C	C
Hispanic	39.45	0.86	0.53, 1.39	0.38	0.21, 0.72 *	
African American	3.86	3.29	1.66, 6.56 *	2.36	1.13, 4.94 *	4.98
Native American	2.85	3.52	1.66, 7.49 *	2.00	0.86, 4.63	
Smoking	8.00	2.23	1.26, 3.95 *	1.53	0.81, 2.89	4.09
Prenatal Care Visits						
0 to 4 Visits	6.17	3.90	2.14, 7.09 *	3.14	1.58, 6.24 *	11.66
5 to 9 Visits	18.03	1.94	1.16, 3.26 *	1.89	1.10, 3.24 *	13.84
10 or More Visits	75.81	C	C	C	C	C

Note. The Maricopa County prevalence is the percent of the risk factor among live births. PAR% = Estimate of the population attributable risk or the percent of infection-related deaths that could be prevented if the predisposing risk factor were eliminated. C = Comparison group.

* Statistically significant, $p < .05$.

Maricopa County women with a high school education or less were 2.3 times more likely to have a post-neonatal infant die of an infection than women with some education beyond high school. If maternal education were increased along with all of the other factors that are associated with higher education, then 28.2% of these deaths could potentially be prevented. Hispanic women were significantly less likely (odds=0.38) to have a baby die of an infection during the post-neonatal period than White women. On the other hand, African American women were 2.4 times more likely to have a baby die of infection during the post-neonatal period than White women. When race/ethnicity was examined by itself, Native American women were more likely than White women to have a post-neonatal infant die of infections; however, this was not statistically significant when adjusted for other risk factors. This indicates that when the other available risk factors such as low education, prenatal care, and others are accounted for, being a Native American mother by itself carries no higher risk for an infant death due to infection. The number of deaths to Native American women was very small, however.

Although smoking during pregnancy was a risk factor for infections as the cause of death, it was not a statistically significant risk factor when the other risk factors were taken into account. Compared with women who attended 10 or more prenatal care visits, women who went to four or fewer visits were 3.1 times more likely to have a baby die of infection during the post-neonatal period. Increasing prenatal care could potentially decrease the percentage of deaths due to infections by 11.7%. Women who attended prenatal care five to nine times were 1.9 times more likely to have an infant die of infection during the post-neonatal period. Increasing the number of prenatal care visits for these women has the potential to decrease the infection-related deaths by 13.8%.

Table V-20. Infant Health: Odds of SIDS as the Underlying Cause of Death.

Risk Factor	Maricopa County Prevalence (%)	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age< 20 Years Old	13.92	2.79	1.75, 4.42 *	2.72	1.60, 4.63 *	19.33
Education <= 12 Years	30.19	1.48	0.95, 2.31	1.00	0.57, 1.73	
Race/Ethnicity						
White	53.84	C	C	C	C	C
Hispanic	39.45	0.64	0.39, 1.06	0.58	0.32, 1.05	
African American	3.86	2.71	1.33, 5.54 *	2.31	1.10, 4.82 *	4.82
Native American	2.85	2.01	0.80, 5.06	1.64	0.63, 4.26	
Smoking	8.00	4.65	2.90, 7.47 *	3.35	1.96, 5.74 *	15.84
Prenatal Care Visits						
0 to 4 Visits	6.17	3.62	1.95, 6.69 *	3.48	1.79, 6.76 *	13.26
5 to 9 Visits	18.03	2.04	1.23, 3.39 *	1.88	1.10, 3.22 *	13.75
10 or More Visits	75.81	C	C	C	C	C

Note. The Maricopa County prevalence is the percent of the risk factor among live births. PAR% = Estimate of the population attributable risk or the percent of SIDS that could be prevented if the predisposing risk factor were eliminated. C = Comparison group

* Statistically significant, $p < .05$.

Maricopa County teenage mothers were 2.7 times more likely than older women to have a baby die of SIDS during the post-neonatal period. Preventing teenage pregnancy could potentially prevent approximately 19.3% of the SIDS deaths. Compared with White mothers, African American mothers were 4.8 times more likely to have a baby die of SIDS. Maternal smoking during pregnancy was associated with a 3.4 increase in the risk of SIDS. Eliminating smoking could potentially reduce the number of post-neonatal deaths due to SIDS by 15.8%. Women with fewer prenatal care visits were more likely to have babies die of SIDS than women who had 10 or more prenatal care visits (3.4 times more likely with zero to four visits and 1.9 times more likely with five to nine visits). If the number of prenatal care visits increased for these two groups of women, it could potentially decrease the number of SIDS deaths by 27%.

Summary of Infant Health Category Results

The two leading causes of mortality in the "infant health" category for the county as a whole were infections and SIDS. These were also the two leading causes of death for those groups with a high excess mortality rate in the "infant health" category: Teenagers, African Americans, and Native Americans. Only two risk factors other than maternal demographic characteristics were examined because many of the risk factors for these deaths are environmental and not reported during vital registration. Few or no prenatal care visits was an important risk factor for infections. Both smoking during pregnancy and few (or no) prenatal care visits were important risk factors for SIDS. Although smaller percentages of teenagers and Native Americans smoked than women in the reference group, over 8% of teenagers and reference group women smoked and 5.8% of Native American women smoked. Therefore, these rates could be reduced. A recent report by the Surgeon General [17] concluded that "Smoking by the mother causes SIDS." Smoking during pregnancy increases the risk for both SIDS and reduced lung function in the

baby [17]. Infants with second-hand smoke exposure are more likely to die of SIDS and develop asthma later in life [17, 18]. A potential reason for the importance of prenatal care for these older infant deaths may be the education regarding appropriate infant care provided during the prenatal visits. Additionally, women who attend prenatal care might be more likely to visit their provider for well-baby care and immunizations.

Summary of Maricopa County Results

Phase I data analyses computed excess fetal and infant mortality rates (F-IMR) by comparing the rates in the county to the rates of a reference group (composed of Maricopa County non-Hispanic White women who were 20 or more years of age and had some education beyond high school). The excess mortality is considered preventable mortality and shows the disparities between population groups. Based on birth weight and the age of death, the excess F-IMR was partitioned into four areas that correspond to specific intervention points in the health care continuum: "Maternal health and prematurity," "maternal care," "newborn care," and "infant health." The four components have different causes of death, risk factors, and corresponding interventions.

In Maricopa County, the total F-IMR during the period from 1996 through 2000 was 8.5 deaths (per 1,000 live births and fetal deaths) and the excess F-IMR was 2.7 deaths (per 1,000 live births and fetal deaths); this suggests that 32% of the fetal and infant deaths were potentially preventable. One of the largest contributors to these excess rates was "maternal health and prematurity." These findings suggest that women's health prior to conception played a prominent role in determining fetal and infant outcomes. Focusing prevention or intervention programs on women's health prior to conception should yield larger reductions in the overall excess feto-infant mortality rate than focusing elsewhere. The other large contributor to the overall excess rate was "maternal care" which has to do with referral systems, high risk care, and prenatal care. These two categories of excess suggest more integration of the health care system may be needed, preconception through delivery.

The excess feto-infant mortality rates in the county were much higher for women with a high school education or less than for women with some education beyond high school. Education, a risk factor amenable to modification, consistently showed a large impact on feto-infant mortality rates (above age and race/ethnicity). This pattern persisted in the different age groups (teenagers and older women), as well as in the different races/ethnicities. These findings confirm that furthering education is a strong predictor and determinant of health status. Each race/ethnicity showed a different pattern of findings across the excess feto-infant mortality map suggesting that programs might consider targeting these groups differently. In Maricopa County, African Americans' highest excess mortality rate was in the "maternal health/prematurity" category, followed by the "infant health" category. Native Americans' highest excess mortality rate was in the "infant health" category, followed by the "maternal care" category. For Hispanics, the "maternal health/prematurity" and "maternal care" categories were equally high. Whites' highest excess mortality rate was in the "maternal care" category, followed by the "maternal health/prematurity" category.

Phase II analyses examined risk factors in the four F-IMR categories for population groups with high excess mortality and a large enough number of deaths to use in the statistical analyses. There were two pathways to an excess rate in the "maternal health and prematurity" category: the birth weight distribution (too many very low birth weight babies) and birth weight-specific mortality (more babies dying at each birth weight grouping). The population groups with excess F-IMR by map component were as follows:

Maternal Health and Prematurity: Birth Weight Distribution

- Teenagers
- Women with a high school education or less
- African American women

Maternal Health and Prematurity: Birth Weight Specific Mortality

- Women with a high school education or less

Maternal Care:

- Women with a high school education or less
- Native American women

Newborn Care:

- Smallest category of excess that did not significantly vary by population group

Infant Health

- Teenagers
- African American women
- Native American women

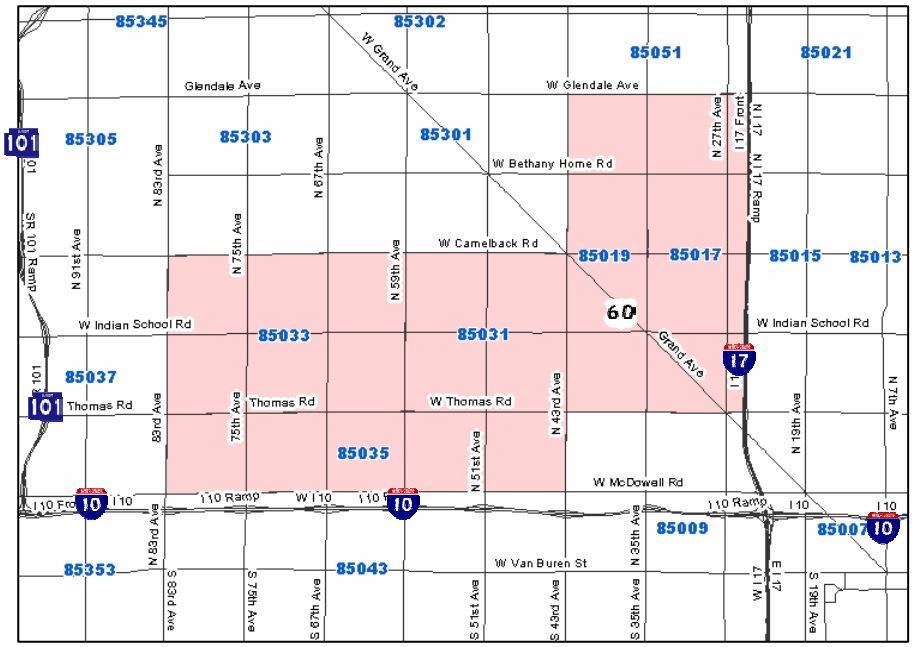
Each component area had different risk factors associated with it. Important risk factors for the "maternal health and prematurity birth weight distribution" category that tends to relate to the mothers preconception health, social and economic situation, included the mother gaining less than 15 pounds during pregnancy, smoking during pregnancy, few prenatal care visits, an unmarried mother (probably indicating a lack of social support or SES), a small for gestational age baby, and a previous premature baby. Important risk factors for the "maternal health and prematurity birth weight-specific mortality" category that tends to relate to perinatal conditions and care included few prenatal care visits, perinatal care designation level provided by the hospital (delivering at an appropriate hospital based on risk factors), a fever during labor and delivery (sign of infection), and assisted ventilation for the newborn (infants that need ventilation tend to be in poorer health). Risk factors for the "maternal care" category that tends to relate to prenatal care, referral systems, and high risk care included inadequate prenatal care, maternal diabetes, prematurity, and small-for-gestational-age babies. Other risk factors related to high risk care and referrals were unavailable for examination. The leading causes of death in the "infant health" category were infections and SIDS. Many of the risk factors associated with these deaths are environmental. The important risk factors available for analysis included maternal smoking and few prenatal care visits.

Section VI. PPOR: Maryvale Neighborhood

Phase I: Feto-Infant Mortality

The west-central Phoenix neighborhood of Maryvale was defined by 5 zip codes: 85017, 85019, 85031, 85033, and 85035 (see map below). These five zip codes may not completely correspond with community members' definition of Maryvale because zip codes are not necessarily consistent with community boundaries. To make data analyses more manageable, the zip codes that best described Maryvale were chosen. There were a total of 179 fetal and infant (feto-infant) deaths and 20,417 live births and fetal deaths in the Maryvale area during the period 1996 through 2000. The corresponding total feto-infant mortality rate (F-IMR) was 8.8 deaths per 1,000 live births and fetal deaths. This means that for every 1,000 recognized pregnancies that survived 6 months or more, 8.8 resulted in a miscarriage or the death of a baby. Maryvale's overall F-IMR during this period was similar to the whole county's F-IMR (8.5 deaths per 1,000 live births and fetal deaths).

The West Phoenix neighborhood of Maryvale, Phoenix, Arizona

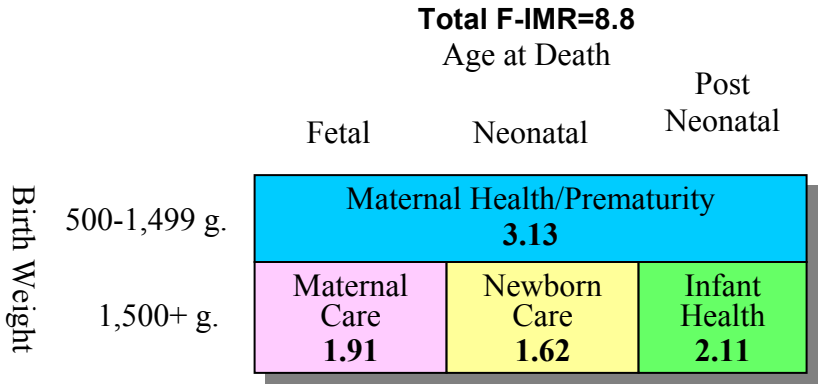


Maryvale

Figure VI-1 shows Maryvale's PPOR map for the years 1996 through 2000. In the map, the overall F-IMR was divided into four cells suggesting the prevention/intervention direction for the deaths in that group. The group-specific rates, shown in the four cells, contribute (or sum) to the total rate. The highest group-specific F-IMR was found in "maternal health/prematurity" category at 3.1 deaths per 1,000 live births and fetal deaths. "Infant health" and "maternal care"

followed with rates around 2 deaths per 1,000 live births and fetal deaths while the "newborn care" category showed the lowest rate (1.6 deaths per 1,000 live births and fetal deaths).

Figure VI-1. Map of Maryvale's Feto-Infant Mortality Rate (1996-2000)

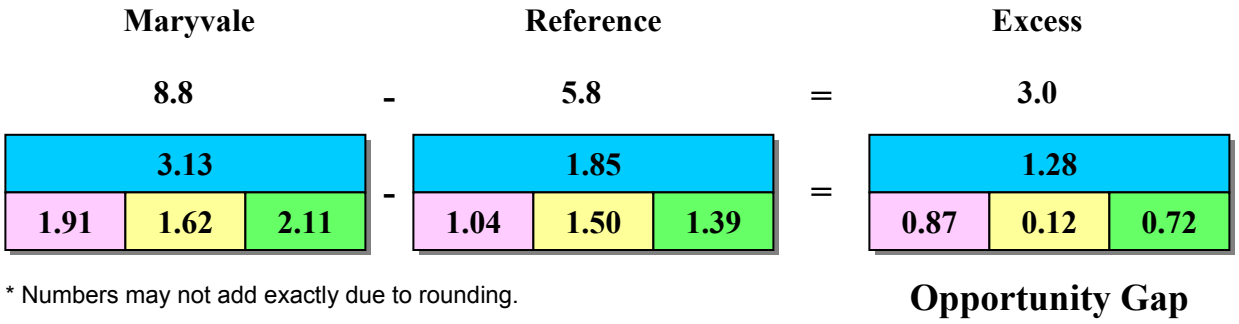


During the same time period, 1996 to 2000, the reference group (consisting of Maricopa County, non-Hispanic White women who were at least 20 years of age and had some education beyond high school) had a total F-IMR of 5.8 deaths per 1,000 live births and fetal deaths. There were a total of 571 feto-infant deaths and 98,823 live births and fetal deaths during the period. The map of the reference group is shown as the middle map in Figure IV-2. Similar to Maryvale's map, the highest group-specific F-IMR was in the "maternal health/prematurity" category (1.9 deaths per 1,000 live births and fetal deaths).

Excess (Preventable) Feto-Infant Mortality

Figure VI-2 shows the excess feto-infant mortality in the Maryvale neighborhood, as well as the method to obtain the excess. The map on the far left is Maryvale's F-IMR map that was shown above, while the middle map is the reference group's F-IMR map. The map on the far right is the excess F-IMR for the Maryvale area. Subtracting the reference group's F-IMR (5.8) from Maryvale's F-IMR (8.8) yielded an excess F-IMR of 3 deaths per 1,000 live births and fetal deaths. The excess F-IMR can be described as an "opportunity gap" and shows disparities within the population. The amount of excess mortality suggests the extent to which the F-IMR can be theoretically reduced in Maryvale. If the F-IMR did not differ across groups, then there would have been 3 fewer feto-infant deaths per 1,000 live births and fetal deaths in Maryvale during the period 1996 through 2000. Note that the individuals in the reference group were not removed from the Maryvale numbers, providing a conservative estimate of the excess. Although Maryvale's F-IMR was similar to the county's rate, the excess death rate of 3 (per 1,000 live births and fetal deaths) suggests that there is room to reduce the feto-infant mortality rate in the area.

Figure VI-2. Maryvale Opportunity Gap (Excess Feto-Infant Mortality Relative to the Reference Group), Potential for Reduction

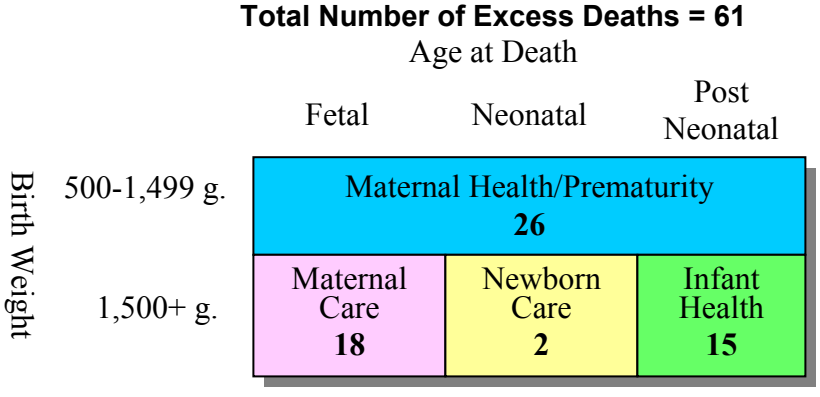


* Numbers may not add exactly due to rounding.

Each of the group-specific rates in the map was subtracted from the corresponding group rate in the reference map in the same manner that the total population rate was subtracted. The largest excess rate was in the "maternal health/prematurity" category with 1.3 deaths per 1,000 live births and fetal deaths. "Maternal care" showed an excess rate of 0.9, "infant health" an excess rate of 0.7, and "newborn care" an excess rate of 0.1 deaths per 1,000 live births and fetal deaths.

If Maryvale's F-IMR was similar to the reference group's F-IMR, there would have been 61 fewer feto-infant deaths in the five-year period than actually occurred. See Figure VI-3 for the translation of rates into number of deaths over the five-year period. Of the 61 excess feto-infant deaths, 26 occurred in the "maternal health/prematurity" category, 18 were in the "maternal care" category, 2 were in the "newborn care" category, and 15 were in the "infant health" category. These excess deaths represented 34.1% of the feto-infant mortality in Maryvale.

Figure VI-3. Maryvale Potential for Reduction: Excess Rates Expressed as Number of Deaths



* Numbers may not add exactly due to rounding.

These findings suggest that successful prevention and intervention efforts focused on "maternal health/prematurity" should yield larger reductions in the overall excess feto-infant mortality rate in the area more than focusing on other points in the health care continuum. Although there is room for improvement in all areas, some categories contribute fewer deaths; for example, "newborn care."

Excess Feto-Infant Mortality for Selected Population Groups

The excess rates were also examined by population groups to determine which groups contribute more to the excess feto-infant mortality. Risk factors within each population group can affect infant mortality. This knowledge allows prevention efforts to be further focused on those groups with higher mortality rates.

Figure VI-4. Maryvale's Excess Feto-Infant Mortality Rate (Number of Deaths) by Age Group (1996-2000)

< 20 years old (3.0 rate, N=37)

Maternal Health/Prematurity **1.23 (5)**		
Maternal Care **0.86 (4)**	Newborn Care **0.16 (1)**	Infant Health **0.75 (3)**

= > 20 years old (2.9 rate, N=141)

Maternal Health/Prematurity **1.29 (21)**		
Maternal Care **0.81 (13)**	Newborn Care **0.11 (2)**	Infant Health **0.71 (12)**

Maternal age was categorized into two groups: women under 20 years old (teenagers) and women 20 or more years of age. For teenagers, there were a total of 37 feto-infant deaths and 4,212 live births and fetal deaths. For women 20 or more years of age, there were a total of 141 feto-infant deaths and 16,203 live births and fetal deaths. The total excess F-IMR for teenagers was very similar to the rate for women 20 or more years of age in Maryvale (3.0 and 2.9 deaths per 1,000 live births and fetal deaths, respectively). Although the overall excess rates were similar for the two age groups, there could have been differences between the maps (i.e., different categories with high rates). The pattern of results across the two maps, however, was the same. Figure VI-4 shows the excess feto-infant mortality rate map for women less than 20 years of age and women 20 or more years of age.

The level of maternal education was categorized into two groups: women with a high school education or less (<=12 years) and women with any education beyond high school (>12 years). There were a total of 102 feto-infant deaths and 9,796 live births and fetal deaths for women with a high school education or less. For women with some education beyond high school, there were a total of 58 feto-infant deaths and 10,069 live births and fetal deaths. Figure VI-5 shows the maps of excess feto-infant mortality for both education levels. There was a large difference in the total excess F-IMRs between the two education groups; the excess death rate for women with a high school education or less was 4.6 deaths per 1,000 live births and fetal deaths, while there

was essentially no excess for women with some education beyond high school. For those with a high school education or less, the highest excess rate was in "maternal health/prematurity." It is important to point out that education is an antecedent factor for other measures such as income levels, access to care, and behavioral patterns and a proxy measure for socioeconomic status (SES). Therefore, increasing the population's education level would not necessarily decrease all the risk factors for feto-infant mortality but it may help to improve outcomes dependent on incomes, behaviors, and access to care.

Figure VI-5. Maryvale's Excess Feto-Infant Mortality Rate (Number of Deaths) by Education Group (1996-2000)

< = 12 years (4.6 rate, N=102)

Maternal Health/Prematurity **2.33 (23)**		
Maternal Care **1.51 (15)**	Newborn Care **-0.07 (-1)**	Infant Health **0.86 (8)**

> 12 years (-0.02 rate, N=58)

Maternal Health/Prematurity **-0.26 (-3)**		
Maternal Care **-0.05 (0)**	Newborn Care **-0.01 (0)**	Infant Health **0.30 (3)**

Analyses were also conducted for racial/ethnic groups. Race/ethnicity in the U.S. society can be a proxy measure for many risk factors such as socioeconomic status, living conditions, cultural and behavioral patterns, and life stressors. During the five year period, there were a total of 116 feto-infant deaths and 13,383 live births and fetal deaths for Hispanics; 40 feto-infant deaths and 4,647 live births and fetal deaths for non-Hispanic Whites; 17 feto-infant deaths and 1,340 live births and fetal deaths for African Americans; and 5 feto-infant deaths and 566 live births and fetal deaths for Native Americans. African Americans had the highest total excess F-IMR at 6.9 deaths per 1,000 live births and fetal deaths. The number of feto-infant deaths was too small to partition the overall rate into categories for African Americans. The total Native American rate was unstable due to the small number of births and feto-infant deaths to this population group in this area. See the Maricopa County results in Section V to target African Americans or Native Americans in the Maryvale area.

Figure VI-6. Maryvale's Excess Feto-Infant Mortality Rate (Number of Deaths) by Race/Ethnicity (1996-2000)

Non-Hispanic White (2.8 rate, N=40)

Maternal Health/Prematurity **0.73 (3)**		
Maternal Care **1.32 (6)**	Newborn Care **0.01 (0)**	Infant Health **0.77 (4)**

Hispanic (2.9 rate, N=116)

Maternal Health/Prematurity **1.43 (19)**		
Maternal Care **0.60 (8)**	Newborn Care **0.29 (4)**	Infant Health **0.56 (7)**

Figure VI-6 shows Maryvale's excess feto-infant mortality map for Whites and Hispanics. The overall excess F-IMR for Whites was almost identical to the Hispanic excess rate (2.8 and 2.9 deaths per 1,000 live births and fetal deaths, respectively). Although the overall excess rates were similar, the pattern of mortality across the prevention maps differed. The highest group-specific excess F-IMR fell in the "maternal care" category for Whites but it fell in the "maternal health/prematurity" category for Hispanics.

Phase II: Risk Factor Analyses

In Phase II, the analyses focus on potential risk factors for those areas with excess mortality (preventable deaths). In order to conduct the Phase II analyses, there need to be large enough numbers of births and deaths in the group with excess mortality and the preventable death rate needs to be large enough in order for the statistical methods used to be reliable. If the number of births and deaths are too small or the rate of preventable death is too small, the statistical techniques may produce inaccurate results. Therefore, the minimum number of total fetal and infant deaths in a group (e.g., teenagers) had to be at least 60 and the excess mortality rate within a category (e.g., infant health) for that group had to be 1.5 or greater [4].

Table VI-1 shows the Maryvale summary of groups with excess fetal and infant deaths by category from the Phase I analyses. The groups and areas that met the criteria for further analyses are shown with a check mark (✓). Appendix C shows the same table with the excess mortality for all groups. In Maryvale, the only group that met the criteria for the minimum excess feto-infant mortality and the minimum number of fetal and infant deaths was women with a high school education or less. Women with a high school education or less accounted for approximately ¾ of the total excess in Maryvale. Their highest category of excess mortality was in "maternal health and prematurity." The second highest category of excess mortality was "maternal care." Therefore, risk factor analyses focus on women with a high school education or less.

Table VI-1. Summary of Population Groups with Excess Mortality by Category from the Phase I Results that will be Examined in Phase II (Groups with Check Marks).

Maryvale Group	Maternal Health & Prematurity	Maternal Care	Newborn Care	Infant Health
All mothers				
< 20 years old				
≥ 20 years old				
≤ 12 years Education	✓	✓		
>12 years Education				
White				
Hispanic				
African American				
Native American				

The number of fetal and infant deaths to teenage mothers was too small for further analyses (plus the excess rates in the categories did not reach the minimum rate necessary). Additionally, with the exception of Hispanics, the number of fetal and infant deaths to the different race/ethnic groups was too small for further analyses. Hispanic's excess feto-infant mortality rates did not warrant additional risk factor analyses.

Although their numbers were not large enough to further examine here, African Americans total excess feto-infant mortality was quite high (excess rate of 6.91). Different methodologies would be necessary to examine this group in Maryvale in more detail (e.g., focus groups, fetal and infant mortality review, or child fatality review for the live births). To target this group of women for prevention efforts based on these analyses, see the results for all of Maricopa County for information. The recommendations for Native American women are similar (see the county results). The number of fetal and infant deaths to Native Americans in Maryvale was so small (n=5) that even the overall rate of 8.8 might be misleading.

Maternal Health and Prematurity

Very low birth weight (<1,500 grams) fetal and infant deaths that occur between 24 weeks of gestation (pregnancy) and one year of life comprise the deaths attributed to "maternal health and prematurity." In general, there are two paths to the "maternal health and prematurity" excess death rate. The first potential path is a higher frequency of very low birth weight (VLBW) births (an unfavorable low birth weight distribution) in a group compared to the reference group. VLBW births are at a higher risk of death than higher birth weight births so a population group with more VLBW births (an unfavorable low birth weight distribution) would probably have a higher mortality rate than a population group with fewer VLBW births. When the "maternal health/prematurity" deaths are mainly associated with the birth weight distribution, the associated risk factors tend to be related to the mother's health, behavior, social and economic situation.

The second potential path is that there are more babies dying at each birth weight in a group compared to the reference group. This is birth weight-specific mortality. When the excess "maternal health/prematurity" deaths are mainly associated with higher birth weight-specific mortality, then the risk factors tend to be related to the medical care provided to the mother and infant before, during, and immediately after the birth. The PPOR approach suggests examining the risk factors associated with the birth weight-specific mortality pathway whenever 40% or more of the "maternal health/prematurity" excess death rate is attributable to this contributing pathway. It is likely easier to change risk factors related to birth weight-specific mortality and medical care than those associated with an unfavorable birth weight distribution [4].

Consequently, the first step in describing the reasons for excess "maternal health/prematurity" death rate is determining whether this excess is due to more VLBW babies or more babies dying at each birth weight. The contribution of each pathway was determined using the formula developed by Kitagawa [4, 7]. The pathway to excess "maternal health and prematurity" deaths was determined for Maryvale women with a high school education or less; the group with the highest excess F-IMR in the "maternal health/prematurity" category.

Contributing Pathways to the "Maternal Health and Prematurity" Category

Figure VI-7. Maryvale Women with a High School Education or Less.

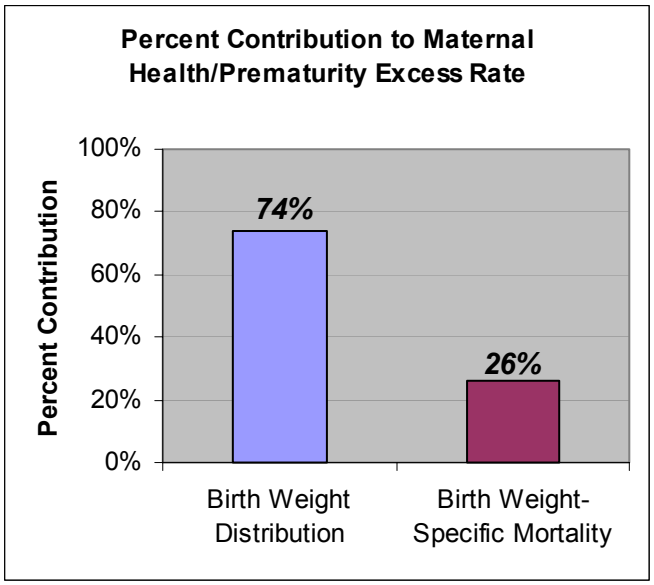


Figure VI-7 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant mortality rate in the "maternal health and prematurity" category for Maryvale women with a high school education or less. Appendix D (Table D-4) shows the rate and percent contribution of the birth weight distribution and birth weight-specific mortality to the overall excess rate by birth weight categories. Approximately ¾ of the excess death in the "maternal health and prematurity" category was a result of the birth weight distribution. In other words, much of the difference between women with a high school education or less and the reference group could be attributed to more very low birth weight babies among women with a high school education or less. Therefore, further analyses will focus on those risk factors that may affect birth weight.

