INFANT MORTALITY IN KING COUNTY:

AN UPDATE

A REPORT FROM THE

SEATTLE-KING COUNTY DEPARTMENT OF PUBLIC HEALTH
INFANT MORTALITY REVIEW PROJECT

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TABLE OF CONTENTS

EXECUTIVE SUMMARY v

I. INTRODUCTION 1
DATA SOURCES 1
HOW TO READ THIS REPORT 1
REFERENCES 4

II. TRENDS IN INFANT MORTALITY 5
1. TRENDS IN INFANT MORTALITY FOR UNITED STATES, WASHINGTON, KING COUNTY, SEATTLE 5
2. TRENDS IN SPECIFIC CAUSES OF INFANT MORTALITY IN KING COUNTY 6
3. CHANGING RISK FACTORS FOR INFANT MORTALITY IN KING COUNTY 7
SUMMARY 9
REFERENCES 9

III. TRENDS IN INFANT MORTALITY BY RACE/ETHNICITY 11
1. GENERAL TRENDS 11
2. TRENDS IN SPECIFIC CAUSES OF INFANT MORTALITY AMONG AFRICAN AMERICANS AND WHITES 12
3. CHANGING RISK FACTORS FOR INFANT MORTALITY AMONG AFRICAN AMERICANS AND WHITES 15
SUMMARY 17

IV. TRENDS IN INFANT MORTALITY BY POVERTY AREAS 19
1. TRENDS IN INFANT MORTALITY IN HIGH AND LOW POVERTY AREAS 19
2. TRENDS IN SPECIFIC CAUSES OF INFANT MORTALITY IN HIGH AND LOW POVERTY AREAS 20
3. CHANGING RISK FACTORS FOR INFANT MORTALITY IN HIGH AND LOW POVERTY AREAS 22
SUMMARY 24
REFERENCES 24

V. REGIONAL VARIATION OF INFANT MORTALITY WITHIN KING COUNTY 25
1. TRENDS IN INFANT MORTALITY BY REGION 25
2. TRENDS IN CAUSES OF INFANT DEATH 25
3. CHANGING RISK FACTORS FOR INFANT MORTALITY IN THE FOUR REGIONS OF KING COUNTY 27
4. INFANT MORTALITY BY HEALTH PLANNING AREA 29
SUMMARY 30

APPENDIX: SUPPLEMENTAL TABLES 31
TABLE A.1: INFANT MORTALITY RATES IN THE UNITED STATES, WASHINGTON, KING COUNTY, SEATTLE, 1980-1995 31
TABLE A.2: INFANT MORTALITY RATES BY HEALTH PLANNING AREA IN KING COUNTY, FIVE YEAR AVERAGE, 1991-1995 32

EXECUTIVE SUMMARY

The infant mortality rate is a fundamental indicator of a community's health and well-being. This report updates trends in infant mortality through 1995. The sources of information for this report are birth and death certificates. The key findings of the report include:

- The infant mortality rate in King County in 1995 (the most recent year for which data are available) was 5.6 per 1000 live births. The 1995 Seattle rate was 7.2 per 1000, the Washington rate was 5.8 per 1000 and the United States rate was 7.6 per 1000 live births. There were 122 deaths among infants living in King County in 1995, 45 of which were in Seattle.
- The infant mortality rates in King County and in King County outside of Seattle continued to decline, while the rate in Seattle, after declining dramatically from the 1987-1989 period to the 1992-1994 period, may have begun to level off. However, examination of the rate in subsequent years is required before drawing any conclusions that the declining trend of recent years has ended; the data are also consistent with the observed rate in the 1993-1995 period being a random fluctuation in a generally downward trend.
- The leading causes of infant deaths in the 1993-1995 period in King County, as in previous years, were SIDS, perinatal conditions, congenital anomalies, and death due to prematurity. The rates for SIDS and death due to perinatal conditions have plateaued since the early 1990s. While the death rate due to prematurity has increased since 1990, the increase is not statistically significant. This increase may be partially explained by an increase in mortality rate among very low birthweight infants.
- As in previous years, African and Native Americans remained at higher risk of dying as infants. During the 1991-1995 period, African American infants were 2.4 times, and Native American infants were 1.9 times more likely to die, as compared to white infants. The Native American infant mortality rate continued to decline in the 1993-1995 period, while the rate among African Americans appeared higher than that observed during the 1992-1994 period. However, the relatively small number of deaths among African American infants makes the difference between these periods statistically indistinguishable. Whether the 1993-1995 rate signals an end of the decline in infant mortality among African Americans observed since 1989 or is a random fluctuation in a generally downward trend will only become clear with data from forthcoming years.
- Infant mortality and risk factors for infant death remained associated with poverty. While the rate of infant death has declined substantially in high poverty areas of the county since the mid 1980s, it appears that the period of marked decline in the high poverty areas ended in the 1993-1995 period.
- The 1993-1995 infant mortality rate in the Central Region appeared higher than the 1992-1994 rate (although the difference was not statistically significant). Data from coming years is needed to determine whether this is the end of the decline observed since 1989, or a random variation in a generally downward trend. Meanwhile, the infant mortality rate appeared to decrease during the 1993-1995 period in the South Region after stagnating since 1988, although the decrease since the 1992-1994 period was not statistically significant. Further data are needed to determine whether infant mortality rate is declining in South Region.
- Within small areas of the county, infant mortality rates in Central and Southeast Seattle were 1.7 and 1.6 times higher than the overall King County rate, similar to the previous period of 1991-1994. They were the only areas to significantly exceed the county average during the 1991-1995 period. Bellevue's rate of 3.5 per 1000 live births was the only rate significantly lower than the county average.

- Among the measured risk factor data available from birth certificates for King County, the rates of maternal smoking, maternal alcohol use and inadequate prenatal care continued to decrease in 1995 while the proportion of births to unmarried mothers continued to increase. The proportion of low birthweight births and preterm births remained steady.

CONCLUSIONS

The infant mortality rate in King County has continued to decline. This encouraging trend may in part be explained by reductions in risk factors for infant death, attributable to expanded health services for pregnant women, advances in medical care, and changes in infant sleep position. However, the new data for 1993-1995 period suggest that the rapid decline in rates may have slowed for African Americans, residents of the Central Region, and residents in high poverty areas. Alternatively, the somewhat higher 1993-1995 rates observed in these groups may represent a random variation in a continued downward trend.

The increase in the infant mortality rate among African Americans was primarily caused by an increase in SIDS deaths, with a smaller amount attributable to more deaths caused by prematurity. While use of prenatal care continued to improve in African Americans, the rate of improvement slowed.