Risk Factors for the "Maternal Health/Prematurity" Birth Weight Distribution Category

The analyses suggested that attention should focus on those risk factors that affect the birth weight distribution. As stated earlier, these factors tend to be related to the mother's health, behavior, social and economic situation. The risk factors selected for analysis were suggested by the PPOR practice collaborative based on other populations and previous experience [4], and available on the birth certificate. The factors examined include marital status, high parity for age, multiple birth (e.g., twins), prenatal care, prematurity, previous preterm infant, small for gestational age, anemia, pregnancy weight gain, tobacco use, alcohol use, and method of payment for delivery. Additional but unavailable risk factors include sexually transmitted disease, infections such as bacterial vaginosis, drug abuse, pregnancy intendedness, domestic violence, income, and the social capital of the community (SES indicator).

Table VI-2. Birth Weight Distribution: Differences in Risk Factor Prevalence (Percent).

Risk Factor	Reference Group	<=12 Years Education
Age		
< 20 Years Old	0	30.69
20-39 Years Old	97.38	68.46
=> 40 Years Old	2.62	0.84
<= 12 Years Education	0	100
Race/Ethnicity		
White	100	14.6
Hispanic	0	77.94
African American	0	4.40
Native American	0	1.93
Asian	0	1.12
Unmarried	15.71	61.81 *
Tobacco Use	8.68	8.20
Alcohol Use	1.27	0.81 *
Weight Gain		
< 15 lbs	5.78	10.92 *
15-40 lbs	72.61	69.22 *
>40 lbs	21.61	19.86 *
High Parity for Maternal Age	13.13	23.85 *
APNCUI		
Inadequate	5.21	28.30 *
Intermediate	9.99	10.42
Adequate	53.87	31.23 *
Adequate plus	30.94	30.04
Trimester Care Began		
First	91.57	62.20 *
Second	7.00	27.38 *
Third	1.08	7.24 *
No Visits	0.36	3.19 *
Prenatal Care Visits		
No Visits	0.39	3.28 *
1 to 4 Visits	0.94	7.49 *
5 to 9 Visits	10.98	24.97 *
10 or More Visits	87.69	64.27 *
Small for Gestational Age	2.77	3.98 *
Premature	9.54	10.80
Previous Preterm	0.53	0.12 *
Multiple Birth	3.44	1.83 *
Anemia	1.99	1.08 *
Method of Payment		
AHCCCS	14.86	76.99 *
Insurance	81.16	16.65 *
IHS	0.09	0.40 *
Self	3.13	4.6 *

Note. The factors that defined the reference group were not tested for statistical significance.
* Statistically significant difference, $p < .05$, between the group and the reference group.

Table VI-2 shows the risk factor prevalence comparison of the reference group to Maryvale women with a high school education or less. An asterisk (*) next to a number denotes that the percent of Maryvale women with a high school education or less with the risk factor is statistically different from the percent of women with the risk factor in the reference group.

Compared with the reference group, a larger percentage of Maryvale women with a high school education or less were unmarried, gained less than 15 pounds during pregnancy, had high parity for their age, inadequate prenatal care (fewer visits and/or beginning care late), small for gestational age babies, and paid for their delivery with AHCCCS, IHS, or self pay.

A smaller percentage of Maryvale women with a high school education or less than reference group women had a previous preterm delivery, multiple birth, anemia, or drank alcohol during pregnancy. There was not a statistically significant difference in the proportion of women who smoked during pregnancy.

Table VI-3 shows the odds of having a very low birth weight birth given each of the risk factors individually and adjusted for other risk factors. The table shows the prevalence (%) of the risk factor/characteristic in Maryvale, the odds, confidence limits around the odds, statistical significance and an estimate of the population attributable percent. The odds show the likelihood of very low birth weight given the risk factor (unadjusted) and holding other risk factors constant (adjusted) in Maricopa County. The population attributable risk percent (PAR%) is an estimate of the percent of very low birth weight outcomes that could be prevented if the predisposing risk factor was eliminated. Note that some risk factors are modifiable while others are not. For example, a multiple pregnancy (e.g., twins or triplets) may not be a modifiable risk factor, whereas smoking cigarettes during pregnancy may be modifiable. The risk factors included in the adjusted analyses did not include prematurity (< 37 weeks gestation) because very low birth weight is usually a result of prematurity. In this data, approximately 97% of the very low birth weight births were premature.

Taking into account (or adjusting for) other risk factors, a very low birth weight birth was more likely among women with certain risk factors, maternal characteristics, and demographics. Teenagers were 1.5 times more likely than older women to have a very low birth weight baby. Preventing teenage pregnancy could potentially reduce the overall county rate of very low birth weight by 9.5%.

Very low birth weight was 4.3 times more likely among women who gained less than 15 pounds than those who gained 15 to 39 pounds during pregnancy. Over 25% of the very low birth weight babies could potentially be prevented if women gained more than 15 pounds during pregnancy. Extremely preterm births, however, preclude sufficient weight gain. Even when preterm birth was included as a risk factor for very low birth weight (see Appendix F for more information on prematurity and very low birth weight), insufficient weight gain remained a statistically significant risk factor. Gaining 40 or more pounds during pregnancy was protective, such that very low birth weight was less likely in mothers who gained more than 40 pounds than mothers who gained 15 to 39 pounds.

A very low birth weight outcome was 1.3 times more likely among unmarried women than married women. Eliminating those factors that may make women who are unmarried more susceptible to the poor birth outcome of very low birth weight (e.g., socioeconomic conditions, social and parenting support, unplanned pregnancy) could potentially prevent 14.3% of very low birth weight babies.

Multiple births (e.g., twins) were 18.6 times more likely to be very low birth weight than singleton births. Although eliminating multiple births is not a realistic goal, it could reduce very low birth weight births by over 25%. A poor birth weight outcome was 1.9 times more likely among women who had a previous preterm baby than women who did not (including women who did not have a prior pregnancy). Babies who were small for gestational age (calculated from grams falling in the smallest 5% of the weight distribution in the US [7]) were 3.9 times more likely to be very low birth weight, accounting for approximately 10% of the very low birth weight births.

Table VI-3. Birth Weight Distribution: Odds of Delivering a Very Low Birth Weight Baby Among All Live Births.

Risk Factor	Maryvale Birth Prevalence (%)	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age						
< 20 years	20.62	1.41	1.23, 1.61 *	1.51	1.29, 1.76 *	9.52
20-39 years	78.37	C	C	C	C	
40 or more years	1.01	1.56	1.14, 2.14 *	1.37	0.96, 1.94	
Education <= 12 Years	49.23	1.20	1.08, 1.34 *	0.81	0.70, 0.93 *	
Race/Ethnicity						
White	22.86	C	C	C	C	
Hispanic	65.88	1.06	0.95, 1.18	0.74	0.65, 0.85 *	
African American	6.57	2.03	1.66, 2.49 *	1.23	0.99, 1.54 +	1.49
Native American	2.78	0.97	0.71, 1.33	0.57	0.40, 0.82 *	
Asian/Hawaiian	1.90	0.81	0.56, 1.16	0.85	0.58, 1.23	
Unmarried	53.88	1.51	1.36, 1.67 *	1.31	1.15, 1.50 *	14.31
High Parity for Age	19.28	1.42	1.26, 1.60 *	0.88	0.77, 1.02	
Multiple Birth	1.89	15.35	13.66, 17.25 *	18.61	16.28, 21.26 *	24.96
Prenatal Care Visits						
No Visits	2.50	5.59	4.24, 7.36 *	6.05	4.47, 8.19 *	11.21
1 to 4 Visits	5.57	9.10	7.90, 10.48 *	12.08	10.22, 14.29 *	38.16
5 to 9 Visits	22.52	3.16	2.81, 3.54 *	3.92	3.46, 4.45 *	39.67
10 or More Visits	69.40	C	C	C	C	
Previous Preterm	0.17	2.28	1.32, 3.96 *	1.89	1.06, 3.36 *	0.15
Anemia	1.04	0.68	0.44, 1.05	0.48	0.30, 0.76 *	
Weight Gain						
<15 lbs.	10.50	4.33	3.84, 4.88 *	4.28	3.76, 4.87 *	25.62
15-40 lbs.	69.67	C	C	C	C	
> 40 lbs.	19.83	0.99	0.86, 1.14	0.74	0.64, 0.86 *	
Tobacco Use	8.33	1.93	1.67, 2.23 *	1.41	1.19, 1.66 *	3.30
Alcohol Use	0.96	1.50	1.00, 2.24	1.03	0.67, 1.59	
Delivery Payment						
Private Insurance	28.81	C	C	C	C	
AHCCCS	65.22	1.13	1.02, 1.26 *	0.61	0.53, 0.70 *	
IHS	0.50	1.05	0.50, 2.22	0.67	0.30, 1.51	
Self	4.06	1.11	0.84, 1.46	0.69	0.52, 0.93 *	
Small for Gestational Age	3.97	6.84	5.99, 7.80 *	3.85	3.33, 4.45 *	10.16

Note. The Maricopa County prevalence is the percent of the risk factor in live births. PAR% = Estimate of the population attributable risk; percent of VLBW that could be prevented if the predisposing risk factor were eliminated. C = Comparison group.
* Statistically significant, $p < .05$.

Smoking during pregnancy increased the likelihood of having a very low birth weight baby by 1.4 times. Preventing smoking during pregnancy could reduce the number of very low birth weight babies by over 3%. Alcohol use during pregnancy was not a statistically significant risk factor for very low birth weight; however, it is a risk factor for serious birth defects such as fetal alcohol syndrome. Almost one percent of women indicated that they drank alcohol during pregnancy.

African American women were more likely than White women to have a very low birth weight baby; however, this was only marginally statistically significant when adjusted for the other potential risk factors. Hispanic and Native American women were less likely than White women to have a very low birth weight birth.

Women with anemia were 0.48 times less likely to have a very low birth weight baby than women without anemia. Maternal iron deficiency anemia during the first and second trimesters of pregnancy has been shown to be a risk factor for SGA, preterm delivery and consequently low birth weight [9, 10, 11, 12]. It is unclear why anemia would be a protective factor in these analyses but several possibilities exist. First, the birth certificate does not distinguish between anemia occurring early versus late during pregnancy and studies suggest that anemia in third trimester does not necessary increase the risk of a poor birth outcome. Second, the birth certificate does not specify that the anemia is associated with iron deficiency and there is some evidence suggesting that anemia without iron deficiency does not necessary increase the risk of a poor outcome. Third, these analyses examine very low birth weight (< 1,500 grams) rather than low birth weight (< 2,500 grams) which may affect the results. Finally, risk factors on the medical portion of the birth certificate are underreported [13], and it is possible anemia is differentially reported among different birth weights.

Women who paid for their delivery with AHCCCS were 0.61 times less likely to have a very low birth weight birth than women who paid using private insurance. Adjusted for other risk factors (but not individually), women who paid for their delivery by themselves were 0.69 times less likely to have a very low birth weight baby.

Summary of the Maternal Health and Prematurity Category Results

In Maryvale, women with a high school education or less had high excess mortality in the "maternal health and prematurity" category. Approximately 75% of the excess rate in this group was related to a disadvantageous birth weight distribution (more very low birth weight babies than in the reference group). Therefore, risk factors associated with the birth weight distribution were examined.

Several risk factors were deemed important for excess mortality in the "maternal health and prematurity" category. The summary consists of risk factors that met two conditions: a) Women with these risk factors were more likely to have a very low birth weight baby and b) there was a higher prevalence (percent) of the risk factor in the group with the higher excess mortality in the "maternal health/prematurity" category than in the reference group.

Table VI-4. Summary of Important Risk Factors for Deaths in the "Maternal Health and Prematurity" Category

Risk Factors	≤ 12 Yrs Education
IUGR/SGA	✓
Prematurity	✓
Unmarried (social support/SES)	✓
Smoking	
Weight Gain < 15 lbs.	✓
Few or No Prenatal Care Visits	✓

Note. Check marks indicate the risk factor is important for deaths in the "maternal health/prematurity" category.

Table VI-4 shows those risk factors deemed important to excess mortality in the "maternal health/prematurity" category. Smoking was listed as a risk factor but not checked because smoking during pregnancy contributed to very low birth weight but women with a high school education or less in Maryvale did not smoke more than women in the reference group. Over 8% of the women in both groups smoked during pregnancy, however. This result suggests that there is potential to reduce the smoking rate in both groups of women.

Maternal Care

Deaths in the "maternal care" category are higher birth weight (1,500 grams or more) fetal deaths. Although this group consists of larger birth weights in this methodology, birth weights in the 1,500 to 2,500 gram range are still low and birth weights of at least 4,250 grams are considered high birth weight. Both the low and high birth weight babies are at higher risk for complications than those between 2,500 and 4,250 grams. Potential risk factors that may increase the risk of fetal death include maternal infection, maternal injury, delays in obtaining medical care for prenatal care or delivery, delays in recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring [14]. The risk factors selected for analysis that were available on the fetal death certificate included age, education, race/ethnicity, the number of prenatal care visits, the trimester that prenatal care began, adequacy of prenatal care utilization index (APNCUI; describes the adequacy of the timing of prenatal care initiation and the number of visits) [15], hospital perinatal service level, prematurity, small for gestational age, placenta previa (abnormal implantation of the placenta) or abruptio placenta (premature separation of the placenta), fetal malpresentation (e.g., breech), cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered), fetal distress (signs indicating that the fetus is not receiving enough oxygen), maternal diabetes, and pregnancy-related hypertension.

Table VI-5 compares the prevalence of the risk factors for the reference group with that of women with a high school education or less residing in Maryvale. Women with less education had excess feto-infant mortality in the "maternal care" category. In comparison to the reference group, a larger percentage of women with a high school education or less began prenatal care later in their pregnancy and had fewer prenatal care visits. This resulted in a significantly larger percentage the women with a high school education or less receiving inadequate prenatal care and fewer receiving adequate prenatal care. The percentages of women receiving adequate plus (intensive care for high risk pregnancies) was essentially the same in the two groups.

Table VI-5. Maternal Care: Differences in Risk Factor Prevalence (Percent).

	Reference Group	<=12 Years Education	
Age			
< 20 Years Old	0	30.65	
20-39 Years Old	97.4	68.55	
=> 40 Years Old	2.6	0.8	
<= 12 Years Education	0	100	
Race/Ethnicity			
White	100	14.67	
Hispanic	0	77.94	
African American	0	4.33	
Native American	0	1.96	
Asian	0	1.10	
Premature	8.79	9.86	*
APNCUI			
Inadequate	5.20	28.27	*
Intermediate	10.03	10.44	
Adequate	54.16	31.34	*
Adequate Plus	30.60	29.94	
Trimester Care Began			
First	91.58	62.18	*
Second	6.98	27.45	*
Third	1.08	7.26	*
No Prenatal Care	0.35	3.11	*
Prenatal Care Visits			
No Visits	0.38	3.22	*
1 to 4 Visits	0.88	7.23	*
5 to 9 Visits	10.82	24.92	*
10 or More Visits	87.91	64.62	*
Hospital Perinatal Designation			
Levels 1 and 2	38.84	41.93	*
Level 2 EQ	22.83	3.34	*
Level 3	38.04	54.49	*
IUGR/SGA	2.62	3.87	*
Pregnancy Complications			
Placenta Previa/Abruptio	1.08	0.51	*
Breech/Malpresentation	3.98	2.46	*
Cord Prolapse	0.22	0.09	*
Fetal Distress	5.60	6.05	
Medical Risk Factors			
Diabetes	2.11	1.91	
Pregnancy Hypertension	2.78	1.07	*

Note. The factors that defined the reference group were not tested for statistically significant differences between groups. APNCUI = Adequacy of Prenatal Care Utilization Index[14].

* Statistically significant difference, $p < .05$.

mother are modifiable while others such as ethnicity are not.

Compared with the reference group, a larger percentage of women with lower education had premature babies and small for gestational age (SGA) babies.

In comparison to the reference group, a smaller percent of women with a high school education or less delivered in a hospital designated as a level 2 EQ while larger percentages delivered in both levels 1 and 2 hospitals and level 3 hospitals. Higher prenatal care designation levels are more equipped to handle higher risk pregnancies.

Other potential risk factors such as pregnancy complications and medical complications were not more prevalent among Maryvale's women with a high school education or less. In fact, there were statistically significantly smaller percentages for placenta previa/abruptio, fetal malpresentation, cord prolapse, and pregnancy-related hypertension.

Table VI-6 shows the prevalence of the risk factor or maternal demographic characteristic among all Maryvale mothers; the odds of having a fetal death given the risk factor in the county; the confidence limits around the odds. The population attributable risk percent (PAR%) is the percent of higher birth weight fetal deaths that could potentially be prevented if the predisposing risk factor was eliminated. Of course, some risk factors like the education of the

Women with a high school education or less were almost six times more likely to have a higher birth weight (> 1,500 grams) fetal death than women with more education. If women's level of education could be increased along with those factors affected by education, then almost 71% of those deaths in the "maternal care" category could potentially be prevented. Teenagers were 0.66 times less likely to have a death in the "maternal care" category than women aged 20 to 39 years old. Hispanic women were 0.52 times less likely to have a higher birth weight fetal death than White women.

Women who received inadequate prenatal care were 1.6 times more likely to have a higher birth weight fetal death. If women received adequate prenatal care, approximately 11.2% of the higher birth weight fetal deaths could be prevented. Women who received adequate plus (intensive) prenatal care were 1.8 times more likely to have a death in the "maternal care" category. Adequate plus care would result in a higher rate of mortality than adequate care because pregnancies receiving intensive prenatal care are selected for their high-risk. If the risk factors that made a pregnancy high risk and/or the management of high risk pregnancies could be perfected so that they were not high risk pregnancies, then the percentage of higher birth weight fetal deaths could potentially be reduced by about 18%.

Taking other risk factors into account, the hospitals perinatal care designation level was unrelated to higher birth weight (> 1,500 grams) fetal deaths in the county. Small for gestational age (SGA) babies were 4.5 times more likely to die prior to birth than babies who were not small. If SGA could be prevented, then 11.9% of the higher birth weight fetal deaths could be prevented. Women with conditions of the placenta such as abruptio placenta/ placenta previa were 9.6 times more likely to have a higher birth weight fetal death than women without these risks. Approximately 4.8% of the deaths in the "maternal care" category could potentially be prevented if these conditions could be prevented. A fetal death was 1.7 times more likely when the fetus was in the wrong position for delivery (e.g., breech). If the malpresentation of the fetus could be prevented, 1.7% of the deaths in the "maternal care" category could be prevented. Cord prolapse increased the chances of a higher birth weight fetal death by 51 times and had an estimated population attributable risk percentage of 4.8%. Maternal diabetes increased the odds of a higher birth weight fetal death by 2.1 and eliminating diabetes could potentially reduce these deaths by 2.3%. Fetal distress and pregnancy hypertension were not statistically significant predictors of deaths in the "maternal care" category.

Table VI-6. Maternal Care: Odds of a Higher Birth Weight (>1,500 grams) Fetal Death.

Risk Factor	Maryvale Prevalence (%)	Unadjusted		Adjusted		PAR %
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age						
< 20 Years Old	20.57	1.05	0.81, 1.35	0.66	0.48, 0.89 *	
20-39 Years Old	78.45	C	C	C	C	
> 40 Years Old	0.98	0.88	0.44, 1.78	0.65	0.24, 1.77	
< 12 years Education	49.24	4.13	3.39, 5.03 *	5.95	4.57, 7.74 *	70.90
Race/Ethnicity						
White	11.39	C	C	C	C	
Hispanic	65.89	1.27	1.05, 1.54 *	0.52	0.40, 0.68 *	
African American	6.48	1.07	0.65, 1.76	0.78	0.45, 1.37	
Native American	2.79	1.35	0.81, 2.24	0.95	0.55, 1.62	
Asian	1.91	0.94	0.50, 1.77	0.88	0.41, 1.88	
Premature	9.14	13.34	11.13, 15.99 *	N/A	N/A	
APNCUI						
Inadequate	22.97	2.52	1.92, 3.29 *	1.55	1.14, 2.30 *	11.23
Intermediate	11.24	1.42	0.99, 2.04	1.28	0.86, 1.88	
Adequate	36.54	C	C	C	C	
Adequate Plus	29.26	2.32	1.83, 2.94 *	1.77	1.36, 2.30 *	18.33
Prenatal Care Visits						
No Visits	2.47	6.45	4.51, 9.23 *	N/A	N/A	
1 to 4 Visits	5.37	4.51	3.34, 6.09 *	N/A	N/A	
5 to 9 Visits	22.42	2.51	2.02, 3.11 *	N/A	N/A	
10 or More Visits	69.74	C	C	C	C	
Trimester Prenatal Care Began						
First	68.83	C	C	C	C	
Second	23.10	1.22	0.95, 1.56	N/A	N/A	
Third	5.69	1.23	0.77, 1.96	N/A	N/A	
No Prenatal Care	2.38	0.27	0.07, 1.07	N/A	N/A	
Hospital Perinatal Care Designation						
Levels 1 and 2	42.92	0.99	0.81, 1.20	1.17	0.93, 1.47	
Level 2 EQ	5.79	0.62	0.45, 0.86 *	0.79	0.53, 1.19	
Level 3	51.01	C	C	C	C	
IUGR/SGA	3.83	5.20	4.06, 6.67 *	4.52	3.35, 6.09 *	11.87
Delivery Complications						
Placenta Previa/Abruptio	0.59	10.23	7.40, 14.12 *	9.58	6.55, 14.02 *	4.82
Breech/Malpresentation	2.57	2.33	1.65, 3.29 *	1.67	1.09, 2.57 *	1.69
Cord Prolapse	0.10	50.02	35.07, 71.33 *	50.96	32.99, 78.73 *	4.76
Fetal Distress	6.13	1.04	0.72, 1.50	0.71	0.46, 1.12	
Medical Risk Factors						
Diabetes	2.15	2.35	1.56, 3.54 *	2.11	1.28, 3.46 *	2.33
Pregnancy Hypertension	1.45	1.39	0.83, 2.33	1.11	0.51, 2.01	

Note. The prevalence is the percent of the risk factor among the higher birth weight (> 1,500 grams) births and fetal deaths. PAR% = Estimate of the population attributable risk or the percent of fetal deaths that could be prevented if the predisposing risk factor were eliminated. C = Comparison group. APNCUI = Adequacy of prenatal care utilization index[14].

* Statistically significant, $p < .05$

Summary of Maternal Care Category Results

Many risk factors for the higher birth weight fetal deaths are not available on vital records. Information regarding maternal infection, maternal injury, delays in obtaining medical care for delivery, delays in recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring were not readily available for analysis. Of the risk factors analyzed, several predicted deaths related to the "maternal care" category and also were more prevalent in Maryvale women with a high school education or less education; these risk factors are shown in Table VI-7.

Table VI-7. Summary of Important Risk Factors for Deaths in the "Maternal Care" Category

Risk Factors	≤ 12 Yrs Education
Inadequate Prenatal Care	✓
Small for Gestational Age	✓
Prematurity	✓

Note. Check marks indicate the risk factor is important

The important risk factors that are subject to change included inadequate prenatal care and lower educational level. Women who received adequate levels of prenatal care (as defined by ACOG) or had some education beyond high school were less likely to have a higher birth weight fetal death.

Although maternal diabetes, placenta previa or abruptio placenta, breech, and cord prolapse were significant risk factors for the deaths attributed to the "maternal care" category, Maryvale women with a high school education or less education did not have higher levels of these risk factors than women in the reference group.

Newborn Care

Phase I analyses indicated that there was not much variability in the "newborn care" category among the different groups of mothers. The excess mortality did not meet the criterion of 1.5 deaths per 1,000 live births and fetal deaths in any of the groups examined. These results suggest that "newborn care" was not an issue in Maryvale. Therefore, Phase II analyses of this category were not conducted.

Infant Health

Phase I analyses indicated that there was some excess fetal and infant death in the "infant health" category but not enough excess to further examine. The excess mortality did not meet the criterion of 1.5 excess deaths per 1,000 live births and fetal deaths in any of the groups examined. These results suggest that "infant health" was not as important in Maryvale as some other categories. Therefore, Phase II analyses of the "infant health" category were not conducted

Summary of Maryvale Results

Phase I data analyses computed excess fetal and infant mortality rates (F-IMR) by comparing the rates in the Maryvale to the rates of a reference group (composed of Maricopa County non-

Hispanic White women who were 20 or more years of age and had some education beyond high school). The excess mortality is considered preventable mortality and shows the disparities between population groups. Based on birth weight and the age of death, the excess F-IMR was partitioned into four areas that correspond to specific intervention points in the health care continuum: "Maternal health and prematurity," "maternal care," "newborn care," and "infant health." The four components have different causes of death, risk factors, and corresponding interventions.

The total F-IMR in Maryvale during the period 1996 through 2000 was 8.8 deaths (per 1,000 live births and fetal deaths) and the excess F-IMR was 3.0 deaths. Approximately 34% of the fetal and infant deaths were potentially preventable based on this analytical method. One of the largest contributors to these excess rates was "maternal health and prematurity." These findings suggest that women's health prior to conception, social and demographic factors played a prominent role in determining fetal and infant outcomes. Focusing prevention or intervention programs on women's health prior to conception should yield larger reductions in the overall excess feto-infant mortality rate than focusing on other points in the health care continuum.

The excess feto-infant mortality rates in Maryvale were higher for women with a high school education or less than for women with some education beyond high school. Education, a risk factor amenable to modification, consistently showed a large impact on feto-infant mortality rates. These findings confirm that furthering education is a strong predictor and determinant of health status.

Hispanics were the only race/ethnicity in the Maryvale area with statistically enough births and deaths to examine in detail but the excess mortality did not reach the minimum necessary excess to examine risk factors. African Americans had a high excess F-IMR but their numbers were too small statistically to examine risk factors. There were also very few fetal and infant deaths to Native Americans residing in Maryvale. To target the African American and Native American women living in Maryvale, see the results of the countywide analyses (section V). Teenagers in Maryvale had both small numbers (statistically) of births and deaths, and an excess mortality that did not reach the minimum necessary in any one particular group to examine risk factors.

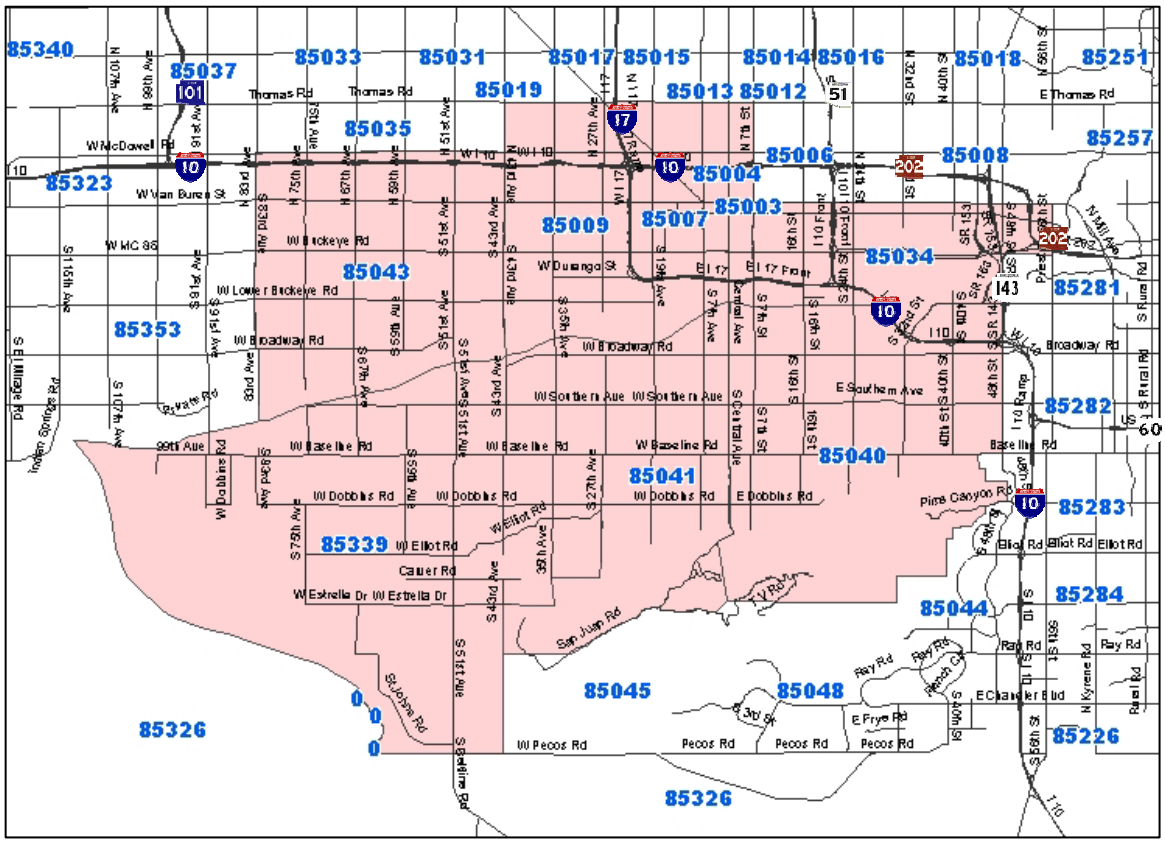
Phase II analyses examined risk factors in the four F-IMR categories for population groups with high excess mortality and a large enough number of deaths to use in the statistical analyses. There were two pathways to excess in the "maternal health and prematurity" category: the birth weight distribution (too many very low birth weight babies) and birth weight-specific mortality (more babies dying at each birth weight grouping). The population group with high excess F-IMR and (statistically) large enough numbers of births and deaths was women with a high school education or less. This group had high excess mortality in "maternal health and prematurity" that was due to a lower birth weight distribution (more very low birth weight babies) than the reference group. The important risk factors for the "maternal health and prematurity birth weight distribution" category that tends to relate to the mothers preconception health, social and economic situation, included the mother gaining less than 15 pounds during pregnancy, smoking during pregnancy, few prenatal care visits, an unmarried mother (probably indicating a lack of social support or SES), a small for gestational age baby, and a previous premature baby.

Women with a high school education or less also had high excess mortality in the “maternal care” category, which tends to relate to prenatal care, referral systems, and high risk care. Important risk factors for maternal care included inadequate prenatal care such that women were beginning prenatal care later and having too few prenatal care visits, small-for-gestational-age, and prematurity. Information on system integration across the health care spectrum was not available and requires additional study.

Section VII. PPOR: South Phoenix Neighborhood

Phase I: Feto-Infant Mortality

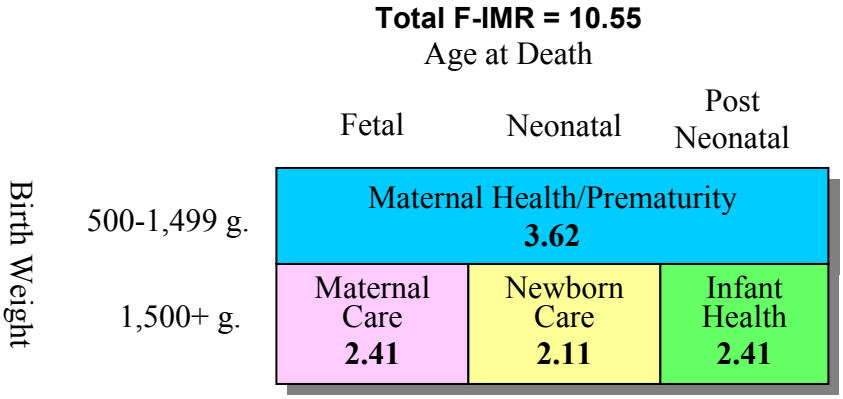
The South Phoenix neighborhood was defined by 10 zip codes: 85003, 85004, 85007, 85009, 85034, 85040, 85041, 85042, 85043, and 85339 (see map below). From 1996 through 2000, there were a total of 245 fetal and infant (feto-infant) deaths and 23,225 live births and fetal deaths in the South Phoenix area. The corresponding total feto-infant mortality rate (F-IMR) was 10.6 deaths per 1,000 live births and fetal deaths. This means that for every 1,000 recognized pregnancies that survived 6 months or more, 10.6 resulted in either a miscarriage or the death of a baby. The South Phoenix rate during the period was higher than the county's rate (8.5 deaths per 1,000 live births and fetal deaths).



South Phoenix, Phoenix, Arizona

Figure VII-1 shows South Phoenix's PPOR map for the years 1996 through 2000. In the map, the overall F-IMR was divided into four cells suggesting the prevention/intervention direction for the deaths in that group. The group-specific rates, shown in the four cells, contribute (or sum) to the total rate. The highest group-specific F-IMR was in the "maternal health/prematurity" category (3.6 deaths per 1,000 live births and fetal deaths). "Infant health" and "maternal care" categories followed with rates of 2.4 deaths per 1,000 live births and fetal deaths, while the "newborn care" category showed the lowest rate (2.1 deaths per 1,000 live births and fetal deaths).

Figure VII-1. Map of South Phoenix's Feto-Infant Mortality Rate (1996-2000)

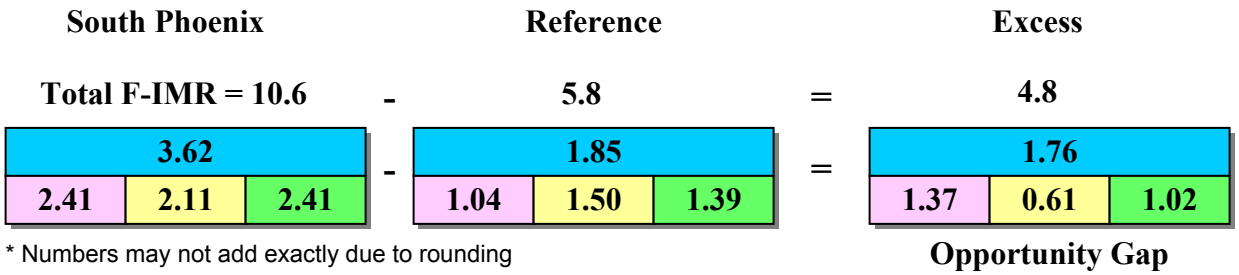


During the same time period, 1996 to 2000, the reference group (consisting of Maricopa County, non-Hispanic White women who were at least 20 years of age and had some education beyond high school) had a total F-IMR of 5.8 deaths per 1,000 live births and fetal deaths. There were a total of 571 fetal and infant deaths and 98,823 live births and fetal deaths during the period. The map of the reference group is shown as the middle map in Figure 17. Similar to the South Phoenix map, the highest group-specific F-IMR was in the "maternal health/prematurity" category (1.9 deaths per 1,000 live births and fetal deaths).

Excess (Preventable) Feto-Infant Mortality

Figure VII-2 shows the excess feto-infant mortality in the South Phoenix area, as well as the method to obtain the excess. The map on the far left is the South Phoenix F-IMR map that was shown above, while the middle map is the reference group's F-IMR map. The map on the far right is the excess F-IMR for the South Phoenix area. Subtracting the reference group's F-IMR (5.8) from South Phoenix's F-IMR (10.6) yielded an excess F-IMR of 4.8 (feto-infant deaths per 1,000 live births and fetal deaths). The amount of excess mortality suggests the extent to which the F-IMR can be theoretically reduced in South Phoenix. The excess F-IMR can be described as an "opportunity gap" and shows disparities within the population. If the F-IMR did not differ across groups, then there would have been almost 5 fewer feto-infant deaths per 1,000 live births and fetal deaths in the area during the period 1996-2000. Note that the individuals in the reference group were not removed from the South Phoenix numbers, providing a conservative estimate of the excess.

Figure VII-2. South Phoenix Opportunity Gap (Excess Feto-Infant Mortality Relative to the Reference Group) Potential for Reduction

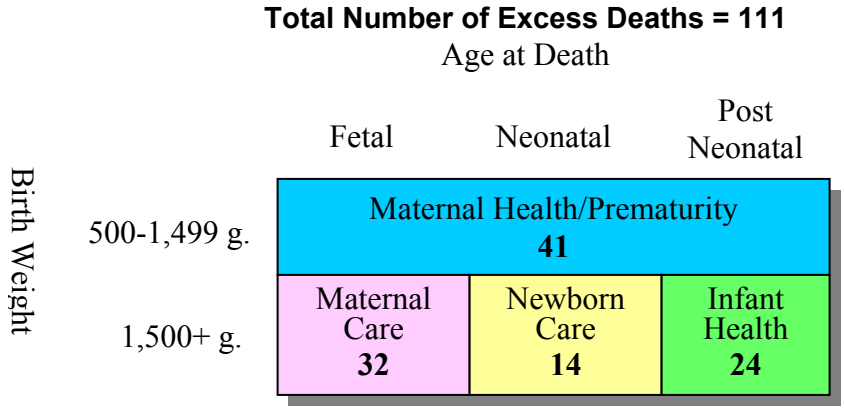


Each of the group-specific rates in the map was subtracted from the corresponding group rate in the reference map in the same manner that the total population rate was subtracted. The largest excess rate was in the "maternal health/prematurity" category with 1.8 deaths per 1,000 live births and fetal deaths. "Maternal care" showed an excess rate of 1.4, "infant health" an excess rate of 1.0, and "newborn care" an excess rate of 0.6 (deaths per 1,000 live births and fetal deaths).

If the South Phoenix F-IMR was similar to the reference group's F-IMR, there would have been 111 fewer feto-infant deaths during the five-year period than actually occurred. See Figure VII-3 for the translation of rates into number of deaths over the period. Of the 111 excess feto-infant deaths, 41 occurred in the "maternal health/prematurity" category, 32 were in the "maternal care" category, 14 were in the "newborn care" category, and 24 were in the "infant health" category. These excess deaths represented 45% of the feto-infant mortality in South Phoenix.

These findings suggest that successful prevention and intervention efforts focused on "maternal health/prematurity" and "maternal care" should yield larger reductions in the overall excess feto-infant mortality rate more than focusing on other points in the health care continuum. Although there is room for improvement in all areas, some categories contribute more to the overall rate than others (e.g., "newborn care").

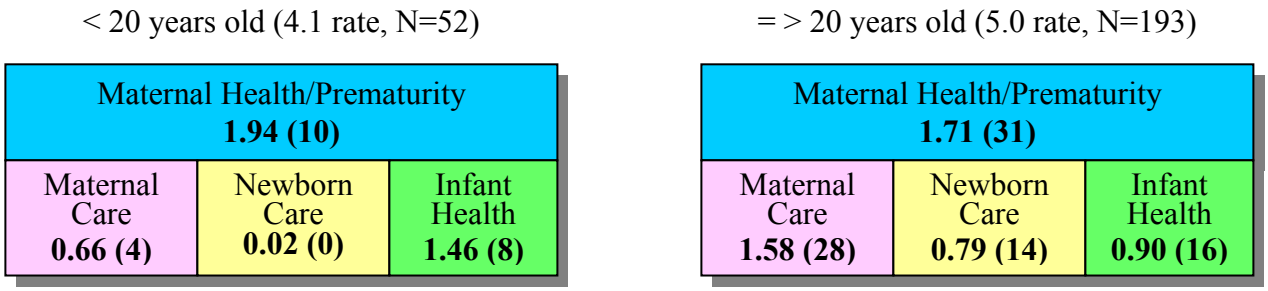
Figure VII-3. South Phoenix Potential for Reduction: Excess Rates Translated Back to Numbers



Excess Feto-Infant Mortality for Selected Population Groups

The excess rates were also examined by population groups to determine which group contributed more to the excess feto-infant mortality. Risk factors within each population group can affect infant mortality. This knowledge allows prevention efforts to be further focused on those groups with higher mortality rates.

Figure VII-4. South Phoenix Excess Feto-Infant Mortality Rate (Number of Deaths) by Age Group (1996-2000)



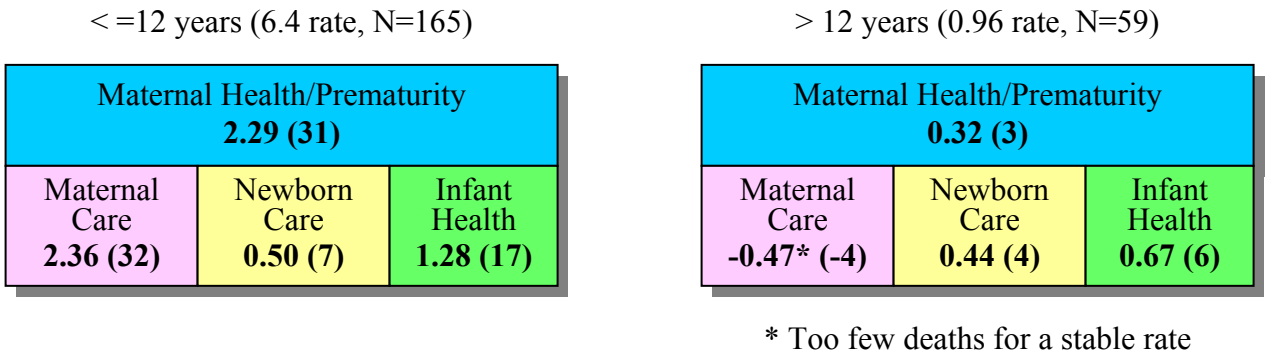
Maternal age was categorized into two groups: women under 20 years old (teenagers) and women 20 or more years of age. For teenagers, there were a total of 52 feto-infant deaths and 5,273 live births and fetal deaths. For women 20 or more years of age, there were a total of 193 feto-infant deaths and 17,949 live births and fetal deaths. The excess F-IMR for teenagers was lower than the excess rate for women 20 or more years of age in South Phoenix (4.1 and 5.0 deaths per 1,000 live births and fetal deaths, respectively). The direction of this difference is opposite of the findings in the county.

Figure VII-4 shows the excess feto-infant mortality rate map for teenagers and women 20 or more years of age. Although the "maternal health/prematurity" category showed the highest excess rate for both groups (1.9 and 1.7 for younger and older women, respectively), the second highest rate differed. The second highest rate was in the "infant health" category for women who were under 20 years of age but was in the "maternal care" category for women who were 20 years of age or older.

The level of maternal education was categorized into two groups: women with a high school education or less (<=12 years) and women with any education beyond high school (>12 years). There were a total of 165 feto-infant deaths and 13,524 live births and fetal deaths for women with a high school education or less. For women with some education beyond high school, there were a total of 59 feto-infant deaths and 8,761 live births and fetal deaths. Figure VII-5 shows the maps of excess feto-infant mortality for both education levels. There was a large difference between the total excess F-IMRs in the two education groups; the excess death rate for women with less education was 6.4 while the rate for women with more education was 1.0 deaths per 1,000 live births and fetal deaths. For those with a high school education or less, the highest group-specific excess rates were in the "maternal care" and "maternal health/prematurity"

categories. Education is an antecedent factor for other measures such as income levels, access to care, and behavioral patterns and a proxy measure for socioeconomic status (SES). Therefore, increasing the population's education level would not necessarily decrease all the risk factors for feto-infant mortality but it may help to improve outcomes dependent on incomes, behaviors, and access to care.

Figure VII-5. South Phoenix Excess Feto-Infant Mortality Rate (Number of Deaths) by Education Group (1996-2000)



* Too few deaths for a stable rate

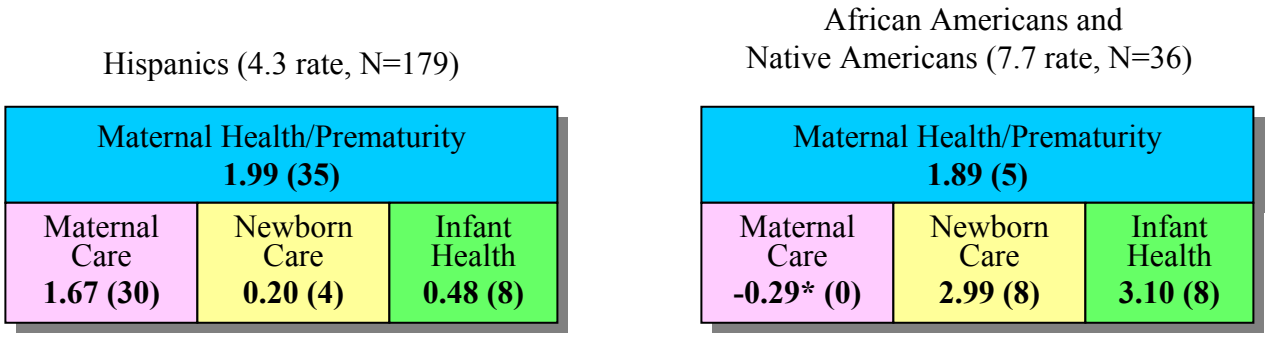
Analyses were conducted for racial/ethnic subgroups. Race/ethnicity in the U.S. society can be a proxy measure for many risk factors such as socioeconomic status, living conditions, cultural and behavioral patterns, and life stressors. During the five year period, there were a total of 179 feto-infant deaths and 17,690 live births and fetal deaths for Hispanics; 28 feto-infant deaths and 2,639 live births and fetal deaths for Whites; 26 feto-infant deaths and 1,905 live births and fetal deaths for African Americans; and 10 feto-infant deaths and 769 live births and fetal deaths for Native Americans. African Americans (7.9 per 1,000 live births and fetal deaths) and Native Americans (7.2 per 1,000 live births and fetal deaths) had the highest total excess F-IMRs.

The number of feto-infant deaths was too small statistically for the African American and Native American groups to further subdivide the total rate; the two groups were combined (in Phase I analyses) for a total excess F-IMR of 7.7 deaths per 1,000 live births and fetal deaths. These groups were combined because they are the South Phoenix Healthy Start target groups. Note that the numbers are still small. Additionally, the results in Maricopa County suggest that these two groups have different patterns of feto-infant mortality (see section V). The total excess F-IMR for Whites was 4.8 per 1,000, which was higher than the countywide excess rate. The number of feto-infant deaths in the White group was too small for further partitioning. The total excess F-IMR for Hispanics was 4.3 deaths per 1,000 live births and fetal deaths.

Figure VII-6 shows the excess feto-infant mortality map for South Phoenix Hispanics and African Americans/Native Americans; the two groups with a large enough population to further categorize feto-infant mortality rates. For Hispanics, the highest group-specific excess F-IMR was in the "maternal health/prematurity" category, and the second highest excess rate was in the "maternal care" category. For African Americans/Native Americans, the highest group-specific

excess F-IMR fell in the "infant health" category, while the second highest rate fell in the "newborn care" category. Note, however, that the "maternal health/prematurity" categories in the two groups had similar excess rates but this was the highest rate for Hispanics and only the third highest rate for African Americans/Native Americans. Prevention efforts need to be distributed, taking into consideration high rates in one population and a high number of deaths in other populations.

Figure VII-6. South Phoenix Excess Feto-Infant Mortality Rate (Number of Deaths) by Race/Ethnicity (1996-2000)



* Too few deaths for a stable rate

Phase II: Risk Factor Analyses

In Phase II, the analyses focus on potential risk factors for those areas with excess mortality (preventable deaths). In order to conduct the Phase II analyses, there need to be large enough numbers of births and deaths in the group with excess mortality and the preventable death rate needs to be large enough in order for the statistical methods used to be reliable. If the number of births and deaths are too small or the rate of preventable death is too small, the statistical techniques may produce inaccurate results. Therefore, the minimum number of total fetal and infant deaths in a group (e.g., teenagers) had to be at least 60 and the excess mortality rate within a category (e.g., infant health) for that group had to be 1.5 or greater [4].

Table VII-1 shows the South Phoenix area summary of groups with excess fetal and infant deaths by category from the Phase I analyses. The groups and categories that met the criteria for further analyses are shown with a check mark (✓). Appendix C shows the same table with the excess mortality for all groups. For "maternal health and prematurity," the South Phoenix area as a whole, teenagers, women aged 20 or more years, women with a high school education or less, teenagers, and Hispanic women met the criteria for further analysis. For "maternal care," analyses concentrate on women 20 or more years of age, women with a high school education or less and Hispanic women. "Infant health" analyses concentrate on teenagers. The "newborn care" category did not meet the criteria for further analysis in any of the groups examined.

Table VII-1. Summary of Population Groups with Excess Mortality by Category from the Phase I Results that will be Examined in Phase II (Groups with Check Marks).

South Phoenix Group	Maternal Health & Prematurity	Maternal Care	Newborn Care	Infant Health
All mothers	✓			
< 20 years old	✓			✓
≥ 20 years old	✓	✓		
≤ 12 years Education	✓	✓		
>12 years Education				
White				
Hispanic	✓	✓		
African American				
Native American				

Because over 75% of the births in South Phoenix are to Hispanic women, the number of fetal and infant deaths to women in other race/ethnicity categories was statistically too small to examine in Phase II. Although their numbers were not large enough to further examine here, high excess feto-infant mortality was found for African American, Native American, and White mothers. Different methodologies would be necessary to examine these groups in the South Phoenix area in more detail (e.g., focus groups, fetal and infant mortality review, or child fatality review). To target these groups of women for prevention efforts based on these analyses and methodology, see the results for all of Maricopa County for information.

Maternal Health and Prematurity

Very low birth weight (< 1,500 grams) fetal and infant deaths that occur between 24 weeks of gestation (pregnancy) and one year of life comprise the deaths attributed to "maternal health and prematurity." In general, there are two paths to "maternal health and prematurity" excess death rate. The first potential path is a higher frequency of very low birth weight (VLBW) births (an unfavorable low birth weight distribution) in a group compared to the reference group. VLBW births are at a higher risk of death than higher birth weight births so a population group with more VLBW births (an unfavorable low birth weight distribution) would probably have a higher mortality rate than a population group with fewer VLBW births. When the "maternal health/prematurity" deaths are mainly associated with the birth weight distribution, the associated risk factors tend to be related to the mother's health, behavior, social and economic situation.

The second potential path is that there are more babies dying at each birth weight in a group compared to the reference group. This is birth weight-specific mortality. When the excess "maternal health/prematurity" deaths are mainly associated with higher birth weight-specific mortality, then the risk factors tend to be related to the medical care provided to the mother and infant before, during, and immediately after the birth. The PPOR approach suggests examining the risk factors associated with the birth weight-specific mortality pathway whenever 40% or more of the "maternal health/prematurity" excess death rate is attributable to this contributing

pathway. It is likely easier to change risk factors related to birth weight-specific mortality and medical care than those associated with an unfavorable birth weight distribution [4].

Consequently, the first step in describing the reasons for excess "maternal health/prematurity" death rate is determining whether this excess is due to more VLBW babies or more babies dying at each birth weight. The contribution of each pathway was determined using the formula developed by Kitagawa [4, 7]. The South Phoenix area as a whole and four South Phoenix population groups had high enough excess fetal and infant death rates attributed to the "maternal health/prematurity" category to further examine:

- South Phoenix area overall
- Women under the age of twenty
- Women 20 years of age or more
- Women with a high school education or less
- Hispanic women.

Contributing Pathways to the "Maternal Health and Prematurity" Category

Appendix D (Tables D-5 through D-9) shows the rate and percent contribution of the birth weight distribution and birth weight-specific mortality to the overall excess rate by birth weight categories for each of the groups presented in this section.

Figure VII-7. South Phoenix Area

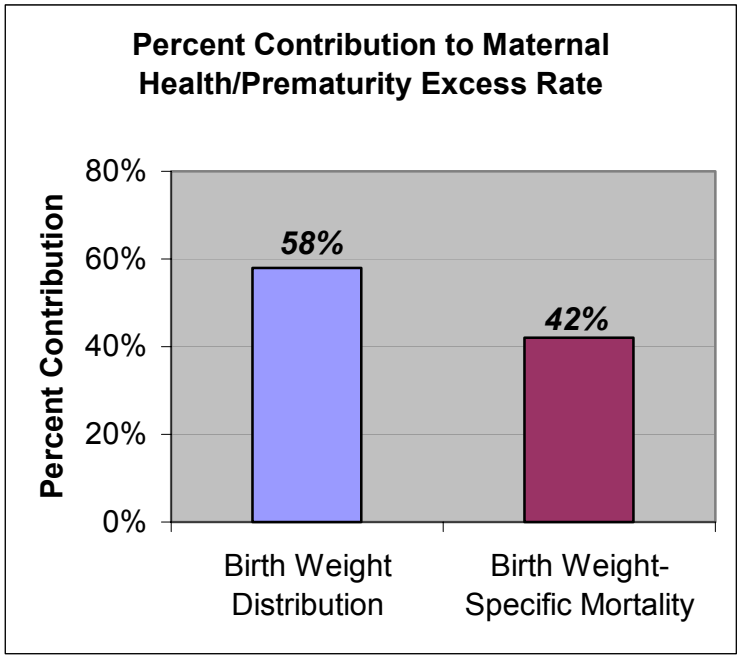
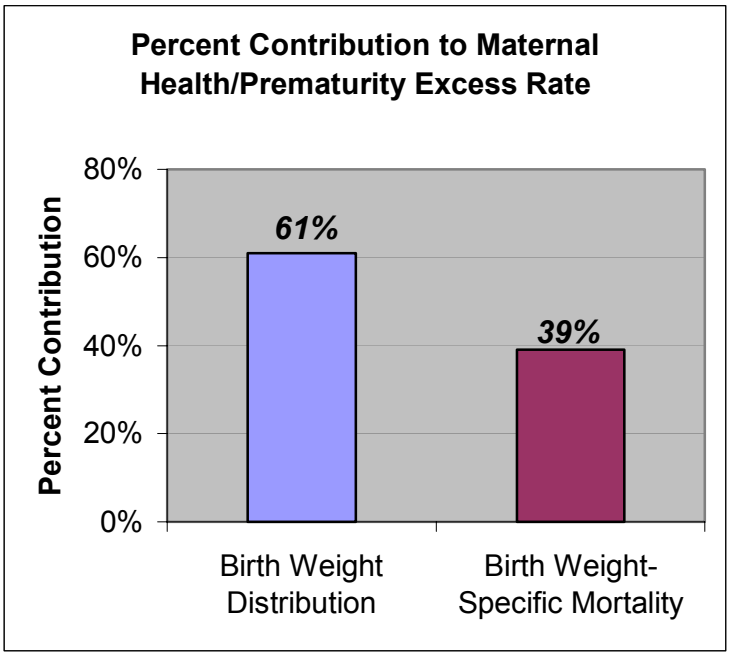


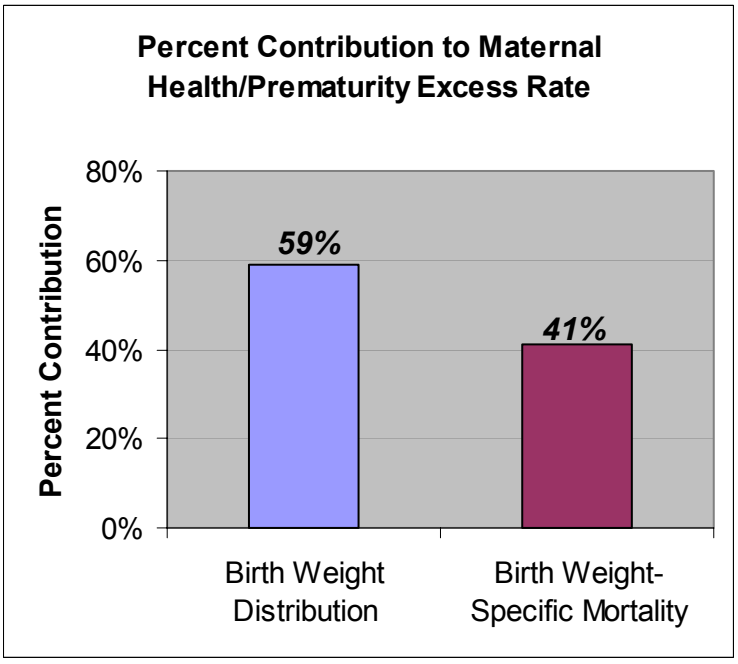
Figure VII-7 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant mortality rate in the "maternal health and prematurity" category for the South Phoenix area overall. Over half (58%) of the "maternal health and prematurity" excess rate was due to the birth weight distribution. In other words, most of the difference in the death rates of very low birth weight babies between South Phoenix and the reference group occurred because the women in South Phoenix had more very low birth weight babies than the reference group. Over 40% of the excess mortality rate was due to the contribution of the birth weight-specific mortality pathway, however. Therefore, risk factors associated with both the birth weight distribution and birth weight-specific mortality will be examined following a description of the relevant pathways for the four demographic groups.

Figure VII-8. South Phoenix Teenagers.



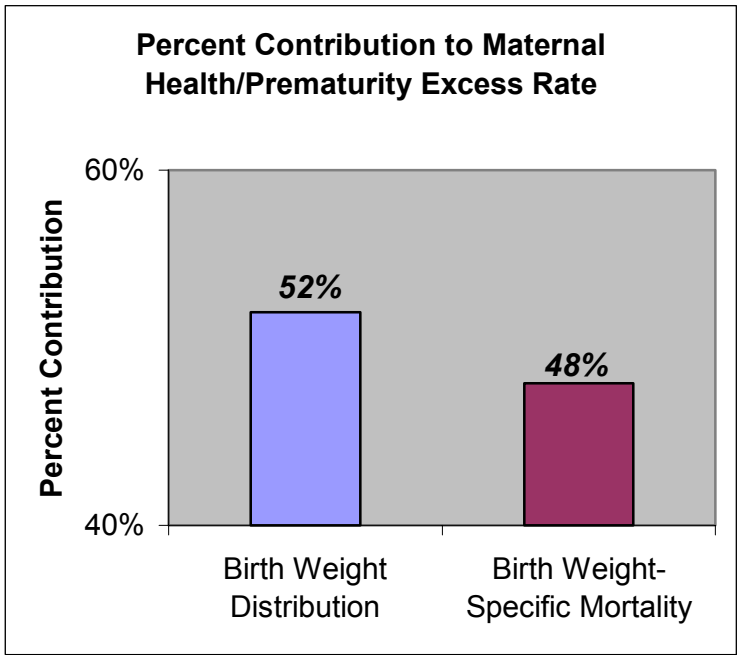
FigureVII-8 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant death rate attributed to the "maternal health/prematurity" category for South Phoenix teenagers. Approximately 61% of the excess mortality rate in the "maternal health/prematurity" category was due to the birth weight distribution pathway. Risk factors associated with the birth weight distribution will be examined for teenagers.

Figure VII-9. South Phoenix Women 20 or More Years of Age



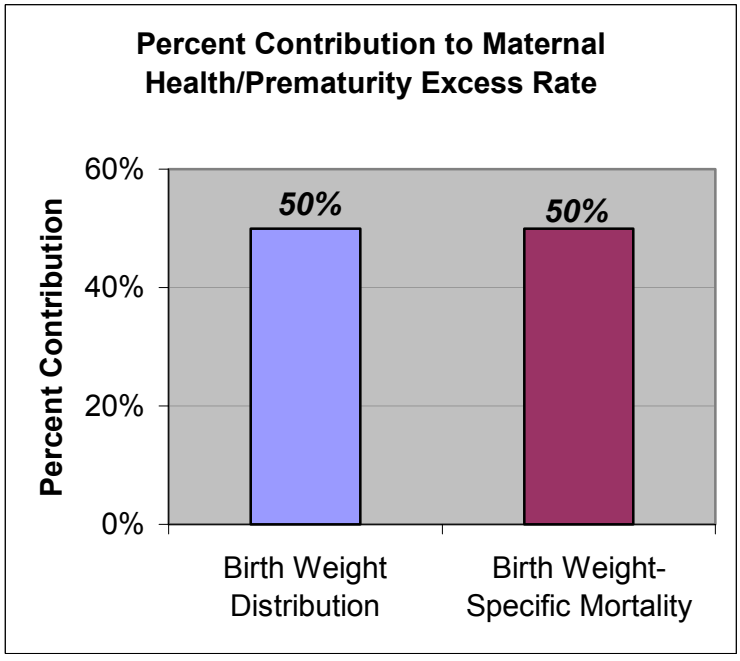
For women 20 or more years of age, Figure VII-9 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant mortality rate in the "maternal health and prematurity" category. Among women 20 or more years of age, the birth weight distribution pathway accounted for more than half (59%) of the excess rate in the "maternal health and prematurity" category. The birth weight-specific mortality pathway, however, accounts for over 40% of the excess mortality rate. As a result, the risk factors for both the birth weight distribution and birth weight-specific mortality will be explored

Figure VII-10. South Phoenix Women with a High School Education or Less



For South Phoenix women with a high school education or less, FigureVII-10 shows the percent contribution of the birth weight distribution and birth weight-specific mortality to the excess feto-infant death rate attributed to the "maternal health and prematurity" category. The contribution of the birth weight distribution pathway was 52% and the contribution of the birth weight-specific mortality pathway was 48%. The risk factors for both pathways will be examined.