The increase in the infant mortality rate in the Central Region was mainly caused by an increase in SIDS deaths as well as a smaller increase in deaths caused by prematurity and perinatal conditions. The rate of improvement in prenatal care utilization slowed in recent years.

The increase in the infant mortality rate in high poverty areas was mainly caused by a small increase in deaths due to prematurity and perinatal conditions. Slowing of the rate of adequate utilization of prenatal care was also observed.

It thus appears that the decline in the infant mortality rate among the more vulnerable populations in King County (African Americans, residents of high poverty areas in King County, and residents of the Central Region, particularly of Central/Southeast Seattle) may have ended in the 1993-1995 period. The SIDS rate also increased or leveled off in these populations and the rapid rate of improvement in prenatal care utilization slowed. These data indicate the ongoing need to encourage early and continuous prenatal care and promote safe sleeping conditions for young infants in these populations.

Further progress in reducing infant deaths will come through collaboration between many sectors of our community. Strategies detailed in our previous report[a] continue to provide direction on:

- Emphasizing placing infants on their backs to prevent SIDS deaths
- Assuring access to prenatal care and maternity support services
- Reducing substance abuse
- Improving coordination of services by multiple providers
- Assuring comprehensive follow-up of high-risk clients
- Improving the quality of medical care during labor and delivery
- Strengthening the capacity and accountability of Child Protective Services to protect infants
- Emphasizing implementation of these strategies among African and Native Americans and for low income and Central/Southeast Seattle and South Region populations.

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[a] Krieger J, El-Bastawissi A, Dickson A, Kline C, Holland S, Fabian P, Schroeder C, and Alexander ER. Healthier Mothers, Healthier Babies: Declining Infant Mortality in King County, August 1996.

CHAPTER I: INTRODUCTION

The Seattle-King County Department of Public Health established the Infant Mortality Review (IMR) Project in 1992 to systematically monitor infant deaths and identify factors that contribute to infant mortality. The need to evaluate infant deaths emerged from concerns about the slow decline in the infant mortality rate observed in King County in the mid to late 1980s and the persistent disparity in rates between whites and African Americans.

The findings of the Infant Mortality Review have been described in the report issued by the IMR Project in August 1996,[1] which contains information on statistical trends in infant death through 1994. This report updates these trends through 1995.

DATA SOURCES

This report is based on data obtained through vital records (birth and death certificates) collected by local and state health departments. In addition, 1989 income data from the 1990 U.S. Census was used for the analysis of infant mortality rate variation across income groups.

The birth and death certificate computer data files used to produce this report are generated yearly by the Washington State Department of Health. They are distributed to the local Health Departments in the second half of the following year. For example, data files for 1996 will be available late in 1997. Therefore, this report contains data only through 1995.

HOW TO READ THIS REPORT

This report uses a number of epidemiological methods and technical terms to analyze data on infant mortality. The following definitions and explanations will assist the reader in reading the report.

Epidemiology: The study of the distribution and determinants of health conditions in a specified population.[2]

Infant Mortality Rate: The infant mortality rate is the number of live born infants who die before reaching their first birthday in a given year, for every 1000 infants born alive in that year. For example, if 1000 infants were born in a town in 1995 and 7 died in that year, the infant mortality rate would be 7.0 deaths per 1000 live births.

Rolling Averages: For populations of small size, small changes in the number of events can cause large fluctuations in rates making year-to-year changes difficult to interpret. To help stabilize the rate for the examination of a time trend of an event, the rates are aggregated into "rolled" averages (such as in 3 or 5 year intervals) across the total observed period. For example, if there is a highly fluctuating rate caused by low numbers of events for years 1990 through 1995, the rates are instead reported as three-year rolling averages: 1990 to 1992, 1991 to 1993, 1992 to 1994, and 1993 to 1995. Each set of three year averages includes a higher number of cases than a single year and thus smoothes out random year-to-year fluctuations.

Significant Trend: Epidemiologists use a statistical test called the chi-square test to see whether a change in a rate over time is statistically significant. A significant trend indicates that the change in a rate is not random and that an increase or decrease is likely to be occurring in a population. Trend tests are always applied to year-by-year trends, not rolling averages. In most cases, when the trend is declining, the year with the highest rate is chosen as the starting point to test for trend significance. Alternatively, when the trend is increasing, the year with the lowest rate is chosen. The significance

level used for a significant trend in this report is $p < 0.05$. Only statistically significant trends are noted in the figures.

Rate Ratio: The rate ratio is the ratio between rates for two different groups. For example, if the infant mortality rate for African Americans is 20 per 1000 live births and that for whites is 10 per 1000, then the rate ratio is 20/10 = 2.0. This means that African American infants are 2.0 times as likely to die as compared to white infants.

Regions and Small Areas: Because infant health varies across the different areas of King County, we present data on infant deaths broken down by small areas and larger regions of the County. Small areas are 21 geographically-defined communities created by grouping together census tracts (definitions are available upon request). The four regions used in this Report (North, Central, East and South) are in turn groupings of the small areas of King County as described below:

North Region: North of Canal Area, North King County, North Seattle

Central Region: Central Seattle, North Central Seattle, Southeast Seattle, West Seattle

East Region: Bellevue, Bothell/Woodinville, Eastgate/Issaquah, East/Northeast King County, Kirkland/Redmond, Mercer Island

South Region: **Southwest Sub-Region:** Federal Way, Highline/Burien, Vashon, White Center/Skyway
Southeast Sub-Region: Auburn, Kent, Renton, Southeast King County

Race: Epidemiologic analyses frequently examine group differences in rates of disease or injury based on characteristics such as age, gender, and race/ethnicity. In recent years, the presentation of data broken down by race/ethnicity has been questioned by researchers and communities; they argue that readers may incorrectly assume that differences between groups are biologically based, and that the racial/ethnic categories used are not necessarily reflective of individuals' self-identification.

Most researchers believe that race/ethnicity is a marker for complex social, economic and political factors that are important influences on community and individual health, and that differences in rates of most diseases and injuries are not due to biologic or genetic differences among racial/ethnic groups. Many communities of color in this country have experienced social and economic discrimination, and other forms of racism, which can negatively affect the health of these communities. We continue to examine and present data by race/ethnicity because we believe that it is important to understand which racial/ethnic groups are disproportionately affected by significant health issues. We hope this understanding will lead to strategies that address these issues, as well as the social and economic inequities which underlie them.

This report uses the Federal Office of Management Budget, Directive Number 15, race and ethnicity categories. The Directive specifies four racial categories: white, African American, Asian/Pacific Islander, and Native American, as well as a Hispanic ethnicity category. A person of Hispanic ethnicity can be of any race.