Figure VII-11. South Phoenix Hispanic Women



As shown in Figure VII-11, there were equal percentages for the contribution of the birth weight distribution and birth weight-specific mortality pathways to Hispanic women's excess fetal and infant mortality rate in the "maternal health and prematurity" category. Therefore, the risk factors associated with each pathway will be explored.

Risk Factors for the "Maternal Health/Prematurity" Birth Weight Distribution Category

In South Phoenix overall and the four population groups with high excess mortality in the "maternal health and prematurity" category (teenagers, women 20 years of age or more, women with a high school education or less, and Hispanic women), the analyses suggested that attention should focus on those risk factors that affect the birth weight distribution. At least 50% of the mortality in each of these population groups was attributed to the birth weight distribution pathway. The factors that tend to be related to the birth weight distribution have to do with the mother's health, behavior, social and economic situation. The risk factors selected for analysis were suggested by the PPOR practice collaborative based on other populations and previous experience [4], and available on the birth certificate. The factors examined include marital status, high parity for age, multiple birth (e.g., twins), prenatal care, prematurity, previous preterm birth, small for gestational age, anemia, pregnancy weight gain, smoking cigarettes during pregnancy, alcohol use during pregnancy, and the method of payment for delivery. Additional but unavailable risk factors include sexually transmitted disease, infections such as bacterial vaginosis, drug abuse, pregnancy intendedness, domestic violence, income, and the social capital of the community (SES indicator).

Table VII-2 shows the risk factor prevalence comparison of the reference group to South Phoenix as a whole, teenagers, women 20 years of age or more, women with a high school education or less, and Hispanic women living in South Phoenix. An asterisk (*) next to a percentage denotes that the number is statistically different from the reference group.

Compared with the women in the reference group, a larger percentage of women in South Phoenix were unmarried, gained less than 15 pounds during pregnancy, had high parity for their age, had small for gestational age babies. A larger percentage of South Phoenix women had inadequate prenatal care than reference group women: they began prenatal care later in pregnancy and had fewer prenatal care visits. A smaller percentage of South Phoenix women than reference group women paid for their delivery with private insurance, had a previous preterm delivery, a multiple birth (e.g., twins), anemia, and smoked during pregnancy.

These differences in risk factor prevalence were essentially the same for each South Phoenix population group examined with one exception: A smaller percentage of teenage and Hispanic mothers drank alcohol during pregnancy, relative to the reference group.

Table VII-2. Birth Weight Distribution: Differences in Risk Factor Prevalence (Percent).

Risk Factor	Reference Group	South Phoenix Area	Hispanics	< 20 Years Old	=> 20 Years Old	<=12 Years Education
Age						
< 20 Years Old	0	22.71	23.22	100	0	30.17
20-39 Years Old	97.38	75.94	75.71	0	98.26	68.71
=> 40 Years Old	2.62	1.34	1.07	0	1.74	1.12
<= 12 Years Education	0	60.59	68.04	79.69	54.91	100
Race/Ethnicity						
White	100	11.41	0	8.02	12.41	6.13
Hispanic	0	76.50	100	78.00	76.05	85.52
African American	0	8.24	0	9.53	7.86	5.04
Native American	0	3.33	0	4.12	3.10	3.14
Asian	0	0.52	0	0.32	0.58	0.17
Unmarried	15.71	61.8 *	61.36 *	85.82 *	54.74 *	67.65 *
Tobacco Use	8.68	6.38 *	3.04 *	4.38 *	6.96 *	6.58 *
Alcohol Use	1.27	1.24	0.67 *	0.83 *	1.35	1.24
Weight Gain						
< 15 lbs	5.78	11.59 *	12.21 *	9.62 *	12.18 *	12.53 *
15-40 lbs	72.61	66.68 *	66.53 *	65.23 *	67.12 *	65.05 *
>40 lbs	21.61	21.73	21.26	25.14 *	20.70 *	22.41 *
High Parity for Maternal Age	13.13	22.78 *	21.12 *	34.85 *	19.22 *	26.95 *
APNCUI						*
Inadequate	5.21	31.75 *	33.82 *	35.49 *	30.66 *	37.43 *
Intermediate	9.99	13.70 *	14.11 *	13.18 *	13.85 *	13.43 *
Adequate	53.87	29.54 *	27.66 *	28.63 *	29.80 *	25.22 *
Adequate plus	30.94	25.01 *	24.41 *	22.71 *	25.68 *	23.92 *
Trimester Care Began						
First	91.57	61.30 *	58.60 *	57.30 *	62.47 *	55.34 *
Second	7.00	25.89 *	27.50 *	29.37 *	24.87 *	29.36 *
Third	1.08	7.86 *	8.60 *	9.16 *	7.48 *	9.39 *
No Prenatal Care	0.36	4.95 *	5.31 *	4.17 *	5.18 *	5.91 *
Prenatal Care Visits						
No Visits	0.39	4.88 *	5.15 *	4.37 *	5.02 *	5.84 *
1 to 4 Visits	0.94	10.10 *	10.80 *	11.81 *	9.61 *	12.50 *
5 to 9 Visits	10.98	27.16 *	28.66 *	29.31 *	26.53 *	29.29 *
10 or More Visits	87.69	57.86 *	55.39 *	54.51 *	58.84 *	52.37 *
Small for Gestational Age	2.77	4.49 *	4.04 *	5.17 *	4.29 *	4.59 *
Premature	9.54	11.05	10.48	11.61	10.88	11.05
Previous Preterm	0.53	0.12 *	0.08 *	0.08 *	0.13 *	0.08 *
Multiple Birth	3.44	2.11 *	1.96 *	1.41 *	2.32 *	1.88 *
Anemia	1.99	1.19 *	0.81 *	1.43 *	1.13 *	1.09 *
Method of Payment						
AHCCCS	14.86	72.33 *	76.80 *	82.27 *	69.41 *	82.51 *
Insurance	81.16	20.89 *	16.71 *	11.36 *	23.69 *	10.28 *
IHS	0.09	0.55 *	0.09	0.71 *	0.51 *	0.58 *
Self	3.13	3.96 *	4.17 *	3.41	4.12 *	4.53 *

Note. The factors that defined the reference group were not tested for statistically significant differences between groups.

* Statistically significant difference, $p < .05$, between the group and the reference group.

Table VII-3 shows the odds of very low birth weight for all county mothers given each of the risk factors individually and adjusted for other risk factors. The table also shows the prevalence (%) of the risk factor/characteristic in South Phoenix, confidence limits around the odds, statistical significance and an estimate of the population attributable percent. The odds show the likelihood of very low birth weight given the risk factor individually (unadjusted) and while controlling other risk factors (adjusted). The population attributable risk percent (PAR%) is an estimate of the percent of very low birth weight outcomes that would be prevented if the predisposing risk factor was eliminated. Note that some risk factors are modifiable while others are not. For example, a multiple pregnancy (e.g., twins or triplets) may not be a modifiable risk factor, whereas smoking cigarettes during pregnancy may be a modifiable risk factor. The risk factors included in the adjusted analyses did not include prematurity (< 37 weeks gestation) because very low birth weight is usually a result of prematurity. In this data, approximately 97% of the very low birth weight births were premature.

Taking into account (or adjusting for) other risk factors, a very low birth weight birth was more likely among women with certain risk factors, maternal characteristics, and demographics. Teenagers were 1.5 times more likely than older women to have a very low birth weight baby. Preventing teenage pregnancy could potentially reduce the overall county rate of very low birth weight by over 10%.

Very low birth weight was 4.3 times more likely among women who gained less than 15 pounds than those who gained 15 to 39 pounds during pregnancy. Over 27% of the very low birth weight babies could potentially be prevented if women gained more than 15 pounds during pregnancy. Extremely preterm births, however, may preclude sufficient weight gain. Even when preterm birth was included as a risk factor for very low birth weight (see Appendix F for more information on prematurity and very low birth weight), insufficient weight gain remained a statistically significant risk factor. Gaining 40 or more pounds during pregnancy was protective, such that very low birth weight was less likely in mothers who gained more than 40 pounds than mothers who gained 15 to 39 pounds.

A very low birth weight outcome was 1.3 times more likely among unmarried women than married women. Eliminating those factors that may make women who are unmarried more susceptible to the poor birth outcome of very low birth weight (e.g., socioeconomic conditions, social and parenting support, unplanned pregnancy) could potentially prevent 16% of very low birth weight babies.

Multiple births (e.g., twins) were 18.6 times more likely to be very low birth weight than singleton births. Although eliminating multiple births is not a realistic goal, it could reduce very low birth weight births by approximately 27%. A poor birth weight outcome was 1.9 times more likely among women who had a previous preterm baby than women who did not (including women who did not have a prior pregnancy). Babies who were small for gestational age (calculated from grams falling in the smallest 5% of the weight distribution in the US [7]) were 3.9 times more likely to be very low birth weight, accounting for approximately nine percent of the very low birth weight births.

Table VII-3. Birth Weight Distribution: Odds of Delivering a Very Low Birth Weight Baby Among All Live Births.

Risk Factor	South Phoenix Prevalence (%)	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age						
< 20 years	22.71	1.41	1.23, 1.61 *	1.51	1.29, 1.76 *	10.38
20-39 years	75.94	C	C	C	C	
40 or more years	1.34	1.56	1.15, 2.14 *	1.37	0.96, 1.94	
Education <= 12 Years	60.59	1.20	1.08, 1.34 *	0.81	0.70, 0.93 *	
Race/Ethnicity						
White	11.41	C	C	C	C	
Hispanic	76.50	1.06	0.95, 1.18	0.74	0.65, 0.85 *	
African American	8.24	2.03	1.66, 2.49 *	1.23	0.99, 1.54 +	1.86
Native American	3.33	0.97	0.71, 1.33	0.57	0.40, 0.82 *	
Asian	0.52	0.81	0.56, 1.16	0.85	0.58, 1.23	
Unmarried	61.80	1.51	1.36, 1.67 *	1.31	1.15, 1.50 *	16.08
High Parity for Age	22.78	1.42	1.26, 1.60 *	0.88	0.77, 1.02	
Multiple Birth	2.11	15.35	13.66, 17.25 *	18.60	16.28, 21.26 *	27.08
Prenatal Care Visits						
No Prenatal Visits	4.88	5.59	4.24, 7.36 *	6.05	4.47, 8.19 *	19.77
1 to 4 Visits	10.10	9.10	7.90, 10.48 *	12.08	10.22, 14.29 *	52.81
5 to 9 Visits	27.16	3.16	2.81, 3.54 *	3.92	3.46, 4.45 *	44.23
10 or More Visits	57.86	C	C	C	C	
Previous Preterm	0.12	2.28	1.32, 3.96 *	1.89	1.06, 3.36 *	0.11
Anemia	1.19	0.68	0.44, 1.05	0.48	0.30, 0.76 *	
Weight Gain						
<15 lbs.	11.59	4.33	3.84, 4.88 *	4.28	3.76, 4.87 *	27.54
15-40 lbs.	66.68	C	C	C	C	
> 40 lbs	21.73	0.99	0.86, 1.14	0.74	0.64, 0.86 *	
Tobacco Use	6.38	1.93	1.67, 2.23 *	1.41	1.19, 1.66 *	2.55
Alcohol Use	1.24	1.50	1.00, 2.24	1.03	0.67, 1.59	
Delivery Payment						
Private Insurance	20.89	C	C	C	C	
AHCCCS	72.33	1.13	1.02, 1.26 *	0.61	0.53, 0.70 *	
IHS	0.55	1.05	0.50, 2.22	0.67	0.30, 1.51	
Self	3.96	1.11	0.84, 1.46	0.69	0.52, 0.93 *	
Small for Gestational Age	4.49	6.84	5.99, 7.80 *	3.85	3.33, 4.45 *	11.34

Note. The South Phoenix prevalence is the percent of the risk factor in live births. PAR% = Estimate of the population attributable risk; the percent of VLBW that could be prevented if the predisposing risk factor were eliminated. C = Comparison group.

* Statistically significant, $p < .05$

Smoking during pregnancy increased the likelihood of having a very low birth weight baby by 1.4. Preventing smoking during pregnancy could reduce the number of very low birth weight babies by 2.6%. Alcohol use during pregnancy was not a statistically significant risk factor for very low birth weight; however, it is a risk factor for serious birth defects such as fetal alcohol syndrome. Just over one percent of women indicated that they drank alcohol during pregnancy on the birth certificate.

African American women were more likely to have a very low birth weight baby than White women; however, this was only marginally statistically significant when adjusted for the other potential risk factors. Hispanic women and Native American women were less likely than White women to have a very low birth weight birth.

Women with anemia were 0.48 times less likely to have a very low birth weight baby than women without anemia. Maternal iron deficiency anemia during the first and second trimesters of pregnancy has been shown to be a risk factor for SGA, preterm delivery and consequently low birth weight [9, 10, 11, 12]. It is unclear why anemia would be a protective factor in these analyses but several possibilities exist. First, the birth certificate does not distinguish between anemia occurring early versus late during pregnancy and studies suggest that anemia in third trimester does not necessary increase the risk of a poor birth outcome. Second, the birth certificate does not specify that the anemia is associated with iron deficiency and there is some evidence suggesting that anemia without iron deficiency does not necessary increase the risk of a poor outcome. Third, these analyses examine very low birth weight (< 1,500 grams) rather than low birth weight (< 2,500 grams) which may affect the results. Finally, risk factors on the medical portion of the birth certificate are underreported [13], and it is possible anemia is differentially reported among different birth weights.

Women who paid for their delivery with AHCCCS were 0.61 times less likely to have a very low birth weight birth than women who paid using private insurance. Adjusted for other risk factors (but not individually), women who paid for their delivery by themselves were 0.69 times less likely to have a very low birth weight baby.

Risk Factors for "Maternal Health/Prematurity" Birth Weight-Specific Mortality Category

In addition to those risk factors that affect the birth weight distribution, analysis of risk factors that may affect birth weight-specific mortality was necessary for several groups of women in the South Phoenix area and several demographic groups of women in the area (Hispanic women, women 20 or more years of age and women with a high school education or less). Birth weight-specific mortality risk factors were not examined for South Phoenix teenagers because they did not have 40% or more of the excess mortality rate in the "maternal health and prematurity" category due to the birth weight-specific mortality pathway. This analysis examines risk factors for birth weight-specific mortality for those births and fetal deaths with very low birth weight. The factors selected for analysis were suggested by the PPOR practice collaborative based on other populations and previous experience [4], and availability on the birth and fetal death certificate. The risk factors examined included maternal age, maternal education, maternal race/ethnicity, hospital perinatal care designation level, prematurity, small-for-gestational-age baby, congenital anomalies (as a group), fever during labor and delivery (indication of infection),

placenta previa (abnormal implantation of the placenta so that it tends to precede the baby at delivery) and abruptio placenta (premature separation of the placenta), premature rupture of the membranes, precipitous labor (quick labor lasting less than three hours), dysfunctional labor, fetal malpresentation (e.g., breech), cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered), fetal distress (signs indicating that the fetus is not receiving enough oxygen), maternal diabetes, pregnancy induced hypertension, infant transferred to another facility, mother transferred to another facility, assisted ventilation for the newborn, prenatal care, and method of payment. Additional risk factors that were unavailable for analysis included stage of labor upon hospital admission, Group B strep screen, and prenatal steroids.

Table VII-4. Percent of Very Low Birth Weight Deaths by Age at Death and Time of Death.

Risk Factor	Reference Group	South Phoenix Area		Hispanics		=> 20 Years Old		<= 12 Years Education	
Death Time									
Before Labor	18.58	23.81		20.59		25.00		32.14	*
During Labor	0	0		0		0		0	
After Labor	77.60	63.10	*	67.65	*	64.06	*	53.57	*
Unknown Time	3.83	13.10	*	11.76	*	10.94	*	14.29	*
Death Age									
Fetal	22.4	36.90	*	32.35	*	35.94	*	46.43	*
Neonatal	69.95	55.95	*	60.29		57.81	*	46.43	*
Post Neonatal	7.65	7.14		7.35		6.25		7.14	

* Statistically significant difference, $p < .05$, between the group and the reference group

A larger percentage of the deaths to women residing in the South Phoenix area and to each population group examined within the area (Hispanics, women 20 or more years of age, women with a high school education or less) occurred during the fetal stage (prior to delivery), whereas a larger percentage of deaths to women in the reference group occurred during the neonatal stage (after birth). The percentages of deaths by age at death and the time of death in relation to labor are shown in Table VII-4

Table VII-5 shows the differences in the prevalence of risk factors between the reference group and the South Phoenix groups with high excess in the "maternal health and prematurity" category attributed to birth weight-specific mortality. Hospital perinatal care designations indicate the level of service a hospital provides for obstetric and nursery care. These designations help identify which hospitals provide an appropriate level of care for deliveries based on risk factors. Level III hospitals provide the highest level of care for those pregnancies that are at the highest risk for poor outcomes. Most (97.6%) of the South Phoenix women with very low birth weight births or fetal deaths delivered at Level III hospitals. Fewer South Phoenix women with a very low birth weight pregnancy outcome delivered at hospitals rated lower than level III compared with women in the reference group.

Compared with the reference group, a smaller percentage of South Phoenix women had adequate prenatal care. They started care later and had fewer prenatal visits than women in the reference group. Fewer South Phoenix mothers (all population groups examined) paid for their delivery with private insurance then mothers in the reference group.

A higher percentage of South Phoenix women overall and South Phoenix Hispanic women were febrile (had a fever) during labor and delivery than reference group women. Fever can indicate infection. Compared with the reference group, significantly fewer South Phoenix women with a high school education or less had premature rupture of the membranes.

Table VII-5. Birth Weight-Specific Mortality: Differences in Risk Factor Prevalence (Percent).

Risk Factor	Reference Group	South Phoenix	South Phoenix Hispanics	S.Phx => 20 Years Old	S.Phx <= 12 Years Educ.
Age					
< 20 Years Old	0	22.29	23.18	0	29.83
20-39 Years Old	95.97	74.84	74.09	96.31	67.96
=> 40 Years Old	4.03	2.87	2.73	3.69	2.21
<= 12 Years Education	0	61.15	71.29	54.51	100
Race/Ethnicity					
White	100	12.78	0	11.52	8.84
Hispanic	0	70.29	100	69.55	82.32
African American	0	13.42	0	15.64	6.08
Native American	0	3.51	0	3.29	2.76
Asian	0	0	0	0	0
Hospital Perinatal Designation					
Levels 1 and 2	5.71	2.36 *	0.97 *	2.17 *	1.75 *
Level 2EQ	3.83	0 *	0 *	0 *	0 *
Level 3	90.70	97.64 *	99.03 *	97.83 *	98.25 *
Premature	97.60	97.44	99.09	98.77	97.22
IUGR/SGA	20.83	18.21	16.83	17.21	16.67
Congenital Anomalies [a]	0.57	0.35	0.51	0	0.65
Conditions of Labor/Delivery					
Febrile (Fever > 100 Degrees)	0.87	1.91 *	2.73 *	1.64	2.21
Placenta Previa/Abruptio	7.41	8.60	9.55	9.02	9.39
Ruptured Membranes	11.11	7.64	7.27	8.2	6.08 *
Precipitous Labor (< 3 Hours)	0.98	0.64	0.91	0.41	1.10
Dysfunctional Labor	0.33	0.32	0.45	0	0.55
Breech / Malpresentation	25.27	22.93	25.91	23.36	25.41
Cord Prolapse	1.63	2.55	2.73	2.46	2.76
Fetal Distress	10.57	8.28	7.27	8.61	7.18
Medical Risk Factors					
Diabetes	2.07	1.27	1.36	1.64	0.55
Pregnancy Hypertension	6.43	4.78	4.09	4.1	4.97
Infant Transferred [a]	3.88	5.3 *	4.04 *	5.88 *	3.23 *
Mother Transferred [a]	6.84	2.83 *	3.03 *	2.26 *	3.87
Assisted Ventilation < 30 mins. [a]	2.85	1.41	1.52	1.81	1.94
Assisted Ventilation >30 mins. [a]	3.65	2.47	3.03	0.9 *	3.87
Adequacy of Prenatal Care					
Inadequate	6.39	33.02 *	33.55 *	31.18 *	36.00 *
Intermediate	3.93	9.91 *	11.18 *	8.24 *	11.20 *
Adequate	15.08	10.85	11.84	8.82 *	11.20
Adequate plus	74.59	46.23 *	43.42 *	51.76 *	41.60 *
Trimester Prenatal Care Began					
First	90.43	64.06 *	61.84 *	67.24 *	63.2 *
Second	7.86	18.89 *	19.08 *	17.82 *	20.00 *
Third	0.57	4.61 *	5.26 *	2.87 *	5.60 *
No Prenatal Care	1.14	12.44 *	13.82 *	12.07 *	11.20 *
Number of Prenatal Care Visits					
No Prenatal Visits	1.52	14.44 *	14.5 *	14.35 *	14.91 *
1 to 4 Visits	9.49	29.96 *	31.5 *	27.31 *	33.54 *
5 to 9 Visits	34.56	24.91 *	26.5 *	23.61 *	24.22 *
10 or More Visits	54.43	30.69 *	27.5 *	34.72 *	27.33 *
Method of Payment					
AHCCCS	16.65	58.28 *	63.18 *	54.1 *	67.40 *
Insurance	78.22	23.89 *	19.55 *	29.92 *	9.94 *
HIS	0.11	0.32	0.45	0	0.55
Self	3.31	4.78	3.64	3.69	5.52

Note. The factors that defined the reference group were not tested for statistically significant differences between groups. a = Data not recorded in the fetal death database from 1996 to 1999 so denominator is live births only.
* Statistically significant difference, $p < .05$, between the group and the reference group.

Table VII-6 shows the Maricopa County odds of a very low birth weight (< 1,500 grams) fetal or infant death. It also shows the confidence limits around the odds, statistical significance, prevalence (%) of the risk factor among very low birth weight live births and fetal deaths in South Phoenix, and an estimate of the population attributable percent. The odds are shown for each of the risk factors individually (unadjusted) and holding other risk factors constant (adjusted). There were two analyses that adjust for other risk factors: one among all the birth and fetal death data and one with only live birth data. This was necessary because several risk factors were unavailable for the fetal deaths (i.e., congenital anomalies, transferring the mother to another hospital, and payment for delivery). Additionally, some risk factors were irrelevant for fetal deaths (i.e., transferring the infant to another hospital and assisted ventilation for the infant). The population attributable risk percent (PAR%) is an estimate of the percent of very low birth weight fetal and infant mortality that could be prevented if the predisposing risk factor was eliminated. As stated for the birth weight distribution results, some risk factors are modifiable while others are not.

All other risk factors being equal, a fetal or infant death given very low birth weight was more likely among women with certain risk factors. The only maternal demographic characteristic that was a statistically significant risk factor in these analyses was having a high school education or less. This was only true in the analysis of both births and fetal deaths possibly because of the higher rate of fetal rather than neonatal death among these women. Women with a high school education or less were 1.8 times more likely than women with higher education to have a fetal or infant death if they had a very low birth weight baby. Almost 32.9% of very low birth weight fetal and infant deaths could possibly be prevented if education and all of the other factors that are associated with education (SES, behavior patterns, access to care, etc.) could be increased.

Women who delivered at a level 2EQ hospital (still a high risk perinatal center) had 2.9 times the risk of a very low birth weight fetal or infant death than women who delivered at a level III hospital. In South Phoenix, however, there were no women with a very low birth weight live birth or fetal death that delivered at level 2EQ hospitals during this time period. Women who delivered at level I and level II hospitals had even higher risk (3.5 times the risk) of a very low birth weight fetal or infant death compared with women who delivered at level III hospitals. Approximately 5.5% of the very low birth weight fetal and infant deaths could potentially be prevented if these women delivered at hospitals more equipped to handle high risk deliveries. Among only the very low birth weight live births, the chances of death at the hospitals with lower perinatal care certification ratings were only marginally statistically significant but in the same direction. This suggests that the difference may be real but with the smaller sample size of only births, the effect is not as detectable.

Fewer than ten prenatal care visits was an important risk factor for very low birth weight fetal and infant deaths (in both the live birth model and the live births and fetal deaths model): women with no prenatal care were 1.9 times more likely than women with 10 or more visits to have a very low birth weight fetal or infant death. Women with one to four prenatal care visits had 1.8 times the risk and women with five to nine prenatal care visits had 1.8 times the risk. Ensuring that all women had early and adequate prenatal care could potentially reduce the death among very low birth weight babies.

Table VII-6. Birth Weight-Specific Mortality: Odds of Death Among Very Low Birth Weight.

Risk Factor	South Phoenix Prevalence %	Unadjusted		Adjusted Births & Fetals+			Adjusted Births Only++		
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	PAR %	Odds	95% Confidence Limits	PAR %
Age									
< 20 Years Old	22.29	1.42	1.13, 1.78 *	1.02	0.76, 1.36		1.24	0.90, 1.78	
20-39 Years Old	74.84	C	C	C	C	C	C	C	C
40 or More Years Old	2.87	0.95	0.57, 1.59	0.96	0.52, 1.77		0.65	0.30, 1.56	
Education <=12 Years	61.15	2.01	1.66, 2.43 *	1.80	1.39, 2.32 *	32.85	1.26	0.86, 1.64	13.72
Race/Ethnicity									
White	12.78	C	C	C	C	C	C	C	C
Hispanic	70.29	1.34	1.11, 1.63 *	0.81	0.63, 1.04 +		1.07	0.74, 1.34	
African American	13.42	0.98	0.68, 1.39	0.83	0.54, 1.29		0.76	0.43, 1.24	
Native American	3.51	1.02	0.58, 1.78	0.67	0.33, 1.35		0.83	0.38, 1.91	
Asian/Hawaiian	0.53	0.46	0.19, 1.10	0.42	0.17, 1.04 +		0.68	0.26, 1.70	
Hospital Perinatal Care									
Levels 1& 2	2.36	3.37	2.45, 4.62*	3.46	2.39, 5.01 *	5.49	1.79	0.93, 3.46 +	1.83
Level 2EQ	0	2.07	1.24, 3.46 *	2.92	1.62, 5.29 *	0.00	2.18	0.99, 4.79 +	0.00
Level 3	97.64	C	C	C	C		C	C	C
Premature	97.44	1.09	0.64, 1.87	1.01	0.52, 1.94		2.12	0.61, 7.42	
Prenatal Care Visits									
No Visits	14.44	2.30	1.57, 3.35 *	1.89	1.18, 3.03 *	11.39	2.05	1.21, 3.50 *	13.17
1 to 4 Visits	29.96	2.21	1.70, 2.89 *	1.82	1.34, 2.46 *	19.72	1.70	1.19, 2.42 *	17.34
5 to 9 Visits	24.91	1.88	1.48, 2.38 *	1.81	1.40, 2.34 *	16.79	1.56	1.16, 2.11 *	12.24
10 or More Visits	30.69	C	C	C	C	C	C	C	C
Small for Gest. Age	18.21	0.86	0.68, 1.09	0.80	0.58, 1.10		0.53	0.34, 0.82 *	
Congenital Anomalies [a]	0.35	29.35	6.69, 128.8 *	N/A	N/A	N/A	24.03	4.96, 116.4 *	7.46
Labor Complications	43.31								
Febrile (Fever > 100)	1.91	1.72	0.91, 3.27	2.03	0.98, 4.23 +	1.93	2.74	1.27, 5.92 *	3.22
Placenta Previa/Abruptio	8.6	1.12	0.80, 1.57	0.81	0.53, 1.22		0.83	0.51, 1.35	
Labor < 3 Hours	0.64	2.06	0.88, 4.85	2.23	0.80, 6.23		3.09	1.07, 8.90 *	1.32
Dysfunctional Labor	0.32	3.96	0.88, 17.74	3.44	0.51, 23.34		6.59	0.99, 43.83 +	
Breech/Malpresentation	22.93	0.98	0.78, 1.20	1.09	0.85, 1.40		1.28	0.96, 1.69 +	
Cord Prolapse	2.55	3.19	1.66, 6.11 *	4.10	1.81, 9.26 *	7.33	1.81	0.60, 5.51	
Fetal Distress	8.28	0.61	0.42, 0.87 *	0.62	0.41, 0.94 *		0.75	0.48, 1.18	
Diabetes	1.27	0.56	0.28, 1.11	0.57	0.26, 1.26		0.44	0.15, 1.24	
Pregnancy Hypertension	4.78	0.58	0.37, 0.93 *	0.47	0.26, 0.85 *		0.37	0.17, 0.82 *	
P. Membrane Rupture	7.64	0.67	0.48, 0.94 *	0.65	0.45, 0.95 *		0.85	0.57, 1.27	
Infant Transfer [a]	5.30	1.39	0.87, 2.22	N/A	N/A	N/A	0.72	0.33, 1.58	
Mother Transfer [a]	2.83	0.82	0.53, 1.26	N/A	N/A	N/A	0.93	0.58, 1.51	
Ventilator <30 mins [a]	1.41	1.82	1.07, 3.10 *	N/A	N/A	N/A	2.67	1.48, 4.82 *	2.30
Ventilator >30 mins [a]	2.47	2.00	1.22, 3.27 *	N/A	N/A	N/A	2.19	1.22, 3.93 *	2.86
Payment for Delivery [a]									
AHCCCS	64.66	0.53	0.44, 0.64 *	N/A	N/A	N/A	0.72	0.54, 0.97 *	
IHS	0.35	0.66	0.14, 3.19	N/A	N/A	N/A	0.99	0.15, 6.75	
Self Pay	5.30	0.67	0.41, 1.09	N/A	N/A	N/A	0.88	0.49, 1.61	
Private Insurance	26.5	C	C	C	C	C	C	C	C

Note. The Maricopa County prevalence is the percent of the risk factor among very low birth weight births and fetal deaths or the prevalence in only births for those factors denoted with *a*. Two adjusted analyses were conducted: 1) available variables in both the birth and fetal databases (+), and 2) All variables were included so only the live births were used (++). PAR% = Estimate of the population attributable risk or the percent of death among VLBW that could be prevented if the predisposing risk factor were eliminated. a = Data not recorded in the fetal death database from 1996 to 1999 so not included in birth and fetal model models. C = Comparison group. N/A = Not available.

* Statistically significant, $p < .05$

+ Marginally significant, $p < .10$ (presented to show the similarities/differences between the analyses with different denominators).

The very low birth weight infants with congenital anomalies were 24 times more likely to die than the live births without congenital anomalies (not available for fetal deaths). If congenital anomalies could be prevented, then the estimated percentage of very low birth weight deaths following live births could potentially be reduced by over 7.5%.

Precipitous labor (quick labor lasting less than three hours) increased the risk of infant death following a live birth by three times. It was not statistically significance in the model that included fetal deaths. Women who had a fever over 100 degrees (indication of infection) during labor and delivery were 2.7 times more likely to have a very low birth weight infant death following a live birth than women without a fever (marginally significant in the same direction for the model that included fetal deaths).

A very low birth weight death was 4.1 times more likely following cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered) but was not statistically significant in the model with births only. The percent of attributable mortality due to cord prolapse was 7.3%. Very low birth weight newborns needing assisted ventilation were over 2 times more likely to die than those not needing assisted ventilation.

Fetal distress (signs indicating that the fetus is not receiving enough oxygen) was protective such that the risk of death was 0.62 times less than without fetal distress. It may be the fact that the distress was noted and measured which prompted medical intervention to be taken that helped the fetus survive. Fetal distress was not statistically significant protective factor in the model that only included births. Women with pregnancy hypertension were 0.47 times less likely to have a fetal or infant death than women without pregnancy hypertension (finding in both sets of analyses). It is possible that women with gestational hypertension are more likely to have delivery induced early and thus help the fetus survive. Women with premature membrane rupture were 0.65 times less likely to have a very low birth weight fetal or infant death than women without. This finding was not statistically significant in the model with only live births. Having the Arizona Health Care Cost Containment System (AHCCCS) pay for delivery was protective, such that the risk of death was 0.72 times less likely than when private insurance paid for the delivery. Some findings are puzzling and need further examination.

Summary of the Maternal Health and Prematurity Category Results

In South Phoenix, the area as a whole, teenagers, women 20 years of age or more, women with a high school education or less, and Hispanic women had high excess mortality in the “maternal health and prematurity” category. At least 50% of the excess rate for each of these groups was related to a disadvantageous birth weight distribution (more very low birth weight babies than in the reference group). Therefore, risk factors associated with the birth weight distribution were examined. In addition, each of these groups except teenagers had at least 40% of their excess mortality rate due to birth weight-specific mortality (more deaths at each birth weight). Thus, risk factors related to birth weight specific mortality were examined.

Several risk factors were deemed important for excess mortality in the “maternal health and prematurity” category. The summary consists of risk factors that met two conditions: a) Women with these risk factors were more likely to have a poor birth outcome (very low birth weight or

feto-infant mortality) and b) there was a higher prevalence (percent) of the risk factor in the group with the high excess mortality in the "maternal health/prematurity" category than in the reference group. Table VII-7 shows those risk factors deemed important by each pathway (birth weight distribution or birth weight-specific mortality) to excess mortality in the "maternal health/prematurity" category.

For the birth weight distribution, the important risk factors for this population consisted of small for gestational age, prematurity, unmarried, smoking, less than 15 lbs. pregnancy weight gain, and few or no prenatal care visits. Smoking does increase the chances of having a very low birth weight baby. Smoking cigarettes was not checked in the table because these groups of women did not smoke more than the reference group. In South Phoenix, however, more than 6% of the women smoked during pregnancy. This suggests that there is room to reduce these smoking rates further.

Table VII-7. Summary of Important Risk Factors for Deaths in the "Maternal Health/Prematurity" Category.

Birth Weight Distribution (Maternal Health)					
Risk Factors	**South Phoenix Area**	**Teenagers**	**20+ Years Old**	**≤ 12 Years Education**	**Hispanic**
IUGR/SGA	✓	✓	✓	✓	✓
Prematurity	✓	✓	✓	✓	✓
Unmarried (social support/SES)	✓	✓	✓	✓	✓
Smoking					
Weight Gain < 15 lbs.	✓	✓	✓	✓	✓
Few Prenatal Care Visits	✓	✓	✓	✓	✓
Birth Weight-Specific Mortality (Perinatal Conditions/Care)					
Few Prenatal Care Visits	✓		✓	✓	✓
Fever During Labor/Delivery	✓				✓

Note. Check marks indicate the risk factor is important for deaths in the "maternal health/prematurity" category.

Risk factors for perinatal conditions and care consisted of few or no prenatal care visits and a fever during labor/delivery for the South Phoenix area as a whole and South Phoenix Hispanic women. Few or no prenatal care visits was also a risk factor for women who were 20 or more years of age and women who had a high school education or less.

Maternal Care

Deaths associated with "maternal care" are higher birth weight (1,500 grams or more) fetal deaths. Although this group consists of larger birth weights in this methodology, birth weights in the 1,500 to 2,500 gram range are still low and birth weights of at least 4,250 grams are considered high birth weight. Both the low and high birth weight babies are at higher risk for complications than those between 2,500 and 4,250 grams. Potential risk factors that may increase the risk of fetal death include maternal infection, maternal injury, delays in obtaining medical care for prenatal care or delivery, delays in recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring [14]. The risk factors selected for analysis that were available on the fetal death certificate included age, education, race/ethnicity, the number of prenatal care visits, the trimester that prenatal care began, adequacy of prenatal care utilization index (APNCUI; describes the adequacy of the timing of prenatal care initiation and the number of visits) [15], hospital perinatal service level, prematurity, small for gestational age, placenta previa (abnormal implantation of the placenta) or abruptio placenta

(premature separation of the placenta), fetal malpresentation (e.g., breech), cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered), fetal distress (signs indicating that the fetus is not receiving enough oxygen), maternal diabetes, and pregnancy-related hypertension.

Table VII-8 compares the prevalence of the risk factors for the reference group with that of women in the South Phoenix area overall, Hispanic women, women 20 or more years of age, and women with a high school education or less. These groups showed excess feto-infant mortality in the "maternal care" category and had statistically large enough numbers to analyze with this method. In the table, APNCUI is the "adequacy of prenatal care utilization index" [15]. The index characterizes the adequacy of the timing of prenatal care initiation and the number of visits after care was initiated but it does not does not assess the quality of prenatal care or adjust for maternal risks.

In comparison to the reference group, a larger percentage of the women in each of these South Phoenix population groups (the area as a whole, Hispanics, women 20 or more years of age, and women with a high school education or less) had inadequate prenatal care. Each of the groups also had less adequate plus prenatal care (intensive prenatal care associated with high risk pregnancies) than the reference group. South Phoenix women began prenatal care later and attended fewer prenatal care visits.

A larger percentage of each of these South Phoenix population groups had premature and small for gestational age babies compared with the reference group. With the exception of women with a high school education or less, a larger percentage of women in each South Phoenix group had diabetes compared with the reference group.

In comparison to the reference group, smaller percentages of women in the South Phoenix groups had the risk factors of placenta previa or abruptio placenta, malpresentation of the fetus (e.g., breech), cord prolapse, and pregnancy hypertension.

Compared with the reference group, much larger percentages of the South Phoenix groups with high excess deaths in the "maternal care" category delivered at hospitals with level III perinatal care designations (hospitals more equipped to handle high risk deliveries).

Figure V-8. Maternal Care: Differences in Risk Factor Prevalence (Percent).

Risk Factor	Reference Group	South Phoenix Area	Hispanics	20+ Years Old	<=12 Years Education
Age					
< 20 Years Old	0	22.71	23.22	0	30.14
20-39 Years Old	97.4	75.95	75.71	98.27	68.73
=> 40 Years Old	2.6	1.34	1.07	1.73	1.13
<= 12 Years Education	0	60.69	68.09	55.03	100
Race/Ethnicity					
White	100	11.39	0	12.42	6.10
Hispanic	0	76.60	100	76.15	85.55
African American	0	8.16	0	7.75	5.04
Native American	0	3.32	0	3.09	3.14
Asian	0	0.53	0	0.59	0.17
Premature	8.79	10.06 *	9.56 *	9.87 *	10.16 *
APNCUI					
Inadequate	5.2	31.78 *	33.88 *	30.69 *	37.49 *
Intermediate	10.03	13.72 *	14.11 *	13.89 *	13.41 *
Adequate	54.16	29.71 *	27.77 *	30.01 *	25.33 *
Adequate plus	30.6	24.79 *	24.24 *	25.41 *	23.78 *
Trimester Prenatal Care Began					
First	91.58	61.26 *	58.54 *	62.42 *	55.28 *
Second	6.98	26.01 *	27.64 *	25.00 *	29.49 *
Third	1.08	7.90 *	8.63 *	7.52 *	9.42 *
No Prenatal Care	0.35	4.84 *	5.19 *	5.06 *	5.81 *
Prenatal Care Visits					
No Visits	0.38	4.79 *	5.06 *	4.94 *	5.75 *
1 to 4 Visits	0.88	9.91 *	10.63 *	9.46 *	12.32 *
5 to 9 Visits	10.82	27.15 *	28.64 *	26.52 *	29.3 *
10 or More Visits	87.91	58.16 *	55.67 *	59.08 *	52.63 *
Hospital Perinatal Designation					
Levels 1 and 2	38.84	15.32 *	11.19 *	15.29 *	13.24 *
Level 2 EQ	22.83	1.05 *	0.62 *	1.21 *	0.46 *
Level 3	38.04	83.30 *	87.92 *	83.14 *	86.00 *
IUGR/SGA	2.62	4.36 *	3.94 *	4.15 *	4.51 *
Pregnancy Complications					
Placenta Previa/Abruptio	1.08	0.67 *	0.60 *	0.78 *	0.62 *
Breech/Malpresentation	3.98	2.38 *	2.30 *	2.46 *	2.27 *
Cord Prolapse	0.22	0.11 *	0.13 *	0.12 *	0.09 *
Fetal Distress	5.60	6.95 *	6.56 *	7.00 *	7.11 *
Medical Risk Factors					
Diabetes	2.11	2.37 *	2.33 *	2.87 *	2.26
Pregnancy Hypertension	2.78	1.46 *	1.28 *	1.37 *	1.33 *

Note. The factors that defined the reference group were not tested for statistically significant differences between groups. APNCUI = Adequacy of Prenatal Care Utilization Index[14].

* Statistically significant difference, $p < .05$, between the group and the reference group.

Table VII-9. Maternal Care: Odds of a Higher Birth Weight (> 1,500 grams) Fetal Death.						
Risk Factor	South Phoenix Prevalence (%)	Unadjusted		Adjusted		PAR %
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age						
< 20 Years Old	22.71	1.05	0.81, 1.35	0.66	0.48, 0.89 *	
20-39 Years Old	75.95	C	C	C	C	
> 40 Years Old	1.34	0.88	0.44, 1.77	0.65	0.24, 1.77	
≤ 12 years Education	60.69	4.13	3.39, 5.03 *	5.95	4.57, 7.74 *	75.01
Race/Ethnicity						
White	11.39	C	C	C	C	
Hispanic	76.60	1.27	1.05, 1.54 *	0.52	0.40, 0.68 *	
African American	8.16	1.07	0.65, 1.76	0.78	0.45, 1.37	
Native American	3.32	1.35	0.81, 2.24	0.95	0.55, 1.62	
Asian	0.53	0.94	0.50, 1.77	0.88	0.41, 1.88	
Premature	10.06	13.34	11.13, 15.99 *	N/A	N/A	
APNCUI						
Inadequate	31.78	2.52	1.92, 3.29 *	1.55	1.14, 2.30 *	14.90
Intermediate	13.72	1.42	0.99, 2.04	1.28	0.86, 1.88	
Adequate	29.71	C	C	C	C	
Adequate Plus	24.79	2.32	1.83, 2.94 *	1.77	1.36, 2.30 *	15.98
Prenatal Care Visits						
0 Visits	4.79	6.45	4.51, 9.23 *	N/A	N/A	
1 to 4 Visits	9.91	4.51	3.34, 6.09 *	N/A	N/A	
5 to 9 Visits	27.15	2.51	2.02, 3.11 *	N/A	N/A	
10 or More Visits	58.16	C	C	C	C	
Trimester Prenatal Care Began						
First	61.26	C	C	C	C	
Second	26.01	1.22	0.95, 1.56	N/A	N/A	
Third	7.90	1.23	0.77, 1.96	N/A	N/A	
No Prenatal Care	4.84	0.27	0.07, 1.07	N/A	N/A	
Hospital Perinatal Care Designation						
Levels 1 and 2	15.32	0.99	0.81, 1.20	1.17	0.93, 1.47	2.48
Level 2 EQ	1.05	0.62	0.45, 0.86 *	0.79	0.53, 1.19	
Level 3	83.30	C	C	C	C	
IUGR/SGA	4.36	5.20	4.06, 6.67 *	4.52	3.35, 6.09 *	13.30
Delivery Complications						
Placenta Previa/Abruptio	0.67	10.23	7.40, 14.12 *	9.58	6.55, 14.02 *	5.44
Breech/Malpresentation	2.38	2.33	1.65, 3.29 *	1.67	1.09, 2.57 *	1.57
Cord Prolapse	0.11	50.02	35.07, 71.33 *	50.96	32.99, 78.73 *	5.21
Fetal Distress	6.95	1.04	0.72, 1.50	0.71	0.46, 1.12	
Medical Risk Factors						
Diabetes	2.37	2.35	1.56, 3.54 *	2.11	1.28, 3.46 *	2.56
Pregnancy Hypertension	1.46	1.39	0.83, 2.33	1.11	0.51, 2.01	

Note. The prevalence is the percent of the risk factor among the higher birth weight (> 1,500 grams) births and fetal deaths. PAR% = Estimate of the population attributable risk or the percent of fetal deaths that could be prevented if the predisposing risk factor were eliminated. C = Comparison group. APNCUI = Adequacy of prenatal care utilization index[14].

* Statistically significant, $p < .05$

Table VII-9 shows the prevalence of the risk factor among South Phoenix women with higher birth weight (> 1,500 grams) fetal deaths or live births; the odds of having a fetal death given the risk factor in Maricopa County; the confidence limits around the odds; the population attributable risk percent (PAR%) is the percent of higher birth weight fetal deaths that could

potentially be prevented if the predisposing risk factor was eliminated. Of course, some risk factors like the education of the mother are modifiable while others such as ethnicity are not.

Women with a high school education or less were almost six times more likely to have a higher birth weight (> 1,500 grams) fetal death than women with more education. If women's level of education could be increased along with those factors affected by education, then approximately 75% of those deaths in the "maternal care" category could potentially be prevented. Teenagers were 0.66 times less likely to have a death in the "maternal care" category than women aged 20 to 39 years old. Initially, Hispanic women appeared 1.3 times more likely to have higher birth weight fetal death than White women. This excessive risk was not present when the model took other risk factors into account, probably due to education and prenatal care as confounding factors; they end up less likely having a death in the "maternal care" category.
Women who received inadequate prenatal care were 1.6 times more likely to have a higher birth weight fetal death. If women received adequate prenatal care, 14.9% of the higher birth weight fetal deaths could be prevented. Women who received adequate plus (intensive) prenatal care were 1.8 times more likely to have a death in the "maternal care" category. Adequate plus care would result in a higher rate of mortality than adequate care because pregnancies receiving intensive prenatal care are selected for their high-risk. If the risk factors that made a pregnancy high risk and/or the management of high risk pregnancies could be perfected so that they were not high risk pregnancies, then the percentage of higher birth weight fetal deaths could potentially be reduced by almost 16%.

The hospitals perinatal care designation level was unrelated to higher birth weight (> 1,500 grams) fetal deaths in the county. Small for gestational age (SGA) babies were 4.5 times more likely to die prior to birth than babies who were not small. If SGA could be prevented, then 13.3% of the higher birth weight fetal deaths could be prevented. Women with conditions of the placenta such as abruptio placenta (premature separation of the placenta) and placenta previa (abnormal implantation of the placenta so that it tends to precede the baby at delivery) were 9.6 times more likely to have a higher birth weight fetal death than women without these risks. Approximately 5.4% of the deaths in the "maternal care" category could potentially be prevented if these conditions could be prevented. A fetal death was 1.7 times more likely when the fetus was in the wrong position for delivery (e.g., breech). If the malpresentation of the fetus could be prevented, 1.6% of the deaths in the "maternal care" category could be prevented. Cord prolapse (expulsion of the umbilical cord before the fetus is delivered during labor) increased the chances of a higher birth weight fetal death by 51 times and had an estimated population attributable risk percentage of 5.2%. Maternal diabetes increased the odds of a higher birth weight fetal death by 2.1 and eliminating diabetes could potentially reduce these deaths by 2.6%. Fetal distress and pregnancy hypertension were not statistically significant predictors of deaths in the "maternal care" category.

Summary of Maternal Care Category Results

Many risk factors for the higher birth weight fetal deaths are not available on vital records. Information regarding maternal infection, maternal injury, delays obtaining medical care for delivery, delays recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring were not readily available for analysis. Of the risk

factors analyzed, several predicted deaths in the "maternal care" category and also were more prevalent in the groups with high excess mortality in the category; these risk factors are shown in Table VII-10.

Table VII-10. Summary of Important Risk Factors for Deaths in the "Maternal Care" Category

Risk Factors	South Phoenix Area	Hispanics	20+ Years of Age	<= 12 Years Education
Inadequate Prenatal Care	✓	✓	✓	✓
Maternal Diabetes	✓	✓	✓	
Prematurity	✓	✓	✓	✓
Small for Gestational Age	✓	✓	✓	✓

An important, modifiable risk factor was inadequate prenatal care. Women who received adequate levels of prenatal care (as defined by ACOG) were less likely to have a higher birth weight fetal death. Diabetes was an important risk factor for higher birth weight fetal deaths for each of the groups with high excess deaths in the "maternal care" category. The exception was women with a high school education or less who did not have higher levels of diabetes than the reference group.

Although placenta previa/abruptio, breech, and cord prolapse were significant risk factors for the deaths attributed to the "maternal care" category, the South Phoenix groups with a high excess death rate in the "maternal care" category did not have higher levels of the risk factor than women in the reference group.

Newborn Care

Phase I analyses indicated that there was not much variability in the "newborn care" category among the different groups of mothers. The excess mortality did not meet the criterion of 1.5 deaths per 1,000 live births and fetal deaths in any of the groups examined. These results suggest that newborn care was not an issue in Maricopa County. Therefore, Phase II analyses of the "newborn care" category were not conducted.

Infant Health

Deaths attributed to "infant health" are those deaths that occur to larger babies (> 1,500 grams) from 28 days and one year of life. The first analysis for excess death rate in the "infant health" category was an examination of the underlying cause of death [5]. The basis of the classification of the causes of death into larger categories was a classification by the CDC for the purposes of post-neonatal mortality surveillance [6]. The categories are perinatal conditions, congenital conditions, infections, sudden infant death syndrome (SIDS), injuries, ill-defined, and other. See Table VII-11 for a brief explanation of each category.

Table VII-11. Underlying Cause of Death (COD) Categories Used for Classification of the Deaths Due to "Infant Health" Risk Factors and Causes.	
COD Category	**Description**
Perinatal Conditions	Deaths due to perinatal conditions include those due to maternal factors and complications of pregnancy, disorders of gestation and fetal growth, birth trauma, specific respiratory, cardiovascular and infectious conditions specific to perinatal period, hemorrhagic and hematological disorders of the newborn, and endocrine and metabolic disorders
Congenital Conditions	Birth defects are physical or mental disabilities that may be fatal. A few examples are Spina Bifida, Downs Syndrome, and Cleft Palate but thousands of birth defects are currently known.
Infections	Include respiratory, gastrointestinal, central nervous system, septicemia, and others.
SIDS	The unexpected, sudden death of an infant under one year of age that continues to be unexplained after a complete investigation
Injuries	Consist of homicide, motor vehicle accidents, poisoning, falls, fire, drowning, suffocation, and other unintentional injuries.
Ill-defined	Ill-defined deaths include other symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified.
Other	All other causes of death that do not fit into the classification scheme are included in the other category.

Infant Health Causes of Death

South Phoenix teenagers had high rates of infant mortality attributed to the "infant health" category. Table VII-12 shows the number of "infant health" deaths, percent of deaths, and rate of death per 100,000 live births and fetal deaths for each cause of death category for the reference group and teenagers. It also shows the excess rate of post-neonatal death for teenager mothers. Negative numbers for the excess death rate mean that teenagers had fewer deaths from 1996 to 2000 in that category than the reference group. The cause of death table is based, in a statistical sense, on an extremely small number of deaths for South Phoenix teenagers. It is important to be aware of how variable these numbers can be without indicating a meaningful change. The number of deaths is given in the table so the absolute size can be taken into account. With that in mind, the only relevant way to compare across groups is to examine the rates.

In Maricopa County, the leading causes of post-neonatal death among teenager mothers were infections and SIDS (see Section IV and Appendix G). This is also the case in South Phoenix, however, congenital conditions was also a leading cause of death. Because these rates are only based on three or four deaths in South Phoenix, it is impossible to know whether congenital conditions are really higher as a cause of post-neonatal deaths among teenagers compared with the reference group or whether this is an artifact of a statistically small number of deaths.

Table VII-12. Underlying Cause of Death for the Infant Health Deaths: South Phoenix Teenagers Compared to the Reference Group

Underlying Cause of Death	Reference Group			Less than 20 Years Old			Excess Rate
	N	Percent of Deaths	Rate per 100,000 Births	N	Percent of Deaths	Rate per 100,000 Births	
Perinatal Conditions	**4**	**2.92%**	**4.05**	**0**	**0.00%**	**0.00**	**-4.05**
Congenital Conditions	**21**	**15.33%**	**21.28**	**3**	**20.00%**	**57.08**	**35.80**
Infections	**26**	**18.98%**	**26.35**	**4**	**26.67%**	**76.10**	**49.76**
SIDS	**28**	**20.44%**	**28.37**	**3**	**20.00%**	**57.08**	**28.70**
Injuries	**17**	**12.41%**	**17.23**	**2**	**13.33%**	**38.05**	**20.82**
Ill-defined	**1**	**0.73%**	**1.01**	**0**	**0.00%**	**0.00**	**-1.01**
Other	**40**	**29.20%**	**40.54**	**3**	**20.00%**	**57.08**	**16.54**
Total	**137**	**100.00%**	**138.83**	**15**	**100.00%**	**285.39**	**146.55**
Births	98,679			5,256			

Note. Use caution when interpreting rates with less than 10 deaths because they tend to be statistically unreliable.

The underlying cause of death with the highest rate was infections with approximately 76 deaths per 100,000 live births and an excess rate of 49.8 per 100,000. The second highest categories were SIDS and congenital conditions with approximately 57 deaths per 100,000 live births each. Figure VII-12 shows the "infant health" related mortality rates (per 100,000 live births) for each cause of death category for higher birth weight post-neonatal deaths among South Phoenix teenage mothers.

Figure VII-12. Rate of Death by Underlying Cause of Death Category: South Phoenix Teenagers Compared with the Reference Group

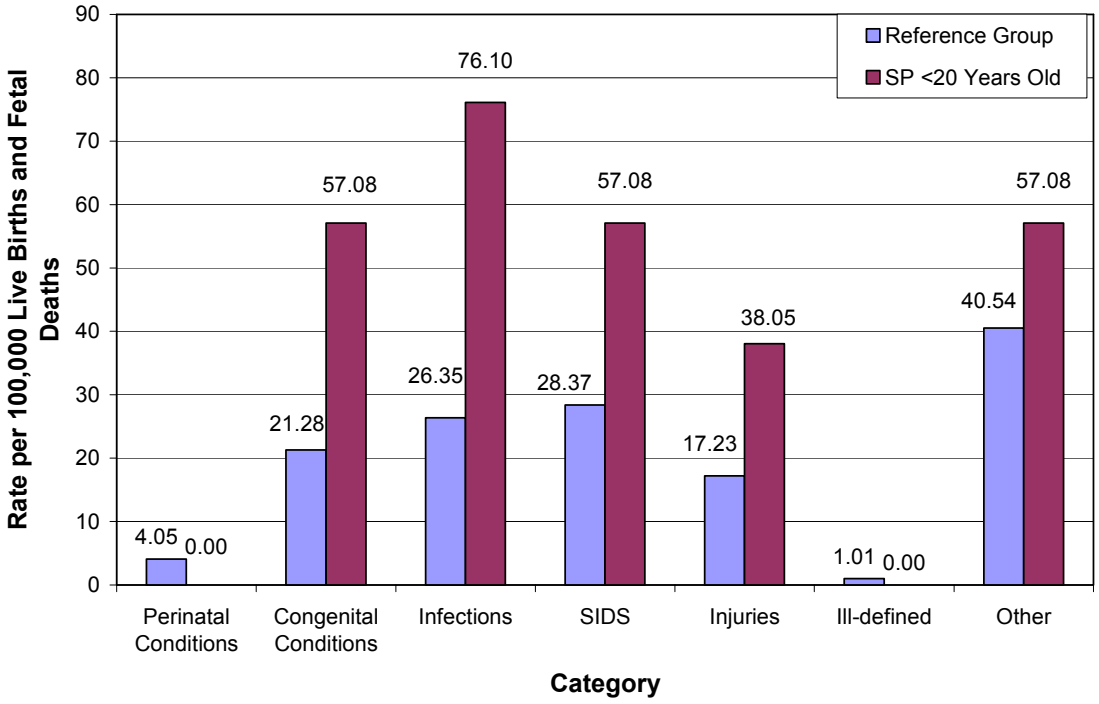
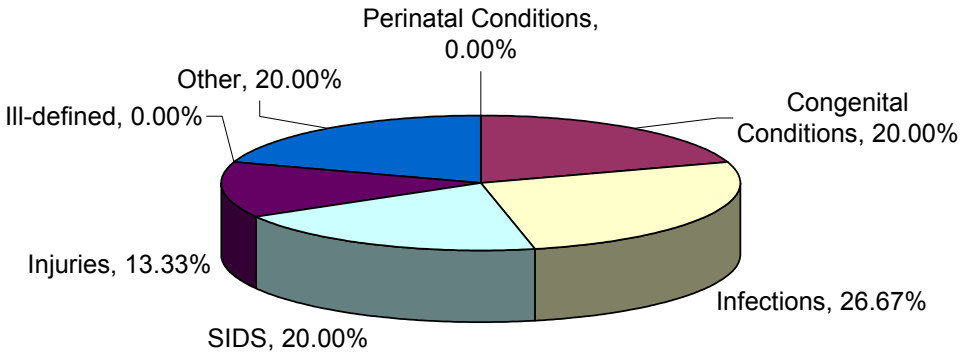


Figure VII-13 graphically shows the percent of deaths in each cause of death category for South Phoenix teenage mothers.

Figure VII-13. Percent of Deaths by Cause of Death for South Phoenix Teenagers



Risk Factors for the Deaths in the Infant Health Category

Different causes of death have different potential risk factors and interventions, albeit some risks are important for more than one cause of death. A list of some of the risk factors by cause of death is shown Table VII-13. The prevalence of each risk factor (when available) for the reference group and South Phoenix teenagers are also shown. The prevalence of each risk factor in South Phoenix teenagers was compared to the prevalence of the risk factor for the reference group. Statistically significant differences between the group and the reference group are shown with an asterisk (*). Many of the potential "infant health" risk factors are not available on birth or death certificates (indicated by "U" in the table).

In comparison to the reference group, a smaller percentage of South Phoenix teenagers smoked cigarettes and drank alcohol during pregnancy. Additionally, fewer South Phoenix teenagers had diabetes than the reference group. Although these findings are promising, a smaller percentage of the teenagers had an ultrasound and they had fewer prenatal care visits than the reference group.

Table VII-13. Infant Health: Differences in Risk Factor Prevalence (Percent) by Cause of Death.

COD / Risk Factor	Reference Group	< 20 Years Old	
Perinatal Conditions			
Smoking	8.68	4.39	*
High Risk Follow-Up	U	U	
Medical/Health Home	U	U	
Congenital Conditions			
Ultrasound	79.89	61.29	*
Alcohol Use	1.27	0.84	*
Drug Use	U	U	
Folic Acid Intake	U	U	
Alpha-Feto Protein	U	U	
Diabetes	2.11	0.67	*
Genetic Counseling	U	U	
Infections			
Medical/Health Home	U	U	
Smoking / Passive Smoke	8.68	4.39	*
Prenatal Care			
No Visits	0.39	4.36	*
1 to 4 Visits	0.94	11.83	*
5 to 9 Visits	10.98	29.34	*
10 or More Visits	87.69	54.47	*
Breast-Feeding			
Maternal Age (<20 yrs)	0	100	
Maternal Education (<=12 yrs)	0	79.76	
Immunizations	U	U	
SIDS			
Smoking/Passive Smoke	8.68	4.39	*
Sleep Position	U	U	
Breast-Feeding	U	U	
Bedding	U	U	
Death Scene Investigation	U	U	
Maternal Age (<20 yrs)	0	100	
Maternal Education (<=12 yrs)	0	79.76	
Injuries			
Bedding	U	U	
Co-Sleeping	U	U	
Death Scene Investigation	U	U	
Car Seat Use	U	U	
Abuse	U	U	
Environment	U	U	
Supervision	U	U	
Ill-Defined			
Autopsy Rate	37.24	41.46	
Death Scene Investigation	U	U	

Note. The factors that defined the reference group were not tested for statistically significant differences between groups. U=Unknown, data not available.

* Statistically significant difference, $p < .05$

Analyses predicting "infant health" deaths in Maricopa County from the risk factors were analyzed by cause of death. Tables VII-14 and VII-15 show the risk factors for the two leading causes of death, infections and SIDS, respectively. Some causes of death could not be analyzed in this way because the numbers of deaths in these categories were small. Thus only the two leading causes were examined. The unadjusted columns show the results when only one risk factor at a time was examined. The adjusted columns show the association between the risk factor and death while holding the other risk factors constant. The South Phoenix prevalence is the percent of live births in the South Phoenix area with the risk factors.