Poverty Terciles: No easily accessible data[a] exist indicating how many King County infants are born into poverty. Therefore, we compared infant mortality rates between those living in poorer and more

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[a] Birth certificates do not assess maternal income. Information on source of payment for prenatal care has been collected since 1992. Source of payment can serve as a proxy for income because mothers whose source is classified as Medicaid or charity care are likely to have low incomes. The birth certificate also contains information on the educational attainment of the mother, which is an important measure of socioeconomic status. However, information on education is missing on 15.5 percent of birth certificates.

affluent areas within the county. The U.S. Census provides data for each census tract on the proportion of female residents age 12 to 64 who live in households with incomes below the poverty line.[b] A census tract is a geographic area which contains approximately 4,000 residents. We grouped the 285 census tracts in King County by terciles into the following groups: high, medium, and low poverty level areas. The one third of tracts with the highest proportion of female residents living in poverty are defined as the high poverty tracts.

Classification of Causes of Infant Death: Infant deaths are caused by a wide range of conditions. To better understand the pattern of infant death, we have grouped these conditions into seven categories:[c]

1. Prematurity (including prematurity, low birthweight, respiratory distress syndrome, bronchopulmonary dysplasia, and necrotizing enterocolitis)
2. SIDS (Sudden Infant Death Syndrome)
3. Congenital anomalies
4. Perinatal conditions (including other perinatal respiratory conditions, birth trauma, hypoxia, perinatal/neonatal asphyxia, perinatal infections and other perinatal conditions).
5. Other infections (e.g., pneumonia, meningitis)
6. External causes (e.g., positional/accidental asphyxia, motor vehicle accident, trauma, burns, etc.)
7. Other miscellaneous (e.g., cardiac arrythmia, cardiopulmonary arrest, and umbilical cord compression).

Low Birthweight: A newborn weighing less than 2,500 grams (5.5 pounds) is considered to be low birthweight.

Preterm/Premature Birth: The average pregnancy lasts 40 weeks. An infant born at less than 37 weeks gestation is considered premature or preterm. The gestational age of a newborn is calculated as the interval between the newborn's date of birth and the first day of the mother's last menstrual period before she conceived.

Kotelchuck Index To Measure Adequacy of Prenatal Care (PNC): The Kotelchuck Index measures the adequacy of the initiation and quantity of prenatal care visits.[4] This index considers initiation of prenatal care, number of prenatal care visits and gestational age in determining an Expected Visit Ratio [(number of visits/expected visits) x 100]. If this ratio is 0, then no prenatal care was received. A ratio of less than 50 percent means "inadequate prenatal care", from 50 to less than 80 percent means "intermediate prenatal care", from 80 to less than 110 percent means "adequate prenatal care", and 110 percent or more means "more than adequate prenatal care".

Smoking: Data on smoking have been collected on birth certificates since 1984. It is defined as maternal smoking during pregnancy, without specification of number of cigarettes smoked per day, or trimester of pregnancy during which mother smoked. Data from 1984 have not been reported here because of technical problems with its collection. Data from 1989-1991 have also not been included in this report because the question regarding smoking was revised and moved to a different part of the birth

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[b] $12,674 per year for a four-person household in 1989, the year for which the U.S. Census collected information.

[c] The National Infant Mortality Survey (NIMS) classified infant's causes of death into eleven categories, based on the International Classification of Diseases, 9th revision, (ICD-9).[3] NIMS categories have been regrouped into seven categories for simplification. For further details, see "Healthier Mothers, Healthier Babies: Declining Infant Mortality in King County, August 1996, Appendix A, p. 123-133."[1]

certificate in those years, changing the responses for those years and making the data non-comparable. For the remaining years used in this report, data on smoking is missing in about 5.2 percent of birth certificates.

Alcohol Consumption: Data on maternal alcohol consumption during pregnancy and number of drinks per week have been collected on birth certificates since 1989. No specification of trimester of pregnancy during which mother consumed alcohol has been collected. Data on maternal alcohol consumption is missing in about 13.9 percent of birth certificates used in this report.

Marital Status: Data on mother's marital status have been collected on birth certificates since 1980. It is only denoted whether mother is married or not, without further specification of the various possible relationships between the parents of the baby. For example, it is not indicated whether the mother is separated or actually living with her husband. It is also not indicated whether the recorded marital status pertains to the actual father of the baby or to a different partner. Lastly, the various relationships single mothers may have with the birth father are not distinguishable. For example, a single mother may be the sole caretaker of her child, or she may be living with the infant's father or have other sources of support.

Births to Adolescents: The adolescent birth rate refers to the number of births among females age 15-17 years old. Births to younger teens age 10-14 were relatively uncommon and were, therefore, not included in the analysis (refer to cited report for further clarification of choosing this age group).[5] The adolescent birth rate can be calculated by taking the total number of births occurring among all 15-17 year olds during a specified time period, and dividing it by the total number of 15-17 year olds in the population. It can be interpreted as the number of births per year among 1000 females age 15-17.

Managed Care Plan: The Washington State Department of Social and Health Services (DSHS) Medical Assistance Administration (MAA) created the Healthy Options program to make mandatory enrollment in managed care the predominant health care delivery model for Medicaid recipients. The program's chief goals were to increase access to appropriate medical services and reduce costs. The Healthy Option program requires certain groups of Medicaid eligibles to enroll in a managed care plan and to choose a single Primary Care Provider within that plan to be responsible for providing or arranging for all covered medical care 24-hours-a-day, seven-days-a-week.

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[1] Krieger J, El-Bastawissi A, Dickson A, Kline C, Holland S, Fabian P, Schroeder C, and Alexander ER. Healthier Mothers, Healthier Babies: Declining Infant Mortality in King County, August 1996.
[2] Adapted from: Last, JM. A Dictionary of Epidemiology. New York: Oxford University Press, 1985.
[3] Centers for Disease Control and Prevention: Advance report of final mortality statistics, 1990. Monthly Vital Statistics Report 1993; 41(7)suppl:9-11.
[4] Kotelchuck M: An evaluation of the Kessner adequacy of prenatal care index and a proposed adequacy of prenatal care utilization index. Am J Pub Health 1994; 84:1414-20.
[5] Krieger J, Adams C, Talltree C, and Stewart L. Changing Direction: An Update on Teen Pregnancy and Birth in King County, April 1996.

CHAPTER II: TRENDS IN INFANT MORTALITY

In this chapter, we describe the overall trends in infant mortality, specific causes of infant deaths, and risk factors for infant death in King County.

1. TRENDS IN INFANT MORTALITY FOR UNITED STATES, WASHINGTON, KING COUNTY, SEATTLE

The infant mortality rate in King County in 1995 (the most recent year for which data are available) was 5.6 deaths per 1000 live births as compared to 4.9 for King County outside Seattle, 7.2 for Seattle, 5.8 for Washington state, and 7.6 for the United States. The total number of infants who died in King County in 1995 was 122: 45 infants within Seattle and 75 infants in King County outside of Seattle, with 2 in an unknown area.