Table VII-14. Infant Health: Odds of Infection as the Underlying Cause of Death.

Risk Factor	South Phoenix Area Prevalence	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age < 20 Years Old	22.76	1.60	0.95, 2.68	1.07	0.59, 1.95	
Education <=12 Years	60.81	2.15	1.39, 3.33 *	2.30	1.31, 4.01 *	44.15
Race/Ethnicity						
White	11.47	C	C	C	C	C
Hispanic	76.90	0.86	0.53, 1.39	0.38	0.21, 0.72 *	
African American	8.28	3.29	1.66, 6.56 *	2.36	1.13, 4.94 *	10.11
Native American	3.35	3.52	1.66, 7.49 *	2.00	0.86, 4.63	
Smoking	6.39	2.23	1.26, 3.95 *	1.53	0.81, 2.89	
Prenatal Care Visits						
0 to 4 Visits	15.02	3.90	2.14, 7.09 *	3.14	1.58, 6.24 *	24.32
5 to 9 Visits	27.22	1.94	1.16, 3.26 *	1.89	1.10, 3.24 *	19.52
10 or More Visits	57.76	C	C	C	C	C

Note. The South Phoenix prevalence is the percent of the risk factor among live births. PAR% = Estimate of the population attributable risk or the percent of SIDS that could be prevented if the predisposing risk factor were eliminated. C = Comparison group.

* Statistically significant, $p < .05$

Women with a high school education or less were 2.3 times more likely to have a post-neonatal infant die of an infection than women with some education beyond high school. If maternal education were increased along with all of the other factors that are associated with higher education, then 44.5% of these deaths could be prevented. Hispanic women were significantly less likely (odds=0.38) to have a baby die of an infection during the post-neonatal periods than White women. On the other hand, African American women were 2.34 times more likely to have a baby die of infection during the post-neonatal period than White women. When race/ethnicity was examined by itself, Native American women were more likely than White women to have a post-neonatal infant die of infections; however, this was not statistically significant when adjusted for other risk factors. This indicates that when the other available risk factors such as low education, prenatal care, and others are accounted for, being a Native American mother by itself carries no higher risk for an infant death due to infection. The number of deaths to Native American women was very small, however.

Although smoking during pregnancy was a risk factor for infections as the cause of death, it was not a statistically significant risk factor when the other risk factors were taken into account.

Compared with women who attended 10 or more prenatal care visits, women who went to four or fewer visits were 3.1 times more likely to have a baby die of infection during the post-neonatal period. Increasing prenatal care could potentially decrease the percentage of deaths due to infections by 24.3%. Women who attended prenatal care five to nine times were 1.9 times more likely to have an infant die of infection during the post-neonatal period. Increasing the number of prenatal care visits for these women has the potential to decrease the infection-related deaths by 19.5%.

Teenage mothers were 2.7 times more likely than older women to have a baby die of SIDS during the post-neonatal period. Preventing teenage pregnancy could potentially prevent approximately 28.2% of the SIDS deaths in South Phoenix. Compared with White mothers, African American mothers were 4.8 times more likely to have a baby die of SIDS, accounting for 9.8% of the SIDS related deaths in South Phoenix. Maternal smoking during pregnancy was associated with a 3.4 increase in the risk of SIDS. Eliminating smoking could potentially reduce the number of post-neonatal deaths due to SIDS by 13.1%. Women with fewer prenatal care visits were more likely to have babies die of SIDS than women who had 10 or more prenatal care visits (3.4 times more likely with zero to four visits and 1.9 times more likely with five to nine visits). If the number of prenatal care visits increased for these two groups of women, it could potentially decrease the number of SIDS deaths by about 46%.

Table VII-15. Infant Health: Odds of SIDS as the Underlying Cause of Death

Risk Factor	South Phoenix Area Prevalence	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age < 20 Years Old	22.76	2.79	1.75, 4.42 *	2.72	1.60, 4.63 *	28.15
Education <= 12 Years	60.81	1.48	0.95, 2.31	1.00	0.57, 1.73	
Race/Ethnicity						
White	11.47	C	C	C	C	C
Hispanic	76.90	0.64	0.39, 1.06	0.58	0.32, 1.05	
African American	8.28	2.71	1.33, 5.54 *	2.31	1.10, 4.82 *	9.80
Native American	3.35	2.01	0.80, 5.06	1.64	0.63, 4.26	
Smoking	6.39	4.65	2.90, 7.47 *	3.35	1.96, 5.74 *	13.07
Prenatal Care Visits						
0 to 4 Visits	15.02	3.62	1.95, 6.69 *	3.48	1.79, 6.76 *	27.12
5 to 9 Visits	27.22	2.04	1.23, 3.39 *	1.88	1.10, 3.22 *	19.40
10 or More Visits	57.76	C	C	C	C	C

Note. The South Phoenix prevalence is the percent of the risk factor among live births. PAR% = Estimate of the population attributable risk or the percent of SIDS that could be prevented if the predisposing risk factor were eliminated. C = Comparison group.

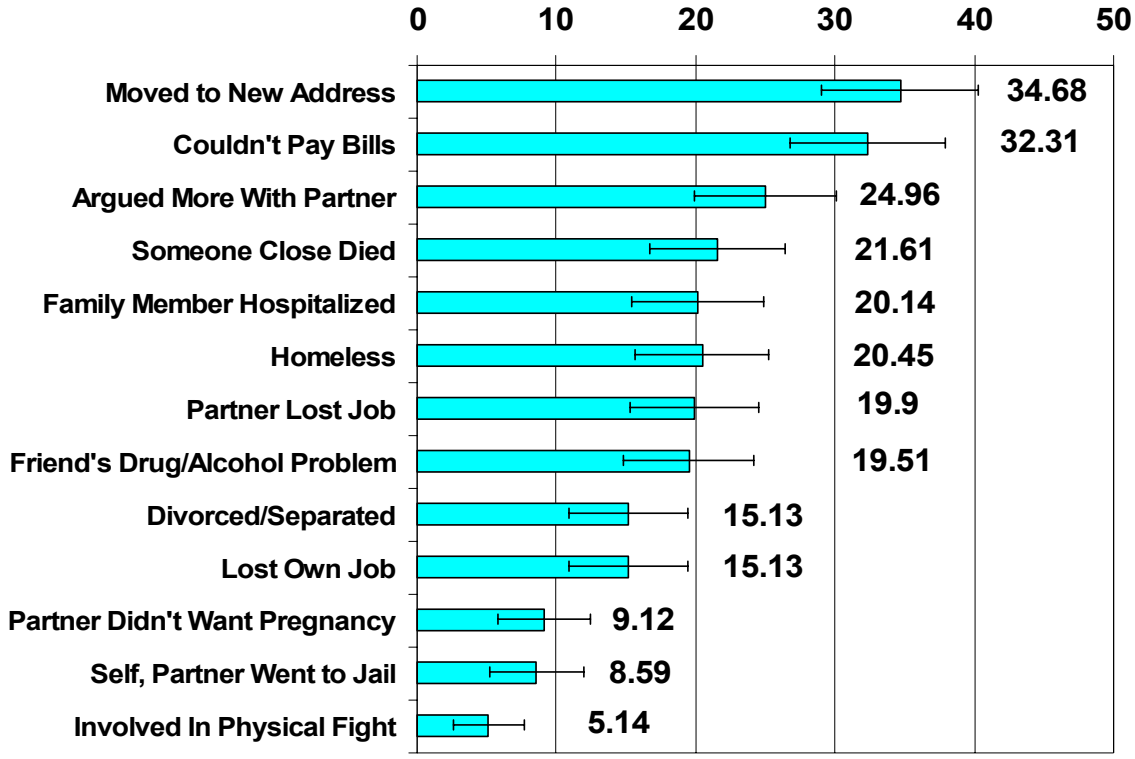
* Statistically significant, $p < .05$

Additional Risk Factors in South Phoenix

Additional data from the Pregnancy Risk Assessment Monitoring Survey (PRAMS) were available for the mothers in the South Phoenix area. PRAMS, developed by the CDC, is a survey of mothers that have recently delivered a baby. The survey collects information about maternal experience and behavior around the time of pregnancy. The PRAMS survey in South Phoenix was a pilot study to determine the feasibility of conducting the survey county-wide. Because the survey was only conducted in South Phoenix, information on the reference group was not available. Therefore, the experiences and behaviors of the South Phoenix mothers may not be different from those of the reference group. Although the PRAMS data were collected during the same time period as the data presented today, only a few months of births were sampled in 2000 so the data may not reflect the whole time period from 1996 through 2000. More information about the survey and additional data from the survey were provided in the 2003 *Maternal and Child Health Needs Assessment* [1].

Psychosocial stressors are relevant for deaths in the "maternal health and prematurity" category because stress can affect health. A question included in the survey asked mothers whether or not they had experienced particular stressful life events in the 12 months prior to delivering their baby. Figure VII-14 shows the estimated percent of new mothers in South Phoenix who stated that they had experienced the particular stressful life events.

Figure VII-14. South Phoenix PRAMS: Psychosocial Stressors in the 12 Months Prior to Delivery



Over 30% of the mothers indicated that they had moved to a new address or couldn't pay their bills. Over 20% of the mothers argued more with their partner, had someone close to them die, or

had a hospitalized family member. More than 15% of the mothers lost their job, had a partner lose a job, got divorced or separated from their husband/partner, or dealt with a friend's drug or alcohol problem. More than 5% of the mothers had a partner who didn't want the pregnancy, they or their partners went to jail, or they were involved in a physical fight.

Many of the women in South Phoenix lacked basic social support during their last pregnancy. Almost 32% of the women stated that they did not have someone with whom to speak about their problems. Approximately 41% of the South Phoenix mothers did not have someone to lend them $50 if they needed it; almost 30% did not have someone to help them if they were sick and needed to stay in bed; and 23% of the women did not have someone to give them a ride to the clinic if they needed it.

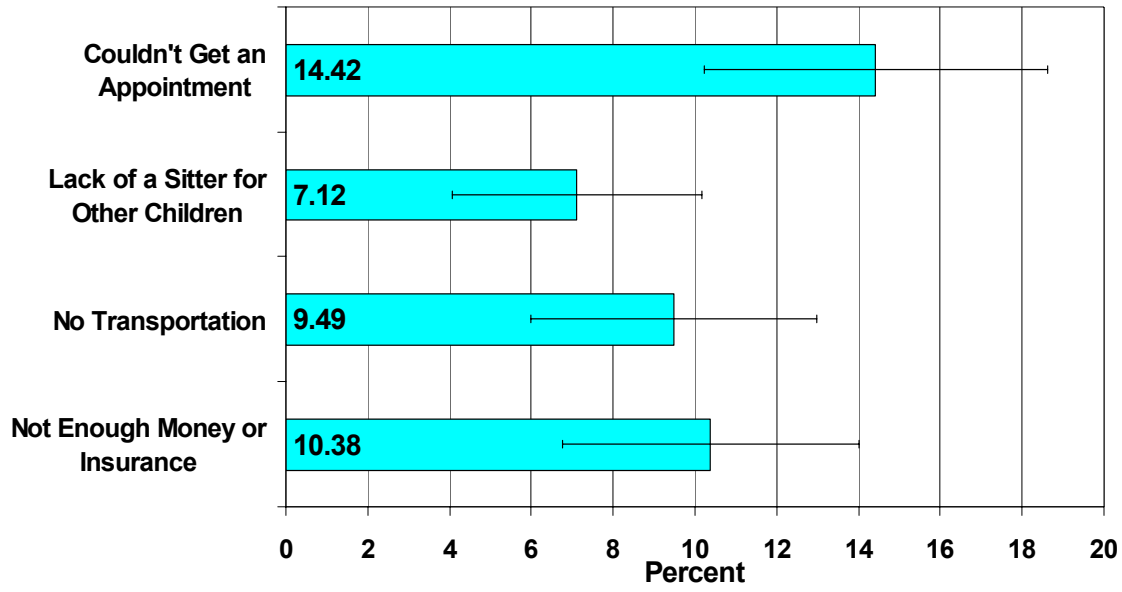
Approximately 39% of the South Phoenix mothers had living arrangements with more than two persons per bedroom. Crowded living conditions may produce higher levels of stress, suggests a lower socioeconomic status, and can increase the chances of infant infections.

Approximately 69% of the mothers in the area did not take a multivitamin the month prior to their pregnancy. Multivitamins are important prior to pregnancy and during early pregnancy because they generally contain the B vitamin, folic acid. Folic acid helps prevent neural tube defects (birth defects). Because 50% of the South Phoenix pregnancies were unplanned, it is important for all women of childbearing age to routinely take or consume adequate amounts of folic acid.

Several questions in the PRAMS survey were relevant to deaths occurring in the "infant health" category. Breast-feeding decreases the risk of infections and SIDS, the two leading causes of death in the "infant health" category. Almost 23% of South Phoenix mothers did not breast-feed their infant for any amount of time. Around 8% of the mothers indicated that their baby was exposed to passive smoke daily, which is also a risk factor for infections and SIDS. Infants placed on their backs to sleep are at lower risk for SIDS. Over 60% of the mothers indicated that they did not lay their baby on their back to sleep. About 11% of these babies were placed on their stomachs and 50% were placed on their sides to sleep (side placement is associated with a higher risk of SIDS but not as high a risk as stomach placement).

Most of the South Phoenix mothers indicated that their infant had a well-baby care checkup (94%) and many of the infants had seen a provider within the first week after the infant left the hospital (83%). A fair number of South Phoenix mothers, however, stated that they had barriers to well-baby care. Figure VII-15 shows the percent of mothers who had trouble getting an appointment, did not have a sitter for their other children, did not have transportation, or thought that they did not have enough money or insurance for well-baby care.

Figure VII-15. South Phoenix PRAMS: Barriers to Routine Well-Baby Care



Summary of South Phoenix Results

Phase I data analyses computed excess fetal and infant mortality rates (F-IMR) by comparing the rates in South Phoenix to the rates of a reference group (composed of Maricopa County non-Hispanic White women who were 20 or more years of age and had some education beyond high school). The excess mortality is considered preventable mortality and shows the disparities between population groups. Based on birth weight and the age of death, the excess F-IMR was partitioned into four areas that correspond to specific intervention points in the health care continuum: "Maternal health and prematurity," "maternal care," "newborn care," and "infant health." The four components have different causes of death, risk factors, and corresponding interventions.

The total F-IMR in South Phoenix during the period 1996 through 2000 was 10.6 deaths (per 1,000 live births and fetal deaths) and the excess F-IMR was 4.8 deaths. Approximately 45% of the fetal and infant deaths were potentially preventable based on this method. The largest contributor to these excess rates was "maternal health and prematurity." These findings suggest that women's health prior to conception played a prominent role in determining fetal and infant outcomes. Focusing prevention or intervention programs on women's health prior to conception should yield larger reductions in the overall excess feto-infant mortality rate than focusing on other points in the health care continuum.

The excess feto-infant mortality rates in South Phoenix were higher for women with a high school education or less than for women with some education beyond high school. Education, a risk factor amenable to modification, consistently showed a large impact on feto-infant mortality rates. These findings confirm that furthering education is a strong predictor and determinant of health status. Additionally, both teenagers and women who were 20 or more years of age had high excess rates in South Phoenix, although their patterns of excess were somewhat different.

There were high excess mortality rates for all the maternal races/ethnicities examined: White, Hispanic, African American, and Native American women. The only race/ethnicity group with a statistically large enough number of deaths to examine in Phase II risk factor analyses was Hispanic women. Approximately 75% of the births in South Phoenix are to Hispanic women. To determine which risk factors to target for the other race/ethnicity groups with high excess, please see the results for those groups in the analyses for Maricopa County.

Phase II analyses examined risk factors in the four F-IMR categories for population groups with high excess mortality and a large enough number of deaths to use in the statistical analyses. There were two pathways to excess "maternal health and prematurity": the birth weight distribution (too many very low birth weight babies) and birth weight-specific mortality (more babies dying at each birth weight grouping). The population groups with excess F-IMR by map component were as follows:

Maternal Health and Prematurity: Birth Weight Distribution

- South Phoenix area as a whole
- Teenagers
- Women 20 or more years of age
- Women with a high school education or less
- Hispanic women

Maternal Health and Prematurity: Birth Weight Specific Mortality

- South Phoenix area as a whole
- Women 20 or more years of age
- Women with a high school education or less
- Hispanic women

Maternal Care:

- South Phoenix area as a whole
- Women 20 or more years of age
- Women with a high school education or less
- Hispanic women

Newborn Care:

- Generally the smallest category of excess with little variation

Infant Health

- Teenagers

Each component area had different risk factors associated with it. Important risk factors for the "maternal health and prematurity birth weight distribution" category that tends to relate to the mother's preconception health, social and economic situation included the mother gaining less than 15 pounds during pregnancy, smoking during pregnancy, few prenatal care visits, an unmarried mother (probably indicating a lack of social support or SES), a small for gestational age baby, and a previous premature baby.

Important risk factors for the "maternal health and prematurity birth weight-specific mortality" category that tends to relate to perinatal conditions and care included few prenatal care visits and a fever during labor and delivery (sign of infection). Risk factors for the "maternal care" category that tends to relate to prenatal care, referral systems, and high risk care included inadequate prenatal care, maternal diabetes, prematurity, and small-for-gestational-age babies. Risk factors related to high risk care and referrals were unavailable for examination.

The leading causes of death in the "infant health" category were infections, SIDS, and congenital conditions. The leading causes countywide were infections and SIDS. Extrapolating from the county results because the number of deaths was statistically too small in South Phoenix, risk factors for the "infant health" category that tend to relate to the environment included maternal smoking and few prenatal care visits.

PRAMS data from South Phoenix show additional risk factors for negative outcomes in this area. These data were not linked to individual deaths and the reference group was not surveyed, so the findings cannot be used to compare the reference group with any specific groups at risk. Therefore, these risks may be the same in the reference group. South Phoenix mothers had low vitamin use prior to pregnancy, a low breast-feeding rate, a high rate babies not put to sleep on their backs. They also had little social support as measured by the high percentage who did not have anyone to lend them $50, to help if mom was ill, to talk about their problems with, or to give them a ride in an emergency. They had high rates of social stressors, barriers to prenatal care use (no transportation, no babysitter, no money or insurance, etc), and crowded living quarters.

Section VIII. Discussion of the Results

Although there were no surprises in the results of these PPOR analyses, the findings dramatically reinforced the empiric and intuitive understanding of the forces acting upon infant mortality in the county. They provide the necessary confirmation in order to begin to develop plans to address the issues that lend themselves to change. In Maricopa County, 32% of the current fetal-infant mortality is potentially preventable. This proportion is 34% for Maryvale and 45% for South Phoenix.

The most important finding is that a low level of education is the risk factor overriding almost all other demographic traits. Mothers with lower levels of education are at excess risk of infant mortality and of having a very low birth weight birth. They have twice to 18 times the risk of experiencing an adverse outcome than those with higher educational levels. Whether one examines these educational categories by race/ethnicity, or by age, or area, invariably, the mothers with the low educational levels are at increased risk. Although not all these analyses are statistically significant, given the small numbers in some of the categories, the results are consistently in the same direction. This is a modifiable risk factor, one about which something can be done.

Another finding relevant to how we practice interventions in the area of maternal and child health is that each race/ethnicity category has a different pattern of risk. So, for example, although both African Americans and Hispanics have high risk of delivering a very low birth weight baby who will have a high probability of dying, their risk factor profiles are not the same. The necessary interventions must be targeted at different points of the health care continuum for each group. These results confirm the crucial importance of culturally-appropriate delivery of services, targeted to a specific population group, depending on its needs.

The estimates of the Population Attributable Risk Percentage (PAR%) gives us an approximate idea of the improvements in health and mortality that could result from the reduction of risky conditions and behaviors. The PAR% is the proportion of negative outcomes that could be prevented by completely eliminating the particular risk factor. This helps us target those interventions that might result in the highest percentage reduction in risk.

For example, if we were able to give Maricopa County mothers the social support they do not receive when they are unmarried, we may be able to reduce the births of very low birth weight babies by 10%, perhaps by 20% if all women could gain at least 15 lbs during pregnancy, and another 3% if no pregnant woman smoked. Mortality in very low birth weight babies could be reduced by 25% or more by coordinating high risk births so that delivery occurs in the appropriate hospital, with the appropriate service level and NICU resources. Infant health deaths could be reduced by over 30% if all moms were educated and received adequate prenatal care during pregnancy. Although these are not exact estimates, all these findings provide a guideline to select interventions that will modify risk factors that will produce the largest positive impact on mothers and infants.

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Appendix A: Methodology and Analysis Map

Data Sources

The data sources consisted of Maricopa County natality and mortality vital registration records from 1996 through 2000 (2001 for infant deaths). A period of five years was necessary because the small population size of the South Phoenix and Maryvale neighborhoods may have displayed unstable rates over a shorter time period. A longer period would have been inappropriate because both the epidemiology of infant health and medical practice may change over time, so that grouping any more than five years would have collapsed very different rates into one average.

The most up-to-date data available were retrieved from the Arizona Department of Health Services (ADHS) vital record databases during October of 2002. These included birth and fetal death data from 1996 through 2000 and infant death data from 1996 through 2001. In addition, Maricopa County Department of Public Health (MCDPH) fetal death databases from 1996 through 1999 were also sources of data for some variables. For the South Phoenix analysis, separately collected Pregnancy Risk Assessment Monitoring System (PRAMS) data were also reviewed.

Death certificates for infants were linked with their corresponding birth certificates in order to obtain additional information about the infant, the delivery, the pregnancy, and the mother, that was not available in the death documents. MCDPH linked one year of birth data to two years of death data (birth cohort) because infant death includes deaths up to one year of age. For example, births in 2000 were linked to infant deaths from 2000 and 2001. The 2002 mortality records were not complete at the time of data preparation; thus, 2001 births were not included in the analyses. The percent of infant death certificates linked to infant birth certificates across the period was 98.34%.

Prior to the year 2000, all of the necessary information for PPOR analyses was not entered into either the ADHS fetal death database or the MCDPH fetal death database (e.g., MCDPH entered zip code but not maternal education, while the opposite was true for ADHS). As a result, the ADHS fetal database from 1996 through 1999 was merged with the county fetal database. The merged county and state fetal database was then appended to the state fetal database for 2000, which included all of the information contained on the fetal death certificate. The final fetal database was then appended to the linked infant birth and death file (unlike death certificates that must be merged with birth certificates, fetal death certificates contain information usually collected in both birth and death certificates).

Deaths Not Analyzed

The PPOR methodology excludes infant and fetal deaths with a birth weight of less than 500 grams and fetal deaths with a gestation of less than 24 weeks. Several months (August through December) of fetal death data were unavailable for 1999. Therefore, birth data for the months of

August through December of 1999 were also removed from the analyses. The final numbers of births, fetal deaths, and infant deaths for each area during the years 1996 through 2000 are shown in Table A-1.

Table A-1. Numbers of Births, Infant Deaths, and Fetal Deaths for Maricopa County, Maryvale, South Phoenix, and the Reference Group by Year.

Maricopa County	**1996**	**1997**	**1998**	**1999***	**2000**	**Total**
Births	46,448	47,008	48,995	28,964	54,158	225,573
Fetal Deaths	115	150	158	99	164	686
Infant Deaths	289	261	260	164	265	1,239
Births & Fetal Deaths	46,563	47,158	49,153	29,063	54,322	226,259
Feto-Infant Deaths	404	411	418	263	429	1,925
South Phoenix	**1996**	**1997**	**1998**	**1999***	**2000**	**Total**
Births	5,068	4,936	4,993	2,860	5,281	23,138
Fetal Deaths	17	22	18	14	16	87
Infant Deaths	38	45	26	20	29	158
Births & Fetal Deaths	5,085	4,958	5,011	2,874	5,297	23,225
Feto-Infant Deaths	55	67	44	34	45	245
Maryvale	**1996**	**1997**	**1998**	**1999***	**2000**	**Total**
Births	4,136	4,231	4,366	2,593	5,025	20,351
Fetal Deaths	14	12	17	5	18	66
Infant Deaths	33	21	23	16	20	113
Births & Fetal Deaths	4,150	4,243	4,383	2,598	5,043	20,417
Feto-Infant Deaths	47	33	40	21	38	179
Reference Group +	**1996**	**1997**	**1998**	**1999***	**2000**	**Total**
Births	21,085	21,043	21,597	12,643	22,311	98,679
Fetal Deaths	20	23	33	20	48	144
Infant Deaths	104	85	93	50	95	427
Births & Fetal Deaths	21,105	21,066	21,630	12,663	22,359	98,823
Feto-Infant Deaths	124	108	126	70	143	571

***** The 1999 data do not include the months of August through December.

+ The reference group comprises Maricopa County, non-Hispanic White women who were 20 or more years of age and had some education beyond high school.

Area Definitions

The west Phoenix neighborhood of Maryvale was defined by five zip codes: 85017, 85019, 85031, 85033, and 85035. The Maryvale results section shows a map of the area. The South Phoenix area was defined by 10 zip codes: 85003, 85004, 85007, 85009, 85034, 85040, 85041, 85042, 85043, and 85339. The South Phoenix section shows a map of the area.

Demographic Groups

The demographic traits of maternal age, maternal educational level, and maternal race/ethnicity, readily available on birth certificates, are associated with feto-infant mortality rates. Maternal age was the mother's age at the time she delivered a baby or miscarried. Following PPOR methodology suggestions, age was categorized into two groups: women under 20 years old (teenagers) and women 20 or more years of age. Maternal education was the highest level of education the mother completed by the time she delivered a baby or miscarried. Education was dichotomized into two groups: women with a high school education or less and women with some education beyond high school.

The U.S. Census and birth certificates currently record race and ethnicity separately, such that Hispanics can be of any race and non-Hispanics can be of any race. "Hispanic" refers to persons who trace their origin or descent to Mexico, Puerto Rico, Cuba, Central America, South America, or other Spanish cultures and can be of any race. In this document, race and ethnicity were collapsed into a single indicator, including non-Hispanic White, Hispanic/Latino (of all races), non-Hispanic Black/African American, and non-Hispanic Native American. In Maricopa County, this classification is consistent with the area's cultural groupings. Persons are classified by race and ethnicity according to how they identify themselves to hospitals, or how their relatives identify them to the funeral director upon their death.

Limitations of the Data

The first and most important limitations of the data used for the PPOR analyses are those inherent in the use of birth and death certificates. The quality of the vital registration data, that is, how faithfully the certificates represent the actual real life event and the circumstances surrounding the birth and death, has never been properly assessed in Maricopa County. Another issue ultimately affecting the validity of the database is the quality of the data entry. Although work has been done during the last two years to identify data entry errors in the database, this process is not complete. Some variables either have many missing values so they could not always be used, or their validity is doubtful. Substantive issues in the use of birth and death certificates include, for example, the discrepancies in race/ethnicity classifications between the birth and the death certificate. This is why the data are linked.

Underreporting of fetal deaths is a common problem, thus, the total population examined here is by no means complete. There is a portion of miscarriages or fetal deaths of more than 24 weeks of gestation that do not make it to the hospital, and thus, never get recorded in a fetal death certificate. In part because most parents will not use the fetal death certificate, there is much information about the parents, and the conditions leading to the fetal demise that are either erroneous or missing, because the certificate is often never reviewed by the parents once it is filed.

Data were entered using different formats, variable names, and configurations for each year. This presented a challenge when trying to merge data from different years and from different data sets. Fetal deaths were recorded in a different system than infant deaths. Additionally, fetal

deaths from two different systems had to be merged together to obtain the necessary information for the analyses. Additionally, the database platforms changed during the period.

In order to maintain comparability with other PPOR analyses throughout the country, we preserved the categorization of education into a dichotomy (a high school degree or less and more than high school). Grouping the completed high school educational level with higher education, however, may have been more appropriate, given employment, income and insurance realities.

One of the most important limitations in these analyses is the lack of sufficient data for many of the Phase II risk factors. Without the possibility of accessing post-delivery information for the child and mother, most of the known risk factors for Infant Health are not measurable in this report. For other outcome categories, such as fetal deaths and low birth weight death, some data are also missing. For example, information on diagnoses of infectious diseases during pregnancy is not available without medical record review. The poor reporting of complications during pregnancy and delivery and infant pathologic conditions in the birth and death certificates further limit the variables available for analyses.

In order to have a complete picture of the infant mortality risk factors using Phase II methods, other sources of data not available at this time in Maricopa County are needed. Fetal and infant mortality review, PRAMS, and other data do not exist. Immunization, WIC and hospitalization data exist but the linkages with birth and death certificates are not done routinely and the condition of the data would require many months of work to link them.

Analyses

There are two phases of PPOR analyses. Phase I of the data analyses followed previously established standardized procedures for PPOR. Statistical analyses began by calculating the overall fetal and infant mortality (feto-infant mortality) rate, consisting of the number of fetal and infant deaths per 1,000 live births and fetal deaths. Based on the age at death (fetal, neonatal, or post-neonatal) and birth weight of the child ($< 1{,}500$ grams or $\geq 1{,}500$ grams), the feto-infant mortality was then "mapped" to, or divided into, four areas of perinatal health contributors: "Maternal health and prematurity," "maternal care," "newborn care," and "infant health."

Excess mortality was determined by comparing (subtracting) the mortality rates in each area to a standard reference group with low feto-infant mortality rates. The internal reference group comprised Maricopa County non-Hispanic White women who were 20 or more years of age and had some education beyond high school. Note that the individuals in the reference group were not removed from area numbers (county, Maryvale, or South Phoenix) providing a conservative estimate of the excess. The amount of excess mortality in each category suggested the extent to which the feto-infant mortality rate could have been reduced. The excess feto-infant mortality map was then compared across standard demographic groups that frequently show disparities (i.e., maternal age, maternal race/ethnicity, and maternal education level). Additional information is presented in the introduction section.

Phase II of the data analyses followed the established procedures for PPOR when defined. Phase II depends on the results of Phase I, community specifics, and available data. The organization of the Phase II analysis methods follows the four areas of perinatal contributors to fetal and infant deaths: "Maternal health and prematurity," "maternal care," "newborn care," and "infant health."

Risk factors for excess fetal and infant deaths attributed to each of the categories were examined when the feto-infant death rate was at least 1.5 per 1,000 live births and fetal deaths and there were at least 60 total fetal and infant deaths in the group of interest. The choice of lower bounds for examination was based on suggestions from the PPOR practice collaborative [4]. The excess fetal and infant mortality rate cut-off was based on the midpoint between an excess rate that produces the most stable results (2.0) and one that produces results so unstable that Kitagawa's formula (described below) should not be used (1.0). An exception to the 60-death rule was for South Phoenix teenagers; the total number of deaths was 52, there were almost 10 deaths in each category, and there were 20 deaths in the "maternal health and prematurity" category.

Maternal Health and Prematurity

The analyses began by partitioning the excess feto-infant mortality in the "maternal health and prematurity" category into deaths attributed to a low birth weight distribution and deaths attributed to high birth weight-specific mortality. The Kitagawa formula [4, 7] estimated the excess mortality due to each pathway. Although the process uses all live births and fetal deaths, the very low birth weight births and fetal deaths (< 1,500 grams) were the relevant ones for the "maternal health and prematurity" category. The birth weight-specific mortality pathway was examined when at least 40% of the excess "maternal health and prematurity" mortality was associated with it, based on PPOR practice collaborative recommendations [4]. Different outcomes and risk factors were analyzed based on the results of the partitioning.

Once the appropriate path and relevant risk factors were identified, differences in risk factor distributions between the group of interest (defined by area, age, education, and race/ethnicity) and the reference group were examined. For the birth weight distribution pathway, the prevalence was the percent of live births (regardless of birth weight) with the risk factor; all births are at risk for very low birth weight. For the birth weight-specific mortality pathway, the prevalence was the percent of very low birth weight fetal deaths and live births with the risk factor. The differences in the risk factor proportion between the group of interest and the reference group were tested for statistical significance with a Chi-Square Goodness of Fit Statistic [19]. The theoretical distribution that all groups in the area should be able to achieve was the reference group's distribution. This analysis allowed overlap between the reference group and the other groups. For example, the Maricopa County non-Hispanic White women who were 20 or more years of age and had some education beyond high school that lived in South Phoenix were part of both the overall South Phoenix group and the reference group.

For the birth weight distribution pathway, the risk factors examined were marital status, smoking during pregnancy, alcohol use during pregnancy, pregnancy weight gain, number of prenatal care visits, trimester prenatal care began, adequacy of prenatal care utilization index (APNCUI) [15], small for gestational age, prematurity, previous preterm delivery, multiple pregnancy, maternal anemia, and method of payment for delivery, age, education, and race/ethnicity. The risk factors examined for the birth weight-specific mortality pathway included the hospitals perinatal care

designation level, prematurity, small for gestational age, congenital anomalies (any of those listed on birth certificate), complications of labor and delivery (any complication, febrile, placenta previa or abruptio, ruptured membranes, precipitous labor of less than 3 hours, dysfunctional labor, breech or malpresentation, cord prolapse, and fetal distress), medical risk factors (maternal diabetes and hypertension), infant transfers, maternal transfers, the infant needing assisted ventilation for less than 30 minutes and more than 30 minutes, the number of prenatal care visits, trimester prenatal care began, adequacy of prenatal care utilization index (APCUI), and method of payment for delivery. Not all of the risk factors for the birth weight-specific mortality pathway were available for fetal deaths; some were not entered into the earlier fetal death database (i.e., congenital anomalies, transferring the mother to another hospital, and payment for delivery) while others were irrelevant for the fetal deaths (i.e., transferring the infant to another hospital and assisted ventilation for the infant). Therefore, the denominator for these factors was very low birth weight live births rather than very low birth weight live births and fetal deaths. For the birth weight-specific mortality analyses, "infant transfers" from Banner's Good Samaritan Hospital were not included as infant transfers. Phoenix Children's Hospital has a level 3 neonatal intensive care unit within Good Samaritan. As a result, most of the transfers were technically to another hospital but not to another premise. Therefore, high-risk deliveries were occurring at an appropriate level perinatal care center.

The APNCUI describes the adequacy of the timing of prenatal care initiation and the number of visits after care was initiated but does describe the quality of the care or adjust for maternal risk factors:

a) Inadequate utilization began after the fourth month of pregnancy or less than 50% of the expected visits were attended (expected visits based on ACOG standards),
b) Intermediate prenatal care began before the fourth month and 50 to 79% of the expected visits were attended,
c) Adequate prenatal care began prior to the fourth month and 80-109% of the expected visits were received,
d) Adequate plus is intensive where care began prior to the fourth month of pregnancy and 110% or more of the expected visits were received.

The third analysis examined the association between the risk factors and the outcome. For the birth weight distribution path, the outcome was very low birth weight among all live births ($<$ 1,500 gram live birth versus $\geq$ 1,500 gram live birth). For the birth weight-specific mortality path, the outcome was death among the very low birth weight births ($<$ 1,500 gram fetal or infant death versus $<$ 1,500 gram live birth that survived one year). The associations were tested with logistic regression, both univariate and adjusted for the other risk factors. These analyses included all of Maricopa County. For the birth weight-specific mortality pathway, there were two multiple logistic regression analyses: one with all of the birth and fetal death data and one with only live births. This was necessary because several risk factors were unavailable for the fetal deaths, as described above.

The South Phoenix and Maryvale numbers were too small to reliably estimate some of the models. On the assumption that risk factors in these two smaller areas of the county are similar to the county as a whole, the models for the county were used for these areas. An estimate of the Population Attributable Risk Percent (PAR%) was computed from the adjusted odds and the

prevalence of the risk factor in the area. The PAR% was calculated with the formula: P(OR-1)/[P(OR-1)+1], where P was the proportion in the population and OR was the odds ratio adjusted for other risk factors [20]. The formula gives an estimate of the percent of the outcome that could be prevented if the predisposing risk factor were eliminated. The population proportions used in the formula were the proportions for the respective area (Maricopa County, South Phoenix, or Maryvale).

Maternal Care

Maternal care associated deaths were examined when the excess fetal and infant mortality rate was at least 1.5 per 1,000 live births and fetal deaths. In addition to age, education, and race/ethnicity, the risk factors included the number of prenatal care visits, the trimester that prenatal care began, APNCUI, hospital perinatal service level, prematurity, small for gestational age, placenta previa or abruptio, fetal malpresentation, cord prolapse, fetal distress, maternal diabetes, and pregnancy-related hypertension.

The differences in the risk factor proportions between the group of interest and the reference group were tested for statistical significance with a Chi-Square Goodness of Fit Statistic described in the "maternal health/prematurity" section above. The proportions were the percent of higher birth weight (> 1,500 grams) live births and fetal deaths with the risk factor. The associations between each risk factor and fetal death were tested with univariate and multiple logistic regressions. The outcome was fetal death among the higher birth weight ($\geq$ 1,500 grams) live births and fetal deaths ($\geq$ 1,500 gram fetal death versus $\geq$ 1,500 gram live birth). The PAR% was also calculated.

Newborn Care

The excess fetal and infant mortality rate in the newborn category did not exceed 1.0 fetal and infant deaths per 1,000 live births and fetal deaths in any maternal group. There was little variability among groups in newborn care. Therefore, further analyses of this category were not conducted. The prevalence would have been the percent of higher birth weight (> 1,500 grams) live births with the risk factor. The logistic regression dependent variable would have included the risk of a higher birth weight neonatal death (< 28 days of age) among all live births ($\geq$ 1,500 gram neonatal deaths versus infants that survived at least 28 days).

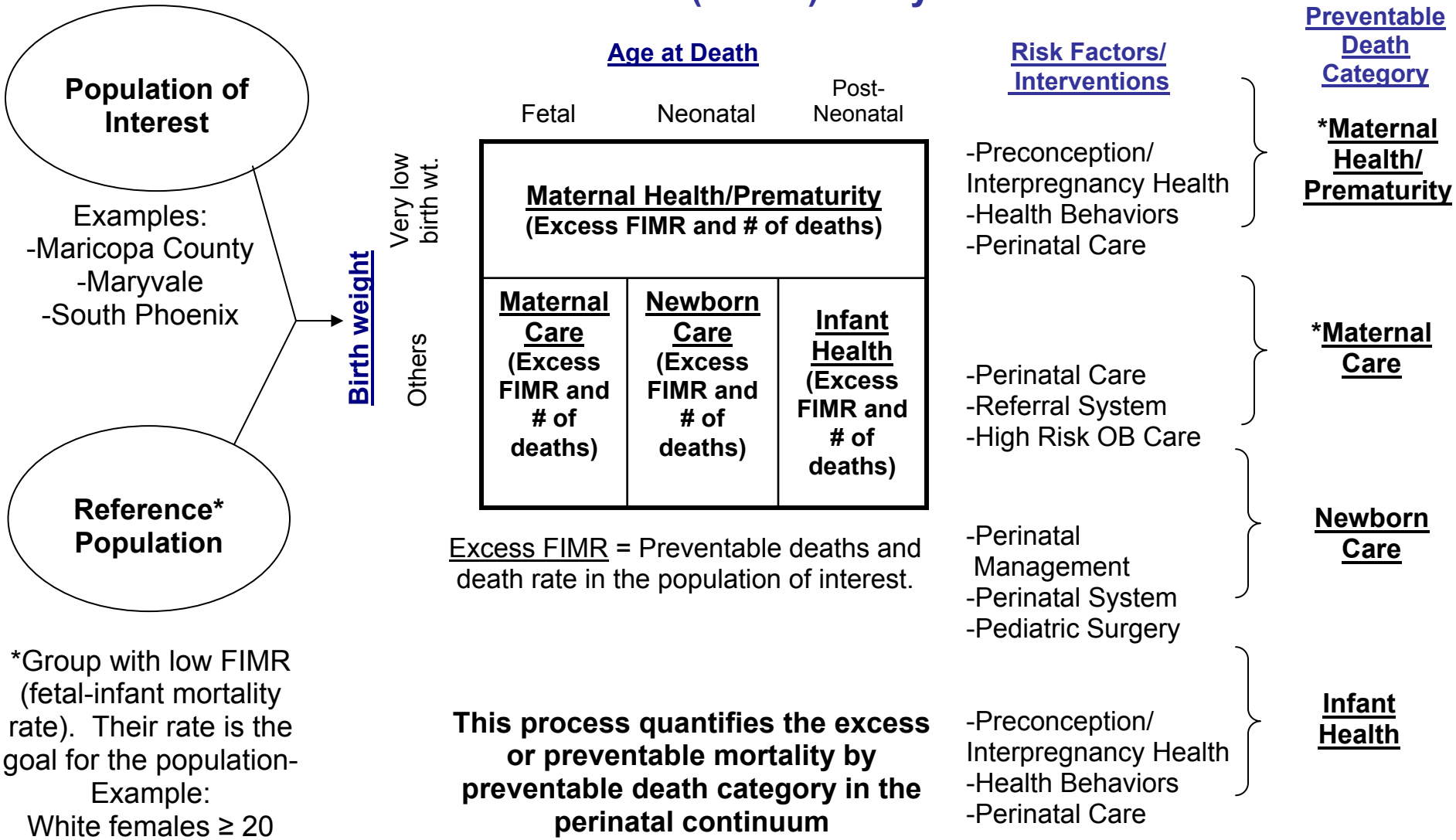
Infant Health

The analysis for excess "infant health" deaths began with an examination of the underlying cause of death [5]. The basis for the classification of the causes of death into groups was an article in the *Morbidity and Mortality Weekly* Report authored by members of the CDC's Division of Reproductive Health, which modified "the 1980 National Infant Mortality Surveillance" cause of death groupings [6]. The categories consisted of perinatal conditions, congenital conditions, infections, SIDS, injuries, ill-defined, and other. Several categories also included subcategories; however, the small numbers of "infant health" deaths did not lend themselves to further categorization. Appendix G presents all categories and subcategories for the "infant health" category deaths in Maricopa County. In 2000 (and some in 1999) the International Classification of Diseases-Version 9 (ICD-9) coding for causes of death was replaced by International Classification of Diseases-Version 10 (ICD-10) coding. Because the death data covered the years

1996 to 2001, the ICD-10 codes were recoded to ICD-9 codes prior to grouping the underlying causes of death into categories.
The risk factors for different causes of death are different so risk factor analyses should be based on the cause of death. Some of the known risk factors are presented in the section describing the results. Differences in the risk factor distributions between the group of interest and the reference group were statistically tested with the Goodness of Fit Chi-Square described above. The proportions were the percent of live births with the risk factor. Logistic regression and the PAR% were calculated as previously described. The outcome was deaths in the "infant health" category versus infants that survived one year ($\geq$ 1,500 gram infant deaths that occurred between 28 days and 1 year of life versus ($\geq$ 1,500 gram births that survived one year). Only the leading two causes of death, infections and SIDS, were analyzed with logistic regression due to the small numbers of death in the other cause of death categories. The two leading causes of "infant health" deaths in Maricopa County were analyzed separately. The risk factors for these causes of death that were available in the vital registration databases included smoking during pregnancy and prenatal care, along with the demographic factors of age, education, and race/ethnicity.

There were statistically too few deaths in the "infant health" category among Asian mothers. Therefore, Asians were not included in these analyses. Similarly for the number of prenatal care visits, the categories of "zero" and "one to four" used in other analyses were combined into a single category for the "infant health" analyses.

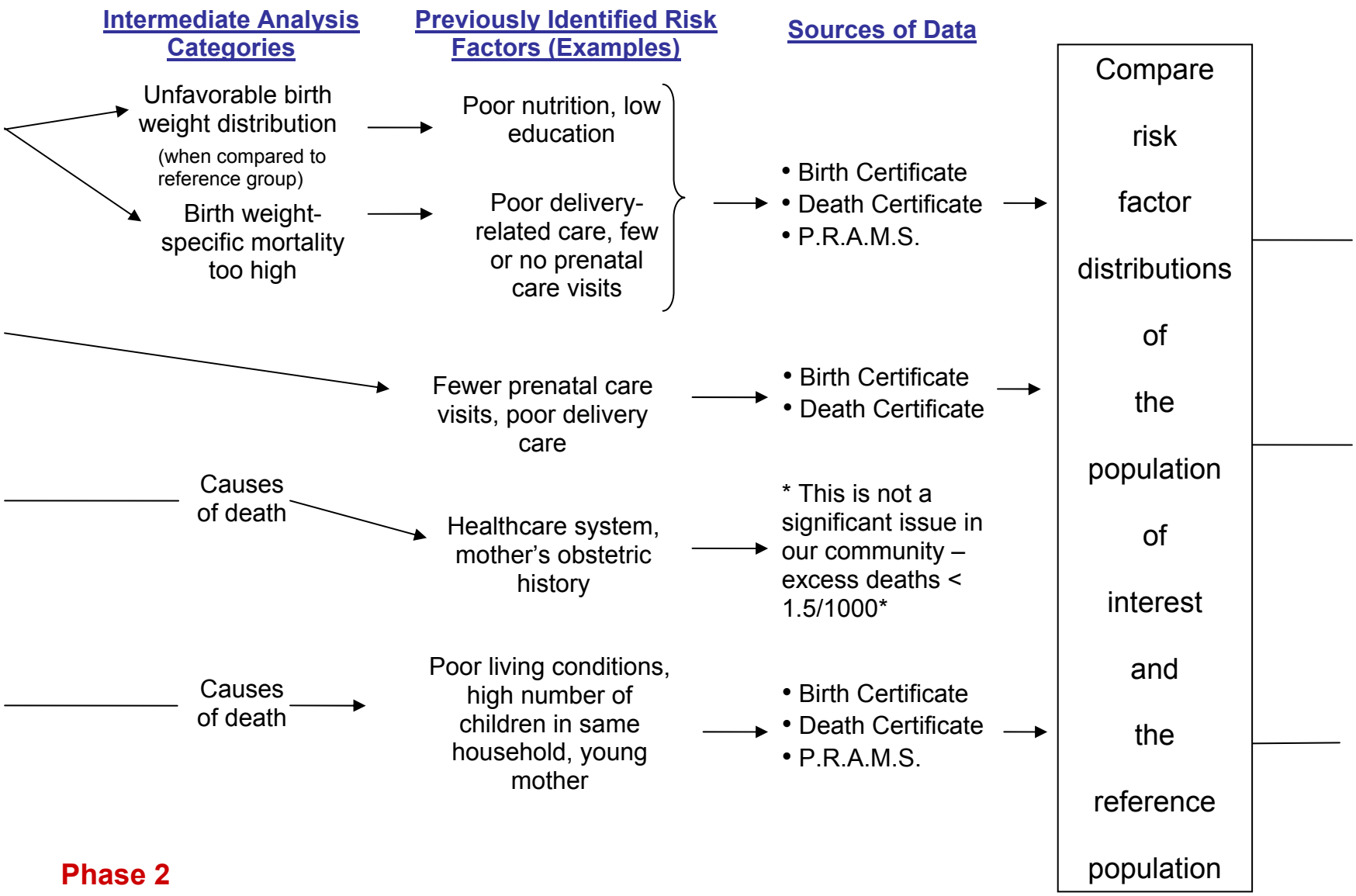
Perinatal Periods of Risk (PPOR) Analysis



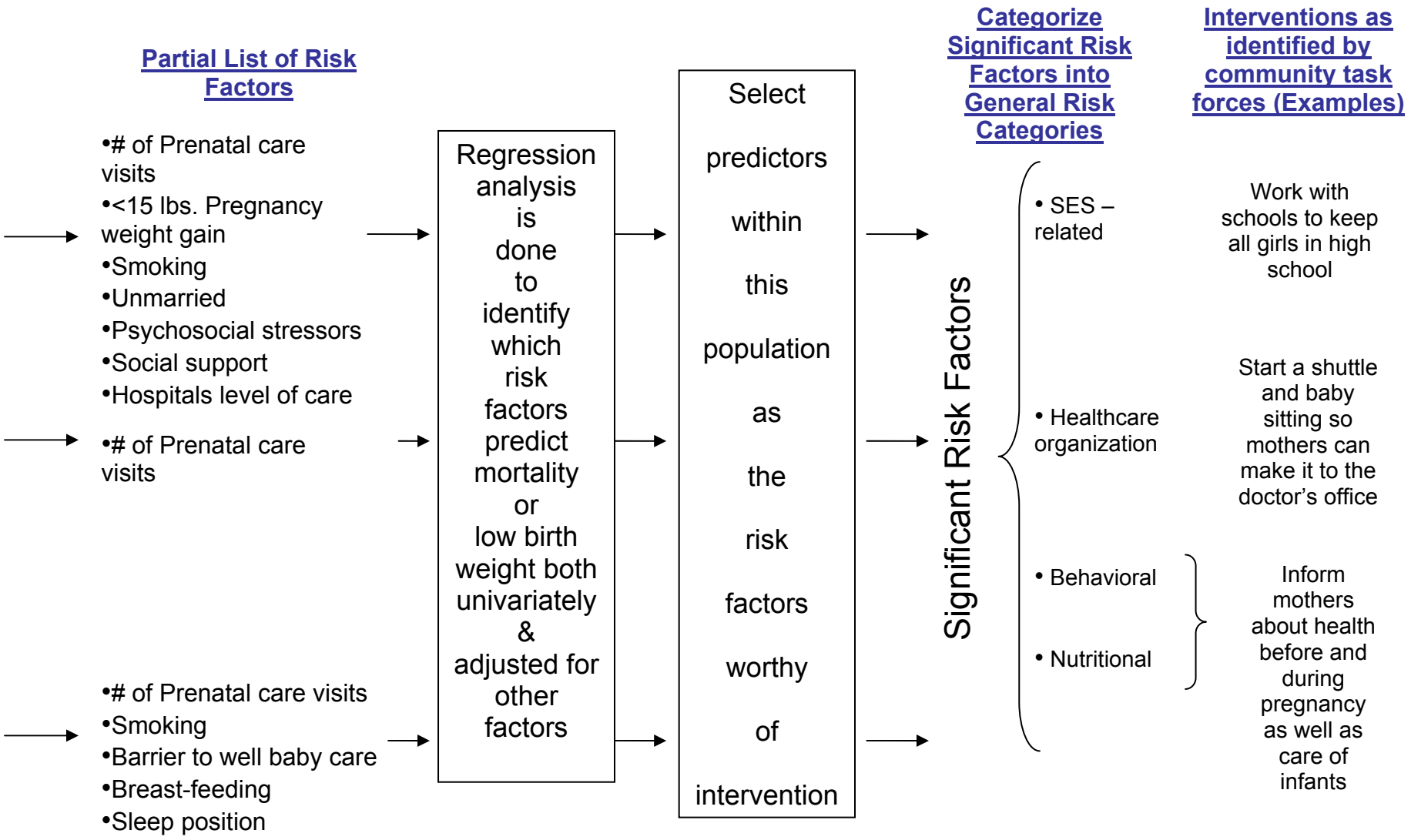
*Group with low FIMR (fetal-infant mortality rate). Their rate is the goal for the population- Example: White females ≥ 20 years of age with ≥ 12 years of schooling

* Cause of death not used because small and early deaths are multifactorial and causes are ill defined and poorly reported.

Phase 1


Intermediate Analysis Categories
Previously Identified Risk Factors (Examples)
Sources of Data
Unfavorable birth weight distribution
(when compared to reference group)
Birth weight-specific mortality too high
Poor nutrition, low education
Poor delivery-related care, few or no prenatal care visits
• Birth Certificate
• Death Certificate
• P.R.A.M.S.
Fewer prenatal care visits, poor delivery care
• Birth Certificate
• Death Certificate
Causes of death
Healthcare system, mother's obstetric history
* This is not a significant issue in our community – excess deaths < 1.5/1000*
Causes of death
Poor living conditions, high number of children in same household, young mother
• Birth Certificate
• Death Certificate
• P.R.A.M.S.
Compare risk factor distributions of the population of interest and the reference population

Phase 2


Partial List of Risk Factors
•# of Prenatal care visits
•<15 lbs. Pregnancy weight gain
•Smoking
•Unmarried
•Psychosocial stressors
•Social support
•Hospitals level of care
•# of Prenatal care visits
•# of Prenatal care visits
•Smoking
•Barrier to well baby care
•Breast-feeding
•Sleep position
Regression analysis is done to identify which risk factors predict mortality or low birth weight both univariately & adjusted for other factors
Select predictors within this population as the risk factors worthy of intervention
Significant Risk Factors
Categorize Significant Risk Factors into General Risk Categories
• SES – related
• Healthcare organization
• Behavioral
• Nutritional
Interventions as identified by community task forces (Examples)
Work with schools to keep all girls in high school
Start a shuttle and baby sitting so mothers can make it to the doctor's office
Inform mothers about health before and during pregnancy as well as care of infants

Phase 2 – con't.

Appendix B: Phase I Analyses: Number of Deaths, Mortality Rate, & Excess Mortality Rate of Fetal & Infant Deaths

Table B-1. Number of Deaths, Infant Mortality Rates, and Excess Rates by Category and Group *(* = numbers too small for stable rate).*

Group	Maternal Health/Prematurity			Maternal Care			Newborn Care			Infant Health			Total		
	N	Rate	Excess	N	Rate	Excess	N	Rate	Excess	N	Rate	Excess	N	Rate	Excess
Reference	183	1.85	N/A	103	1.04	N/A	148	1.5	N/A	137	1.39	N/A	571	5.78	N/A
Maricopa County	635	2.81	0.95	480	2.12	1.08	404	1.79	0.29	406	1.79	0.41	1925	8.51	2.73
<20 Years Old	132	4.27	2.41	68	2.2	1.16	72	2.33	0.83	88	2.84	1.46	360	11.64	5.86
=>20 Years Old	502	2.57	0.72	411	2.11	1.06	332	1.7	0.2	318	1.63	0.24	1563	8.01	2.23
<=12 Years Educ.	283	4.32	2.47	273	4.17	3.12	132	2.01	0.52	156	2.38	0.99	844	12.88	7.1
>12 Years Educ.	306	1.98	0.13	157	1.02	-0.03	253	1.64	0.14	236	1.53	0.14	952	6.16	0.38
White	285	2.42	0.57	224	1.9	0.86	195	1.66	0.16	199	1.69	0.3	903	7.67	1.89
Hispanic	280	3.24	1.39	209	2.42	1.38	164	1.9	0.4	145	1.68	0.29	798	9.24	3.46
African American	46	5.43	3.58	17	2.01	0.97	20	2.36	0.86	35	4.13	2.75	118	13.94	8.16
Native American	17	2.72	0.87	16	2.56	1.52	11	1.76	0.26	19	3.04	1.66	63	10.09	4.31
Maryvale	64	3.13	1.28	39	1.91	0.87	33	1.62	0.12	43	2.11	0.72	179	8.77	2.99
<20 Years Old	13	3.09	1.23	8*	1.9*	0.86*	7*	1.66*	0.16*	9*	2.14*	0.75*	37	8.78	3.01
=>20 Years Old	51	3.15	1.3	30	1.85	0.81	26	1.6	0.11	34	2.1	0.71	141	8.7	2.92
<=12 Years Educ.	41	4.19	2.33	25	2.55	1.51	14	1.43	-0.07	22	2.25	0.86	102	10.41	4.63
>12 Years Educ.	16	1.59	-0.26	10	0.99	-0.05	15	1.49	-0.01	17	1.69	0.3	58	5.76	-0.02
White	12	2.58	0.73	11	2.37	1.32	7*	1.51*	0.01*	10	2.15	0.77	40	8.61	2.83
Hispanic	44	3.29	1.44	22	1.64	0.6	24	1.79	0.3	26	1.94	0.56	116	8.67	2.89
African American	7*	5.22*	3.37*	3*	2.24*	1.2*	1*	0.75*	-0.75*	6*	4.48*	3.09*	17	12.69	6.91
Native American	0*	0*	-1.85*	3*	5.3*	4.26*	1*	1.77*	0.27*	1*	1.77*	0.38*	5*	8.83*	3.06*
South Phoenix	84	3.62	1.76	56	2.41	1.37	49	2.11	0.61	56	2.41	1.02	245	10.55	4.77
<20 Years Old	20	3.79	1.94	9*	1.71*	0.66*	8*	1.52*	0.02*	15	2.84	1.46	52	9.86	4.08
=>20 Years Old	64	3.57	1.71	47	2.62	1.58	41	2.28	0.79	41	2.28	0.9	193	10.75	4.97
<=12 Years Educ.	56	4.14	2.29	46	3.4	2.36	27	2	0.5	36	2.66	1.28	165	12.2	6.42
>12 Years Educ.	19	2.17	0.32	5*	0.57*	-0.47*	17	1.94	0.44	18	2.05	0.67	59	6.73	0.96
White	6*	2.27*	0.42*	6*	2.27*	1.23*	6*	2.27*	0.78*	10	3.79	2.4	28	10.61	4.83
Hispanic	68	3.84	1.99	48	2.71	1.67	30	1.7	0.2	33	1.87	0.48	179	10.12	4.34
African American	6	3.15	1.3	2	1.05	0.01	9	4.72	3.23	9	4.72	3.34	26	13.65	7.87
Native American	4	5.2	3.35	0	0	-1.04	3	3.9	2.4	3	3.9	2.51	10	13	7.23

Appendix C: Summary of Excess Mortality Rates

Table C-1. Summary of Phase I Excess Fetal & Infant Deaths per 1,000 Live Births and Fetal Deaths Plus the Total Number of Deaths in a Category.

Maricopa County Group	$N_{(deaths)}$	MHP	MC	NC	IH	*Total*
All mothers	*1,925*	*1.0*	*1.1*	*0.3*	*0.4*	*2.7*
< 20 years old	360	**2.4**	1.2	0.8	**1.5**	*5.9*
≥ 20 years old	1,563	0.7	1.1	0.2	0.2	*2.2*
≤ 12 years Education	844	**2.5**	**3.1**	0.5	1.0	*7.1*
>12 years Education	952	0.1	0.0	0.1	0.1	*0.4*
White	903	0.6	0.9	0.2	0.3	*1.9*
Hispanic	798	1.4	1.4	0.4	0.3	*3.5*
African American	118	**3.6**	1.0	0.9	**2.8**	*8.2*
Native American	63	0.9	**1.5**	0.3	**1.7**	*4.3*

Table C-2. Summary of Phase I Excess Fetal & Infant Deaths per 1,000 Live Births and Fetal Deaths Plus the Total Number of Deaths in a Category.

Maryvale Group	$N_{(deaths)}$	MHP	MC	NC	IH	*Total*
All mothers	*179*	*1.3*	*0.9*	*0.1*	*0.7*	*3.0*
< 20 years old	37	1.2	0.9*	0.2*	0.8*	*3.0*
≥ 20 years old	141	1.3	0.8	0.1	0.7	*2.9*
≤ 12 years Education	102	**2.3**	**1.5**	-0.1	0.9	*4.6*
>12 years Education	58	-0.3	-0.1	0	0.3	*0*
White	40	0.7	1.3	0*	0.8	*2.8*
Hispanic	116	1.4	0.6	0.3	0.6	*2.9*
African American	17	3.4*	1.2*	-0.8*	3.1*	*6.9*
Native American	5	-1.9*	4.3*	0.3*	0.4*	*3.1**

Table C-3. Summary of Phase I Excess Fetal & Infant Deaths per 1,000 Live Births and Fetal Deaths Plus the Total Number of Deaths in a Category.