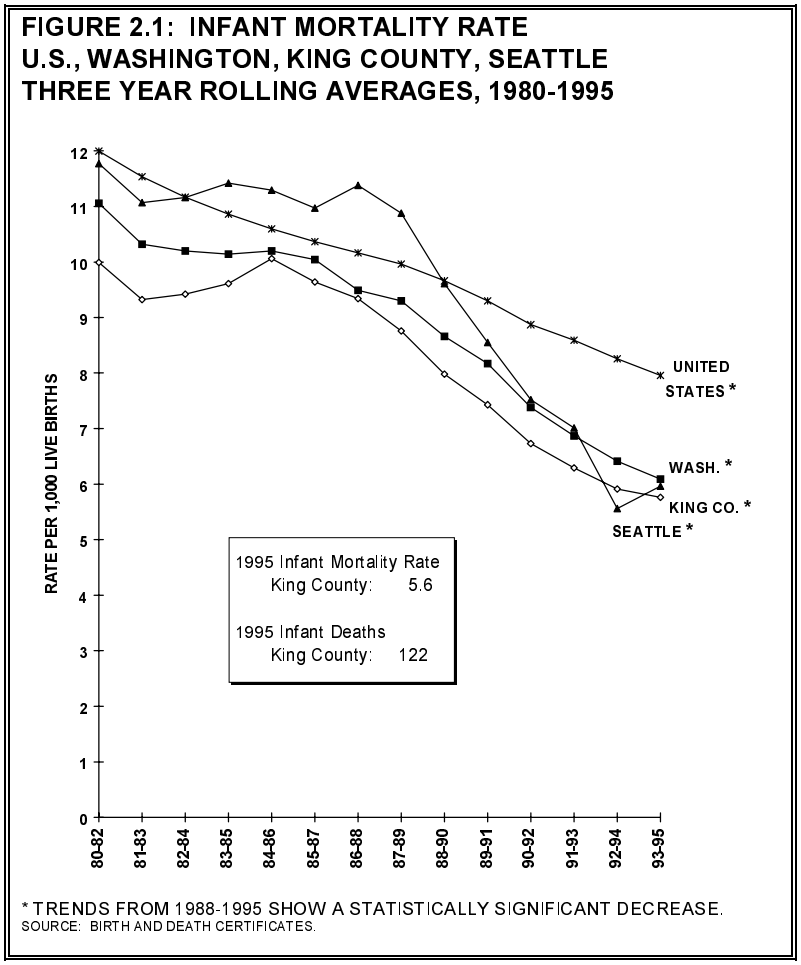


Figure 2.1 displays trends over time in the infant mortality rate using three year rolling averages. The average rate for each three year period is shown to smooth out the random and non-significant year-to-year variation in the infant mortality rate. Because the rates are based on a relatively small number of deaths each year, small changes in the number of deaths can lead to large changes in the rates. However, these changes in the rates are not very meaningful. For example, an increase of six deaths in Seattle will increase the rate by approximately 1.0 per 1000 live births. Yet a change of six in the number of deaths is more likely to represent a random fluctuation than a true change.

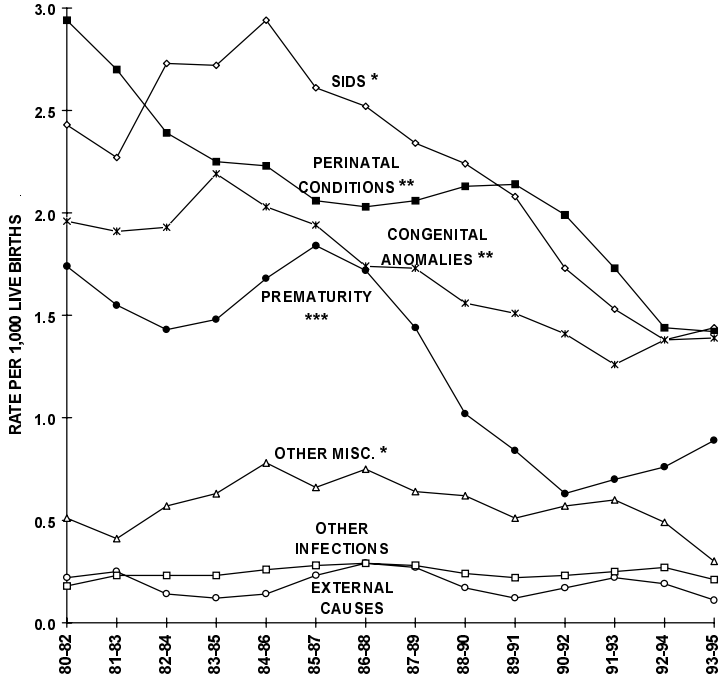
The rate of infant deaths in King County has continued to decline since 1985, as has the rate in King County outside Seattle since 1987. The rate in Seattle, after declining dramatically from the 1987-1989 period to the 1992-1994 period, appears to have leveled in the 1993-1995 period. However, examination of the rate in future years is required before drawing any conclusions that the declining trend of recent years has ended; the data are consistent with the rate in the 1993-1995 period being a random fluctuation in a generally downward trend. This change in Seattle's infant mortality rate was observed only in the central and southeast portions of the city and is discussed in more detail in Chapter V.

2. Trends In Specific Causes Of Infant Mortality In King County

The infant mortality rate is a summary indicator describing the death rate among infants from all causes of death combined. These causes are quite diverse, and each is associated with its own set of risk factors and prevention strategies. Therefore, it is useful to examine the specific causes in more detail.

Similar to the previous period of 1992-1994, the three leading causes of infant deaths in the 1993-1995 period were SIDS (Sudden Infant Death Syndrome), perinatal conditions (conditions causing death during the first 27 days of life, including lung problems, birth-related injuries, suffocation during birth, and infections), and congenital anomalies (birth defects). Each accounted for slightly less than a quarter of all deaths. Deaths due to prematurity[a] also figured prominently and contributed 16 percent of the total. Non-perinatal infections occurring after the perinatal period (such as pneumonia or meningitis), external causes (injuries, both intentional and unintentional), and miscellaneous other causes each represented smaller numbers of cases. Definitions of these causes of death are contained in Chapter I under "How to Read this Report."