South Phoenix Group	$N_{(deaths)}$	MHP	MC	NC	IH	*Total*
All mothers	*245*	***1.8***	*1.4*	*0.6*	*1*	*4.8*
< 20 years old	52	**1.9**	0.7	0	**1.5**	*4.1*
≥ 20 years old	193	**1.7**	**1.6**	0.8	0.9	*5*
≤ 12 years Education	165	**2.3**	**2.4**	0.5	1.3	*6.4*
>12 years Education	59	0.3	-0.5*	0.4	0.7	*1*
White	28	0.4*	1.2*	0.8*	2.4*	*4.8*
Hispanic	179	**2**	**1.7**	0.2	**5**	*4.3*
African American *	26	1.3*	0*	3.2*	3.3*	*7.9*
Native American *	10	5.2*	0*	4*	4*	*13*

Note. The larger, bolded numbers indicate the groups that met the criteria for Phase II analyses.
*** Numbers too small for a stable excess rate.**

Appendix D: Rate and Percent Contribution of the Birth Weight Distribution and Birth Weight-Specific Mortality to Excess Maternal Health/Prematurity Mortality

Table D-1. Maricopa County Teenagers

Birth Weight in Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates *		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	1.2	0.4	1.6	20.3%	6.3%	26.5%
750-999	0.3	0.3	0.6	5.7%	5.0%	10.7%
1,000-1,249	0.2	0.0	0.2	2.7%	0.4%	3.0%
1,250-1,499	0.0	0.0	0.1	0.2%	0.8%	1.0%
1,500-1,999	0.2	0.7	0.9	3.7%	12.1%	15.8%
2,000-2,499	0.4	0.4	0.8	6.1%	7.3%	13.4%
2,500-6,499	-0.1	1.8	1.7	-1.5%	31.1%	29.6%
Total	**2.2**	**3.7**	**5.9**	**37.1%**	**62.9%**	**100.0%**
VLBW Total	**1.7**	**0.7**	**2.4**	**28.8%**	**12.4%**	**41.2%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the “maternal health and prematurity” category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-2. Maricopa County Women with a High School Education or Less

Birth Weight in Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates*		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	0.8	0.3	1.1	11.6%	4.3%	15.9%
750-999	0.4	0.5	1.0	6.1%	7.6%	13.6%
1,000-1,249	0.1	0.0	0.1	1.2%	0.6%	1.8%
1,250-1,499	0.0	0.2	0.2	0.5%	2.9%	3.4%
1,500-1,999	0.2	0.8	1.0	3.2%	10.9%	14.1%
2,000-2,499	0.3	0.4	0.7	3.7%	5.5%	9.2%
2,500-6,499	-0.1	3.1	3.0	-1.1%	43.2%	42.0%
Total	**1.8**	**5.3**	**7.1**	**25.1%**	**74.9%**	**100.0%**
VLBW Total	**1.4**	**1.1**	**2.5**	**19.3%**	**15.4%**	**34.7%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the “maternal health and prematurity” category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-3. Maricopa County African Americans

Birth weight In Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight Specific Mortality	Total
500-749	2.5	-0.4	2.1	30.0%	-4.5%	25.5%
750-999	0.8	0.1	0.8	9.4%	0.9%	10.3%
1,000-1,249	0.3	0.0	0.3	3.2%	0.5%	3.7%
1,250-1,499	0.3	0.1	0.4	3.6%	0.8%	4.4%
1,500-1,999	0.2	0.8	1.0	3.2%	10.9%	14.1%
2,000-2,499	0.3	0.4	0.7	3.7%	5.5%	9.2%
2,500-6,499	-0.1	3.1	3.0	-1.1%	43.2%	42.0%
Total	**1.8**	**5.3**	**7.1**	**25.1%**	**74.9%**	**100.0%**
VLBW Total	**3.8**	**-0.2**	**3.6**	**46.2%**	**-2.3%**	**43.9%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the “maternal health and prematurity” category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-4. Maryvale Women with a High School Education or Less

Birth Weight In Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	1.1	0.2	1.4	24.7%	5.0%	29.7%
750-999	0.5	0.4	0.9	11.0%	8.0%	19.0%
1,000-1,249	-0.1	-0.3	-0.3	-1.1%	-5.4%	-6.5%
1,250-1,499	0.1	0.2	0.4	2.9%	5.3%	8.2%
1,500-1,999	0.1	0.3	0.4	1.8%	5.8%	7.6%
2,000-2,499	0.1	-0.4	-0.3	2.3%	-7.8%	-5.6%
2,500-6,499	-0.1	2.3	2.2	-1.2%	48.8%	47.6%
Total	**1.9**	**2.8**	**4.6**	**40.5%**	**59.5%**	**100.0%**
VLBW Total	**1.7**	**0.6**	**2.3**	**37.5%**	**12.8%**	**50.3%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the “maternal health and prematurity” category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-5. South Phoenix Area

Birth Weight In Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	0.4	0.2	0.7	9.2%	5.0%	14.2%
750-999	0.3	0.3	0.6	6.5%	5.3%	11.7%
1,000-1,249	0.2	0.1	0.3	3.7%	3.1%	6.9%
1,250-1,499	0.1	0.1	0.2	2.1%	2.0%	4.1%
1,500-1,999	0.2	0.5	0.7	4.4%	11.1%	15.5%
2,000-2,499	0.3	0.2	0.4	5.7%	3.4%	9.2%
2,500-6,499	-0.1	1.9	1.8	-1.7%	40.0%	38.4%
Total	**1.4**	**3.3**	**4.8**	**30.0%**	**70.0%**	**100.0%**
VLBW Total	**1.0**	**0.7**	**1.8**	**21.6%**	**15.4%**	**37.0%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the “maternal health and prematurity” category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-6. South Phoenix Teenagers

Birth weight In Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	0.7	0.3	1.0	16.9%	8.2%	25.1%
750-999	0.2	0.4	0.6	6.0%	8.8%	14.8%
1,000-1,249	0.2	-0.1	0.2	5.4%	-1.4%	4.0%
1,250-1,499	0.0	0.1	0.1	0.8%	2.8%	3.6%
1,500-1,999	0.2	0.1	0.3	4.6%	2.6%	7.2%
2,000-2,499	0.4	0.4	0.8	9.7%	8.6%	18.3%
2,500-6,499	-0.1	1.2	1.1	-2.1%	29.1%	27.0%
Total	**1.7**	**2.4**	**4.1**	**41.2%**	**58.8%**	**100.0%**
VLBW Total	**1.2**	**0.8**	**1.9**	**29.1%**	**18.4%**	**47.5%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the “maternal health and prematurity” category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-7. South Phoenix Women 20 or More Years of Age

Birth Weight In Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	0.4	0.2	0.6	7.4%	4.2%	11.6%
750-999	0.3	0.2	0.5	6.5%	4.5%	11.0%
1,000-1,249	0.2	0.2	0.4	3.3%	4.3%	7.5%
1,250-1,499	0.1	0.1	0.2	2.4%	1.9%	4.3%
1,500-1,999	0.2	0.7	0.9	4.3%	13.2%	17.5%
2,000-2,499	0.2	0.1	0.3	4.8%	2.2%	6.9%
2,500-6,499	-0.1	2.1	2.0	-1.5%	42.6%	41.1%
Total	**1.4**	**3.6**	**5.0**	**27.2%**	**72.8%**	**100.0%**
VLBW Total	**1.0**	**0.7**	**1.7**	**19.6%**	**14.8%**	**34.4%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the "maternal health and prematurity" category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-8. South Phoenix Women with a High School Education or Less

Birth Weight In Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	0.6	0.4	1.0	8.9%	6.3%	15.2%
750-999	0.4	0.4	0.8	6.9%	6.2%	13.1%
1,000-1,249	0.2	0.1	0.3	2.8%	1.2%	4.1%
1,250-1,499	0.0	0.2	0.2	0.6%	2.7%	3.3%
1,500-1,999	0.2	0.5	0.7	2.7%	8.5%	11.2%
2,000-2,499	0.4	0.4	0.8	5.6%	6.6%	12.2%
2,500-6,499	-0.1	2.7	2.6	-1.5%	42.4%	41.0%
Total	**1.7**	**4.8**	**6.4**	**26.0%**	**74.0%**	**100.0%**
MH / Prem.	**1.2**	**1.1**	**2.3**	**19.1%**	**16.5%**	**35.6%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the "maternal health and prematurity" category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Table D-9. South Phoenix Hispanics

Birth Weight In Grams	Actual Contribution to the Difference in Excess Mortality Rates			Percentage Contribution to the Difference in Excess Mortality Rates		
	Birth Weight Distribution	Birth Weight-Specific Mortality	Total	Birth Weight Distribution	Birth Weight-Specific Mortality	Total
500-749	0.6	0.4	0.9	12.9%	8.7%	21.6%
750-999	0.3	0.3	0.6	7.1%	7.1%	14.2%
1,000-1,249	0.1	0.1	0.3	2.9%	3.4%	6.3%
1,250-1,499	0.0	0.1	0.2	0.6%	3.1%	3.8%
1,500-1,999	0.1	0.4	0.5	2.0%	9.4%	11.4%
2,000-2,499	0.2	0.1	0.3	3.9%	3.1%	7.0%
2,500-6,499	0.0	1.6	1.6	-1.1%	36.8%	35.7%
Total	**1.2**	**3.1**	**4.4**	**28.4%**	**71.6%**	**100.0%**
VLBW Total	**1.0**	**1.0**	**2.0**	**23.5%**	**22.4%**	**45.9%**

Note. The very low birth weight (VLBW) total includes those birth weights below 1,500 grams, which are those deaths attributed to the “maternal health and prematurity” category. The VLBW Total percentages are percentages of the total rather than percentages of the maternal health/prematurity total.

Appendix E: Estimated Coefficients & Standard Errors

Maternal Health/Prematurity: Birth Weight Distribution	Unadjusted Model			Adjusted for Other Risk Factors Model		
Risk Factor	**Estimated Coefficient**	**Estimated SE**	**Chi Square**	**Estimated Coefficient**	**Estimated SE**	**Chi Square**
Age						
< 20 Years Old	0.34	0.07	25.07	0.22	0.09	6.18
20-39 Years Old	C	C	C	C	C	C
40 or More Years Old	0.45	0.16	7.61	0.20	0.19	1.17
Education <=12 Years	0.18	0.06	10.93	-0.09	0.08	1.34
Race/Ethnicity						
White	C	C	C	C	C	C
Hispanic	0.06	0.06	1.02	-0.14	0.07	3.39
African American	0.71	0.10	46.55	0.17	0.12	1.94
Native American	-0.03	0.16	0.04	-0.34	0.19	3.23
Asian/Hawaiian	-0.22	0.19	1.35	-0.20	0.20	0.97
Unmarried	0.41	0.05	63.03	0.16	0.07	4.68
High parity for age	0.35	0.06	32.07	-0.16	0.07	4.72
Multiple birth	2.73	0.06	2096.71	1.00	0.07	197.41
Prenatal Care						
No Prenatal Care	1.72	0.14	149.59	0.90	0.16	30.75
1-4 Visits	2.21	0.07	936.27	1.68	0.09	342.72
5-9 Visits	1.15	0.06	379.44	0.92	0.07	192.11
10 or more Visits	C	C	C	C	C	C
Premature	5.87	0.15	1532.92	5.45	0.15	1295.76
Previous preterm	0.83	0.28	8.63	-0.32	0.30	1.17
Anemia	-0.39	0.22	3.09	-0.42	0.24	3.02
Weight Gain						
<15 lbs.	1.46	0.06	577.07	1.19	0.07	281.92
15-40 lbs.	C	C	C	C	C	C
> 40 lbs	-0.01	0.07	0.03	-0.22	0.08	7.97
Tobacco use	0.66	0.07	78.27	0.18	0.09	4.03
Alcohol use	0.40	0.21	3.77	-0.05	0.24	0.04
Delivery Payment						
Private Insurance	C	C	C	C	C	C
AHCCCS	0.13	0.05	5.69	-0.30	0.07	16.36
IHS	0.05	0.38	0.02	-0.30	0.43	0.49
Self	0.10	0.14	0.52	-0.26	0.16	2.65
Small for Gestational Age	1.92	0.07	821.67	1.61	0.08	397.14

* Statististically significant, $p < .05$; + Marginally significant.

C = Comparison group.

Maternal Health/Prematurity: Birth Weight Specific Mortality	Unadjusted Model			Adjusted for Other Risk Factors Model Births & Fetals			Adjusted for Other Risk Factors Model Births Only		
Risk Factor	**Estimated Coefficient**	**Est. SE**	**Chi Square**	**Estimated Coefficient**	**Est. SE**	**Chi Square**	**Estimated Coefficient**	**Est. SE**	**Chi Square**
Age									
< 20 Years Old	0.35	0.12	8.85	0.02	0.15	0.01	0.21	0.17	1.47
20-39 Years Old	C	C	C	C	C	C	C	C	C
40 or More Years Old	-0.05	0.26	0.03	-0.04	0.31	0.02	-0.43	0.41	1.09
Education <=12 Years	0.70	0.10	51.83	0.59	0.13	20.32	0.23	0.16	2.02
Race/Ethnicity									
White	C	C	C	C	C	C	C	C	C
Hispanic	0.30	0.10	9.03	-0.21	0.13	2.75	0.01	0.15	0.00
African American	-0.02	0.18	0.02	-0.18	0.22	0.67	-0.27	0.27	1.04
Native American	0.02	0.29	0.03	-0.40	0.36	1.27	-0.19	0.41	0.21
Asian/Hawaiian	-0.78	0.44	3.08	-0.87	0.47	3.48	-0.38	0.46	0.68
Hospital Perinatal Designation									
Level 1 and 2	1.21	0.16	56.45	1.24	0.19	43.33	0.58	0.34	3.01
Level 2 EQ	0.73	0.26	7.63	1.07	0.30	12.59	0.78	0.40	3.76
Level 3	C	C	C	C	C	C	C	C	C
Premature	0.09	0.27	0.11	0.01	0.34	0.00	0.75	0.64	1.39
IUGR/SGA	-0.15	0.12	1.57	-0.23	0.16	1.95	-0.63	0.22	8.04
Congenital Anomalies	3.38	0.75	20.06	N/A	N/A	N/A	3.18	0.81	15.60
Conditions of Labor/Delivery	C	C	C	C	C	C	C	C	C
Febrile (Fever > 100 Degrees	0.54	0.33	2.76	0.71	0.37	3.58	1.01	0.39	6.63
Placenta Previa/Abruptio	0.11	0.17	0.44	-0.22	0.21	1.06	-0.19	0.25	0.56
Ruptured Membranes	-0.39	0.17	5.34	-0.43	0.19	4.93	-0.16	0.20	0.60
Precipitous Labor (< 3 Hours	0.72	0.44	2.76	0.80	0.53	2.32	1.13	0.54	4.38
Dysfunctional Labor	1.38	0.77	3.24	1.24	0.98	1.60	1.89	0.97	3.81
Breech/Malpresentation	-0.03	0.11	0.10	0.08	0.13	0.43	0.24	0.14	2.89
Cord Prolapse	1.16	0.33	12.17	1.41	0.42	11.47	0.59	0.57	1.09
Fetal Distress	-0.50	0.18	7.53	-0.48	0.21	5.05	-0.29	0.23	1.54
Medical Risk Factors									
Diabetes	-0.58	0.35	2.74	-0.56	0.40	1.94	-0.83	0.53	2.42
Pregnancy Hypertension	-0.54	0.24	5.15	-0.75	0.30	6.17	-1.00	0.41	6.02
Infant Transferred	0.33	0.24	1.84	N/A	N/A	N/A	-0.33	0.40	0.67
Mother Transferred	-0.20	0.22	0.84	N/A	N/A	N/A	-0.07	0.25	0.08
Assisted Ventilation < 30 min.	0.60	0.27	4.92	N/A	N/A	N/A	0.98	0.30	10.66
Assisted Ventilation > 30 min.	0.69	0.25	7.61	N/A	N/A	N/A	0.78	0.30	6.96

(Table continues on next page)

(Table continued)

Birth Weight Specific Mortality	Unadjusted Model			Adjusted for Other Risk			Adjusted for Other Risk		
Risk Factor	**Estimated**	**Est. SE**	**Chi**	**Estimated**	**Est. SE**	**Chi**	**Estimated**	**Est. SE**	**Chi**
Number of Prenatal Visits									
No Prenatal Visits	0.83	0.19	18.65	N/A	N/A	N/A	0.72	0.27	7.01
1-4 Visits	0.79	0.14	34.49	N/A	N/A	N/A	0.53	0.18	8.66
5-9 Visits	0.63	0.12	27.28	N/A	N/A	N/A	0.45	0.15	8.48
10 or More Visits	C	C	C	C	C	C	C	C	C
Method of Payment									
AHCCCS	-0.64	0.10	40.54	N/A	N/A	N/A	-0.33	0.15	4.81
Private Insurance	C	C	C	C	C	C	C	C	C
IHS	-0.42	0.80	0.27	N/A	N/A	N/A	-0.01	0.98	0.00
Self	-0.40	0.25	2.61	N/A	N/A	N/A	-0.12	0.30	0.16

* Statististically significant, $p < .05$; + Marginally significant.

C = Comparison group.

Maternal Care	Unadjusted Model			Adjusted for Other Risk Factors Model		
Risk Factor	**Estimated Coefficient**	**Estimated SE**	**Chi Square**	**Estimated Coefficient**	**Estimated SE**	**Chi Square**
Age						
< 20 Years Old	0.04	0.13	0.11	-0.53	0.14	13.64
20-39 Years Old	C	C	C	C	C	C
40 or More Years Old	-0.13	0.36	0.14	-0.17	0.45	0.15
Education <=12 Years	1.42	0.10	200.10	1.67	0.13	173.51
Race/Ethnicity						
White	C	C	C	C	C	C
Hispanic	0.24	0.10	6.34	-0.79	0.12	41.29
African American	0.06	0.25	0.06	-0.31	0.27	1.33
Native American	0.30	0.26	1.34	-0.27	0.27	1.06
Asian/Hawaiian	-0.07	0.32	0.04	-0.10	0.36	0.08
APNCUI						
Inadequate	0.92	0.14	44.99	N/A	N/A	N/A
Intermediate	0.35	0.18	3.59	N/A	N/A	N/A
Adequate	C	C	C	C	C	C
Adequate Plus	0.83	0.12	46.18	N/A	N/A	N/A
Prenatal Care						
No Prenatal Care	1.85	0.18	102.45	1.41	0.21	45.74
1-4 Visits	1.48	0.15	93.32	1.12	0.17	44.00
5-9 Visits	0.91	0.11	67.84	0.74	0.12	38.63
10 or more Visits	C	C	C	C	C	C
Trimester Prenatal Care Began						
No Prenatal Care	-1.33	0.71	3.54	N/A	N/A	N/A
First	C	C	C	C	C	C
Second	0.20	0.13	2.40	N/A	N/A	N/A
Third	0.21	0.24	0.81	N/A	N/A	N/A

* Statistically significant, $p < .05$; + Marginally significant.

C = Comparison group.

Infant Health: SIDS	Unadjusted Model			Adjusted for Other Risk Factors Model		
Risk Factor	**Estimated Coefficient**	**Estimated SE**	**Chi Square**	**Estimated Coefficient**	**Estimated SE**	**Chi Square**
< 20 Years Old	1.02	0.24	18.77	1.00	0.27	13.62
Education <=12 Years	0.39	0.23	3.03	0.00	0.28	0.00
Race/Ethnicity						
White	C	C	C	C	C	C
Hispanic	-0.45	0.26	3.00	-0.55	0.31	3.19
African American	0.99	0.36	7.36	0.83	0.37	4.93
Native American	0.70	0.47	2.20	0.50	0.49	1.05
Asian/Hawaiian	N/A	N/A	N/A	N/A	N/A	N/A
Prenatal Care						
0-4 Visits	1.26	0.31	16.03	1.21	0.34	12.86
5-9 Visits	0.70	0.26	7.35	0.62	0.27	5.21
10 or more Visits	C	C	C	C	C	C
Tobacco use	1.53	0.24	40.17	1.21	0.27	19.39

* Statististically significant, $p < .05$; + Marginally significant.
C = Comparison group.

Infant Health: Infection	Unadjusted Model			Adjusted for Other Risk Factors Model		
Risk Factor	**Estimated Coefficient**	**Estimated SE**	**Chi Square**	**Estimated Coefficient**	**Estimated SE**	**Chi Square**
< 20 Years Old	0.47	0.26	3.12	0.07	0.31	0.05
Education <=12 Years	0.77	0.22	11.88	0.83	0.28	8.61
Race/Ethnicity						
White	C	C	C	C	C	C
Hispanic	-0.15	0.25	0.39	-0.95	0.32	8.89
African American	1.18	0.35	11.32	0.85	0.38	5.09
Native American	1.26	0.39	10.67	0.70	0.43	2.66
Asian/Hawaiian	N/A	N/A	N/A	N/A	N/A	N/A
Prenatal Care						
0-4 Visits	1.33	0.31	19.05	1.11	0.35	10.13
5-9 Visits	0.66	0.26	6.21	0.63	0.27	5.22
10 or more Visits	C	C	C	C	C	C
Tobacco use	0.80	0.29	7.45	0.42	0.32	1.71

* Statististically significant, $p < .05$; + Marginally significant.
C = Comparison group.

Appendix F: Maternal Health and Prematurity: Birth Weight Distribution Logistic Regression Analyses that Include Prematurity as a Risk Factor

Prematurity (less than 37 weeks gestation) is highly correlated with low birth weight. In the 1996-2000 maternal health and prematurity birth weight distribution data analyzed, 96.99% of the very low birth weight births were also premature. Very low birth weight is often a result of prematurity. Risk factors for very low birth weight may act through prematurity. Therefore, analyses without prematurity were presented in the text. The analyses that include prematurity as a risk factor are presented in this appendix for comparison.

Table E-1. Maternal Health and Prematurity Birth Weight Distribution: Odds of Delivering a Very Low Birth Weight Baby Among All Live Births (includes prematurity as a risk factor).

Risk Factor	Maricopa County Birth Prevalence (%)	Unadjusted		Adjusted		PAR% (Estimate)
		Odds	95% Confidence Limits	Odds	95% Confidence Limits	
Age						
< 20 years	13.68	1.41	1.230, 1.605 *	1.24	1.047, 1.470 *	3.19
20-39 years	84.40	C	C	C	C	
40 or more years	1.92	1.56	1.138, 2.144 *	1.23	0.848, 1.770	0.43
Education <= 12 Years	29.77	1.20	1.078, 1.340 *	0.91	0.784, 1.065	-2.62
Race/Ethnicity						
White	52.47	C	C	C	C	
Hispanic	38.48	1.06	0.948, 1.180	0.87	0.753, 1.009	-5.22
African American	3.77	2.03	1.658, 2.494 *	1.18	0.934, 1.501	0.69
Native American	2.78	0.97	0.707, 1.328	0.71	0.494, 1.031	-0.80
Asian/Hawaiian	2.50	0.81	0.558, 1.160	0.82	0.555, 1.214	-0.45
Unmarried	37.02	1.51	1.362, 1.667 *	1.17	1.015, 1.345 *	5.86
High parity for age	17.33	1.42	1.258, 1.604 *	0.85	0.734, 0.984 *	-2.67
Multiple birth	2.65	15.35	13.656, 17.253 *	2.71	2.356, 3.111 *	4.33
Prenatal Care						
No PNC Visits	1.93	5.59	4.239, 7.357 *	2.46	1.789, 3.378 *	2.71
1-4 PNC visits	4.21	9.10	7.899, 10.481 *	5.38	4.505, 6.433 *	15.48
5-9 PNC visits	18.00	3.16	2.812, 3.544 *	2.51	2.202, 2.856 *	21.31
10 or more PNC visits	75.85	C	C	C	C	
Premature	10.09	354.40	264.2, 475.5 *	231.72	172.3, 311.7 *	95.81
Previous preterm	0.35	2.28	1.316, 3.962 *	0.73	0.405, 1.297	-0.10
Anemia	1.84	0.68	0.441, 1.046	0.66	0.410, 1.055	-0.63
Weight Gain						
<15 lbs.	7.81	4.33	3.839, 4.876 *	3.27	2.850, 3.760 *	15.08
15-40 lbs.	70.41	C	C	C	C	
> 40 lbs	21.78	0.99	0.859, 1.135	0.80	0.688, 0.935 *	-4.51
Tobacco use	7.86	1.93	1.667, 2.230 *	1.20	1.004, 1.432 *	1.54
Alcohol use	1.10	1.50	0.996, 2.242	0.95	0.599, 1.511	-0.05
Delivery Payment						
Private Insurance	52.84	C	C	C	C	
AHCCCS	41.21	1.13	1.023, 1.258 *	0.74	0.640, 0.857 *	-12.04
IHS	0.44	1.05	0.497, 2.216	0.74	0.318, 1.718	-0.11
Self	3.79	1.11	0.840, 1.460	0.77	0.564, 1.054	-0.88
Small for Gestational Age	3.59	6.836	5.994, 7.796 *	5.01	4.276, 5.871 *	12.43

PAR% = Population attributable risk, P(OR-1)/[P(OR-1)+1]. The percent of VLBW that would be prevented if the predisposing risk factor were eliminated.

* Statistically significant $p < .05$.

C = Comparison group.

Appendix G: Maricopa County Underlying Causes of Death

Underlying Cause of Death for Infant Health Category (Post-neonatal mortality with BW>1,500 grams).

	Maricopa County Overall		
	N	Percent of Deaths	Rate per 100,000 Births
Perinatal Conditions	**15**	**3.69%**	**6.66**
Congenital Conditions	**69**	**17.00%**	**30.62**
Central Nervous Systems	8	1.97%	3.55
Cardiovascular	25	6.16%	11.09
Respiratory	1	0.25%	0.44
Gastrointestinal	2	0.49%	0.89
Genitourinary	1	0.25%	0.44
Musculoskeletal	6	1.48%	2.66
Chromosomal	14	3.45%	6.21
Other Anomalies	12	2.96%	5.32
Infections	**88**	**21.67%**	**39.05**
Central Nervous Systems	4	0.99%	1.77
Respiratory	56	13.79%	24.85
Gastrointestinal	1	0.25%	0.44
Septicemia	14	3.45%	6.21
Other	13	3.20%	5.77
SIDS	**86**	**21.18%**	**38.16**
Injuries	**54**	**13.30%**	**23.96**
Intentional	16	3.94%	7.10
Homicide	13	3.20%	5.77
Other Intentional	3	0.74%	1.33
Unintentional	38	9.36%	16.86
Motor Vehicle	9	2.22%	3.99
Poisoning	0	0.00%	0.00
Falls	2	0.49%	0.89
Fire	1	0.25%	0.44
Drowning	4	0.99%	1.77
Suffocation, Obstructive	2	0.49%	0.89
Suffocation, Mechanical	18	4.43%	7.99
Other Unintentional	2	0.49%	0.89
Ill-defined	**2**	**0.49%**	**0.89**
Other	**92**	**22.66%**	**40.82**
Total	**406**	**100.00%**	**180.16**
Live Births	225,354		

Note. Use caution when interpreting rates with less than 10 deaths because they tend to be statistically unreliable.

Appendix H: Glossary of Terms and Acronyms

Abbreviations Defined

ACOG……	American College of Obstetricians and Gynecologists
ADHS…….	Arizona Department of Health Services
AHCCCS……	Arizona Heath Care Cost Containment System (Medicaid)
APNCUI……	Adequacy of Prenatal Care Utilization Index
ASU……	Arizona State University
CDC……	Centers for Disease Control and Prevention
COD……...	Cause of Death
ED……...	Education
EPI……..	Division of Epidemiology and Data Services
F-IMR…….	Feto-Infant Mortality Rate
HRSA…….	Health Resources and Services Administration
IH……...	Infant Health
IHS…….	Indian Health Services
IUGR…….	Intrauterine Growth Restriction
MC…….	Maricopa County
MC…….	Maternal Care (Usually as a header of a table)
MCDPH…….	Maricopa County Department of Public Health
MCH……..	Maternal and Child Health
MCHB……	Maternal and Child Health Bureau
MCFH……	Division of Maternal, Child, & Family Health
MH/P……..	Maternal Health/Prematurity
MV…….	Maryvale
NC……..	Neonatal Care
NCHS…….	National Center for Health Statistics
NICU……..	Neonatal Intensive Care Unit
NH…….	Non-Hispanic
OR…….	Odds Ratio
PAR%.....	Percent Attributable Risk
PNC……...	Prenatal Care
PPOR…….	Perinatal Periods of Risk
PRAMS…….	Pregnancy Risk Assessment Monitoring System
SES……	Socioeconomic Status
SGA……...	Small for Gestational Age
SIDS……..	Sudden Infant Death Syndrome
SP or SPHX……...	South Phoenix
SPHS…….	South Phoenix Healthy Start
TAPI……..	The Arizona Program for Immunization
U.S…….	United States
VLBW……	Very Low Birth Weight (< 1,500 grams)
WHO…….	World Health Organization
WIC……	Women, Infants, and Children Program

Selected Definitions as Used in the Document

Abruptio placenta*	"Premature separation of a normally implanted placenta from the uterus."
Assisted ventilation (<30 minutes) *	"A mechanical method of assisting respiration for newborns with respiratory failure."
Assisted ventilation (≥30 minutes) *	"Newborn placed on assisted ventilation for 30 minutes or longer."
Breech/Malpresentation*	"At birth, the presentation of the fetal buttocks rather than the head, or other malpresentation."
Chi-square (χ^2)	A statistical test to determine whether two attributes are likely to be associated.
Confidence Interval	A range of values calculated from a sample that likely contain the true population value.
Cord prolapse*	"Premature expulsion of the umbilical cord in labor before the fetus is delivered."
Diabetes*	"Metabolic disorder characterized by excessive discharge of urine and persistent thirst; includes juvenile onset, adult onset and gestational diabetes during pregnancy."
Dysfunctional labor*	"Failure to progress in a normal pattern of labor."
Febrile*	"A fever greater than 100°F or 38°C occurring during labor and/or delivery."
Fetal death	Deaths that occur between 24 weeks gestation and delivery.
Fetal distress*	"Signs indicating fetal hypoxia (deficiency in amount of oxygen reaching fetal tissues)."
Feto-infant mortality rate	The number of fetal and infant deaths per 1,000 births and fetal deaths.
Gestation	Duration of pregnancy usually expressed in weeks from conception to delivery, whether of a live birth or fetal death.
Grams to pounds conversion	Grams x 0.002205=lbs; lbs/.002205=grams Example: 1000g x 0.002205=2.205lbs

Infant Death	Deaths that occur between birth and one year (364 days) of age.
Intrauterine growth retardation (IUGR)/Small for gestational age*	"An infant weighing less than the 10th percentile for gestational age using a standard weight-for-age chart."
Neonatal mortality	Infant deaths that occurs between birth and 28 days of life.
Perinatal	The period before, during and after birth/delivery.
Placenta previa*	"Implantation of the placenta over or near the internal opening of the cervix."
Post-neonatal mortality	Infant death that occurs between 28 days and one year (364 days) of life.
Precipitous labor (<3 hours) *	"Extremely rapid labor and delivery lasting less than 3 hours."
Pregnancy hypertension*	"An increase in blood pressure of at least 30mm HG systolic or 15mm HG diastolic on two measurements taken 6 hours apart after the 20th week of gestation."
Premature rupture of membranes*	"Rupture of the membranes at any time during pregnancy and more than 12 hours before the onset of labor."
Prenatal care visits	Visits by the mother to a doctor, nurse, or other health care worker, before the baby is born, to get checkups and advice about the pregnancy.

*Definitions from Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Munson ML. Births: Final data for 2002. *National Vital Statistics Reports*; vol 52 no 10. Hyattsville, Maryland: National Center for Health Statistics. 2003.