FIGURE 2.2: CAUSES OF INFANT MORTALITY
KING COUNTY
THREE YEAR ROLLING AVERAGES, 1980-1995



* TRENDS FROM 1984-1995 SHOW A STATISTICALLY SIGNIFICANT DECREASE.
** TRENDS FROM 1980-1995 SHOW A STATISTICALLY SIGNIFICANT DECREASE.
*** TRENDS FROM 1985-1990 SHOW A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

Significant decreases in the rates of all four major causes of infant death occurred between 1980 and 1995 (Figure 2.2). Each declined by more than 50 percent from their high points in the 1980s to their low points in the early 1990s. Despite these generally favorable trends, the rate for perinatal conditions has remained relatively stable since 1992.

The prematurity death rate has increased since 1990, although the increase is not statistically significant. The increase in prematurity deaths appears to be primarily caused by a recent increase in mortality among infants born with very low-birthweight (<1500 grams or <3.3 pounds).

The death rate due to SIDS declined consistently since the 1985-1987 period; however, the rate appears to have plateaued since 1993 as described in detail on the next page.

The death rate from congenital anomalies appears to have increased since the 1992-1994 period, although non-significantly. Despite the non-significant increase in the death rate due to other miscellaneous causes of death in the early 1980s, the rate has significantly decreased since 1984. Rates of death from other infections and external causes remained relatively stable.

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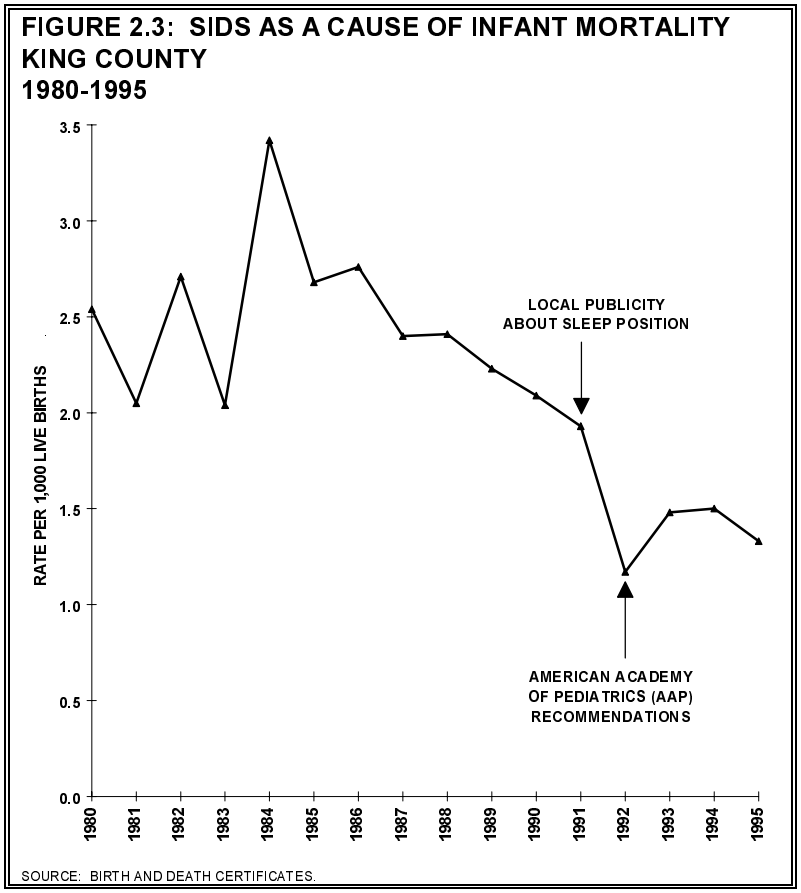
[a] The categorization of causes of infant death is limited by the overlap between the perinatal and prematurity groups. A large portion of infants assigned to the perinatal category were born prematurely. Deciding whether the death of these infants was due primarily to their prematurity or to a complication in the perinatal period is imprecise, probably resulting in the classification of some infants whose deaths were due primarily to prematurity into the perinatal category.



The SIDS rate in King County dropped during 1991 and 1992 (Figure 2.3), when recommendations about sleep position and SIDS were brought to the attention of health providers and parents by local experts and the American Academy of Pediatrics.[b] After the observed steep decrease in infant death from SIDS to 1992, the rate seems to have plateaued.

More awareness regarding sleep position is needed, especially emphasizing the new recommendation[c] of the American Academy of Pediatrics (December, 1996)[1] which advises caregivers to put the infant to sleep on the back rather than either on the side or the stomach. Additionally, awareness regarding the harmful effects of tobacco smoke on the risk of death from SIDS deserves further emphasis.

3. Changing Risk Factors For Infant Mortality in King County

The factors influencing infant mortality are complex and only partially understood. This section describes trends in risk factors for infant mortality. The effect of local programs and advances in medical science on infant mortality rates have been discussed in our previous report.[2]

A *risk factor* for infant mortality is a characteristic or condition that increases the chance that an infant will die. Many risk factors have been identified through epidemiological research.[3-25] The occurrence of an infant's death can be viewed as the consequence of a chain or web of multiple risk factors.

The risk factors considered in this section ("measured risk factors") are limited to those included on the birth certificate, the only currently available source of routinely collected risk factor data.[d] Many other known risk factors remain unmeasured.

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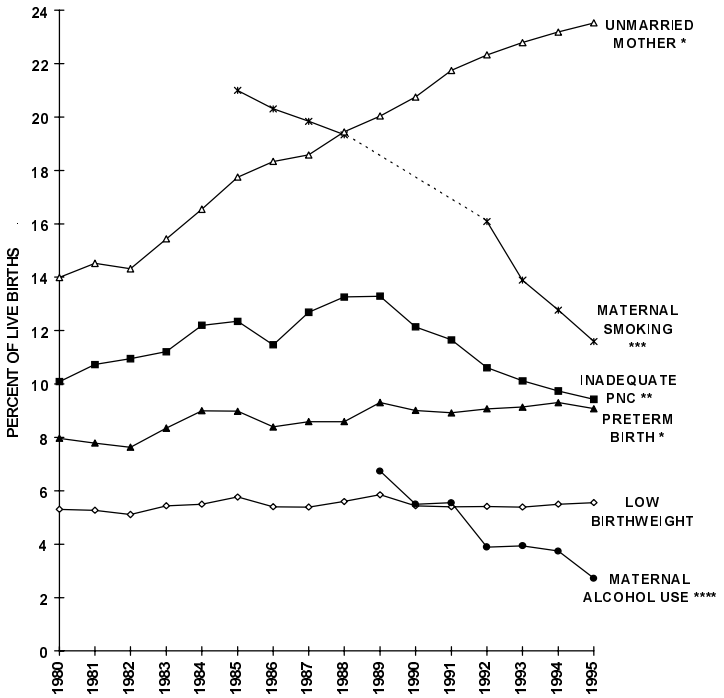
[b] These recommendations suggest placing infants to sleep on either their backs or sides because of the increased risk of SIDS death associated with prone sleep position, i.e. placing infant on the tummy.

[c] These recommendations suggest placing infants to sleep on their backs only because of the increased risk of SIDS death associated with other sleep positions, i.e. placing infant on the tummy or side.

[d] In the near future, data from PRAMS (the Pregnancy Risk Assessment Monitoring System) will be available and will provide information on a broader range of risk factors for poor birth outcomes among pregnant women in Washington State as well as in King County.

FIGURE 2.4: SELECTED BIRTH RISK FACTORS KING COUNTY, 1980-1995

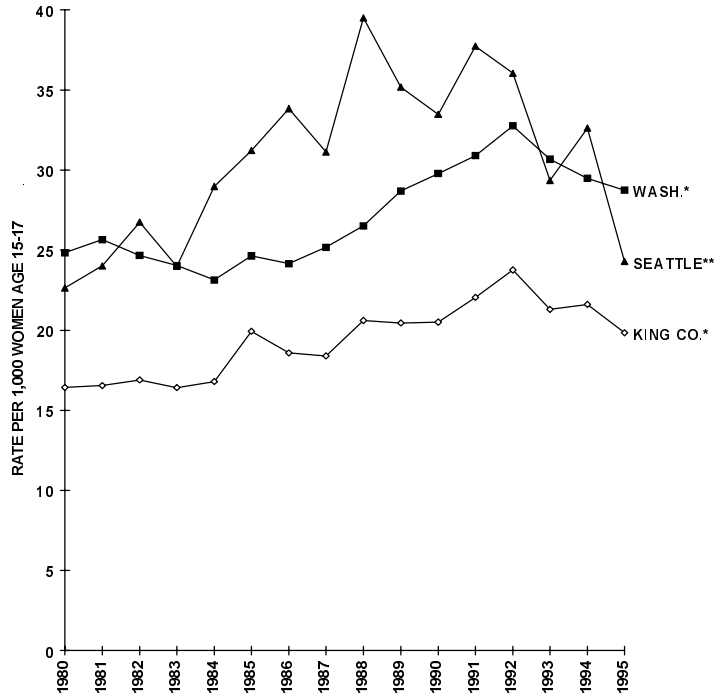


* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT INCREASE.
** THIS TREND FROM 1980-1989 IS A STATISTICALLY SIGNIFICANT INCREASE, AND FROM 1989-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
*** THIS TREND FROM 1985-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
**** THIS TREND FROM 1989-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

Among the measured risk factors data available from birth certificates, the rates of maternal smoking, maternal alcohol use and inadequate prenatal care continued to decrease in 1995, while the proportion of births to unmarried mothers continued to increase (Figure 2.4). The proportion of low birthweight births and preterm births remained steady.

While a portion of the decline in infant mortality is explained by changes in these measured risk factors, other important determinants of infant health are not routinely measured in vital statistics records. These include socio-economic conditions, other maternal behaviors, and social environmental factors which also have major influences on the infant mortality rate.

FIGURE 2.5: BIRTHS TO ADOLESCENTS AGE 15-17 WASHINGTON, KING COUNTY, AND SEATTLE 1980-1995



* THIS TREND FROM 1980-1992 IS A STATISTICALLY SIGNIFICANT INCREASE AND FROM 1992-1995 IT IS A STATISTICALLY SIGNIFICANT DECREASE.
** THIS TREND FROM 1980-1991 IS A STATISTICALLY SIGNIFICANT INCREASE AND FROM 1992-1995 IT IS A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

Infants born to adolescent mothers may be at higher risk of dying. While the proportion of all births occurring among adolescent mothers did not change, the adolescent birth rate has declined in recent years (Figure 2.5).[26]

Many other unmeasured risk factors also influence the infant mortality rate, including:

- Lack of social support
- Stress
- Unintended pregnancy
- Illicit drug use
- Financial and non-financial barriers to health care
- Inadequate resources to cope with difficult life circumstances
- Lack of control over one's economic, physical and social environments.[27-28]

Changes in these unmeasured risk factors may have contributed to both the decline in infant mortality in low income areas as well as in the population as a whole. The Infant Mortality Review of King County collected information on some of these unmeasured factors, which were described in Chapters VI to VIII of our previous report,[2] but accurate population-based estimates of their prevalence and trends over time are unavailable.

SUMMARY

- The infant mortality rate in King County has continued to decline during the 1993-1995 period.
- The rate in Seattle may have leveled in the 1993-1995 period. Data for subsequent years is required before drawing any conclusions that the declining trend of recent years has ended.
- The leading causes of infant deaths in the 1993-1995 period in King County remain SIDS, perinatal conditions, congenital anomalies, and prematurity.
- The rates of maternal smoking, alcohol use and inadequate prenatal care continued to decrease in 1995, while the proportion of births to unmarried mothers continued to rise. The proportions of low birthweight births, preterm births and births to teen mothers remained steady.

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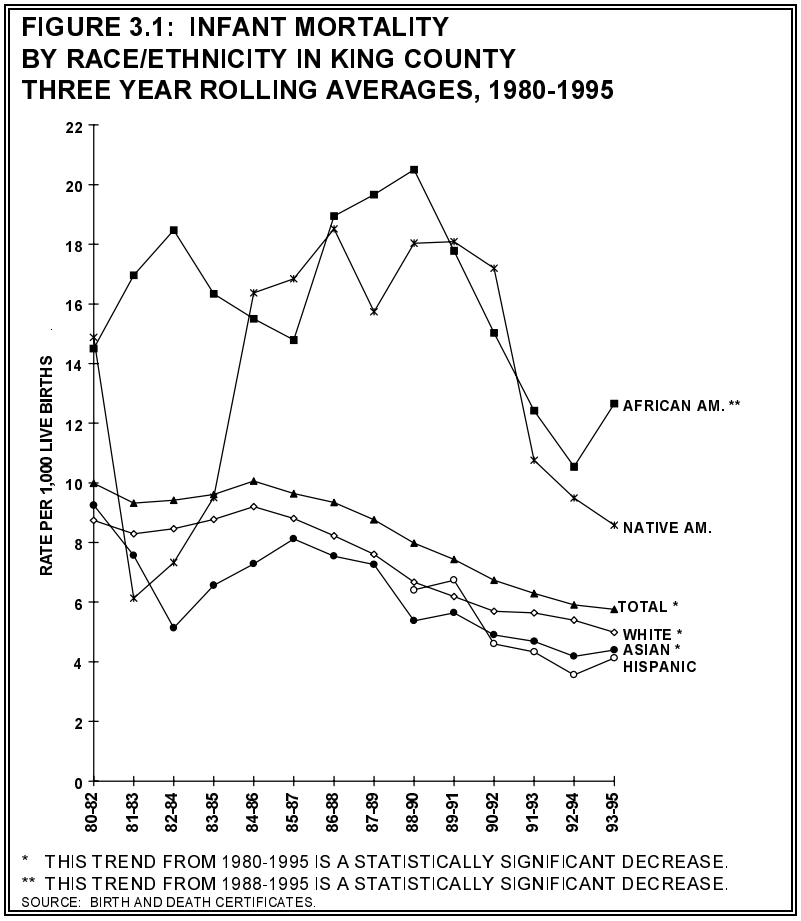
CHAPTER III: TRENDS IN INFANT MORTALITY BY RACE/ETHNICITY

Concern about disparities in infant mortality rates across the racial/ethnic groups of King County was an important factor leading to the establishment of the Infant Mortality Review. In this chapter we evaluate trends in infant mortality, causes of death, and birth risk factors among different racial/ethnic groups.

Epidemiologic analyses frequently examine group differences in rates of disease or injury based on characteristics such as age, gender, and race/ethnicity. In recent years, the presentation of data broken down by race/ethnicity has been questioned by researchers and communities; they argue that readers may incorrectly assume that differences between groups are biologically based, and that the racial/ethnic categories used are not necessarily reflective of individuals' self-identification.

Most researchers believe that race/ethnicity is a marker for complex social, economic and political factors that are important influences on community and individual health, and that differences in rates of most diseases and injuries are not due to biologic or genetic differences among racial/ethnic groups. Many communities of color in this country have experienced social and economic discrimination, and other forms of racism, which can negatively affect the health of these communities. We continue to examine and present data by race/ethnicity because we believe that it is important to understand which racial/ethnic groups are disproportionately affected by significant health issues. We hope this understanding will lead to strategies that address these issues, as well as the social and economic inequities which underlie them.

1. General Trends



Infant mortality varied significantly across the major racial/ethnic groups living in King County. The rates were higher than average among African Americans and Native Americans. Compared with whites, their rates were 2.4 and 1.9 times higher, respectively, during the 1991-1995 period. If their rates had been equal to the rate among whites, 11 fewer African American infants and 2 fewer Native American infants would have died each year during this five-year period. An average of 90 white, 19 African American, 12 Asian, 3 Native American and 4 Hispanic infants died each year during this time.

Among whites, the decline in infant mortality rate which began in 1985 has continued.

Among African Americans, the infant mortality rate in the 1993-1995 period appears higher than that during the previous 1992-1994 interval (Figure 3.1). However, the relatively

small number of deaths makes the difference between the rates statistically indistinguishable. Whether the 1993-1995 rate signals a trend towards increasing infant mortality among African Americans or is a random fluctuation in a generally downward trend will only become clear with data from forthcoming years.

The small number of deaths among Native Americans makes trend interpretation difficult, but the downward trend in rate appears to have continued. Among Asians and Hispanics, the rates appear to have stabilized in the 1993-1995 period.

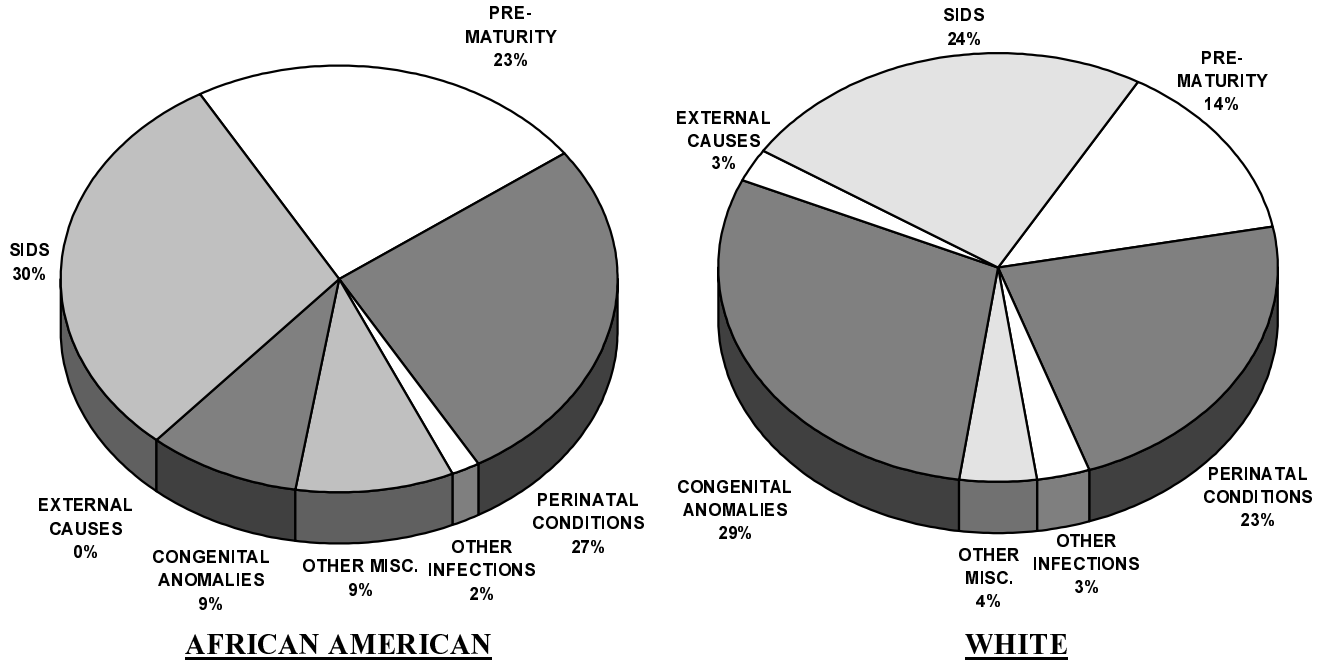
The persistent elevation in the infant mortality rates of African Americans and Native Americans is of concern. More work remains if King County is to reach the goal of eliminating disparities in infant mortality.

To understand the possible increase in infant mortality rate among African Americans in the 1993-1995 period, the following section describes the causes of death and measured birth risk factors among African Americans in comparison to whites.

2. Trends In Specific Causes Of Infant Mortality Among African Americans and Whites

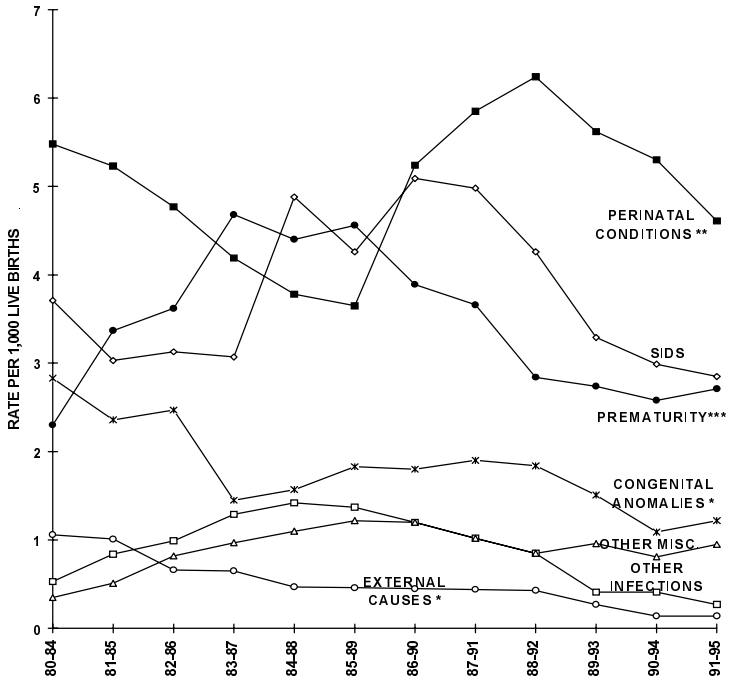
The leading cause of death among white infants in the 1993-1995 period was congenital anomalies, followed by SIDS and deaths due to perinatal conditions, similar to the 1992-1994 period (Figure 3.2). Deaths due to prematurity also figured prominently. The leading cause of death among African American infants in the 1993-1995 period was SIDS, followed by deaths due to perinatal conditions and prematurity. SIDS accounted for 30 percent of all African American infant deaths during the 1993-1995 period, compared to 21 percent in the 1992-1994 interval.

FIGURE 3.2: MAJOR CAUSES OF INFANT MORTALITY AFRICAN AMERICANS AND WHITES, KING COUNTY THREE YEAR AVERAGE, 1993-1995



SOURCE: BIRTH AND DEATH CERTIFICATES.

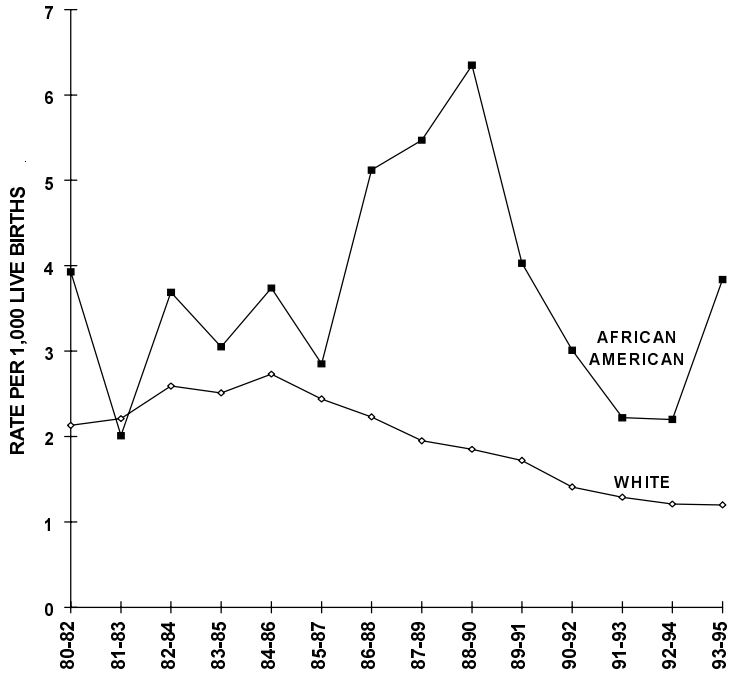
FIGURE 3.3: CAUSES OF INFANT MORTALITY FOR AFRICAN AMERICANS IN KING COUNTY FIVE YEAR ROLLING AVERAGES, 1980-1995



* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
** THIS TREND FROM 1985-1990 IS A STATISTICALLY SIGNIFICANT INCREASE, AND FROM 1990-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
*** THIS TREND FROM 1980-1987 IS A STATISTICALLY SIGNIFICANT INCREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

While the death rate from prematurity among African Americans increased from 1980-1987, the rate declined from 1987-1992, however non-significantly, and has plateaued since (Figure 3.3). On the other hand, death due to perinatal conditions has declined from 1980-1985, increased from 1985-1990, and then declined one more time from 1990-1995. No recent changes occurred in deaths due to congenital anomalies or external causes. However, the overall trends show significant decreases from 1980-1995. No notable changes occurred to death due to other infections or other miscellaneous causes.

FIGURE 3.4: SUDDEN INFANT DEATH SYNDROME RATES AMONG AFRICAN AMERICANS IN KING COUNTY THREE YEAR ROLLING AVERAGES, 1980-1995



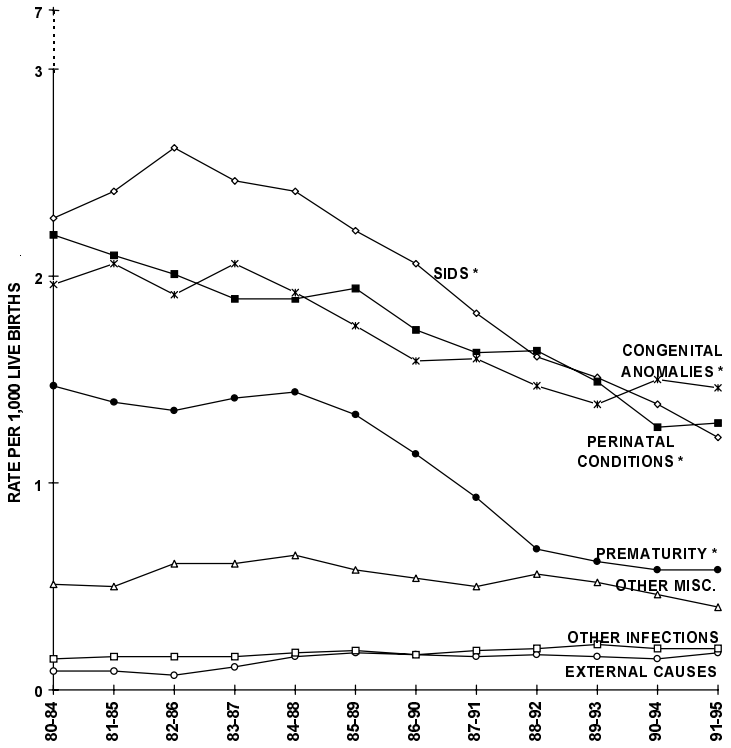
SOURCE: BIRTH AND DEATH CERTIFICATES.

The decline in the SIDS rate for African Americans appears to have reversed (Figure 3.4,[a] which shows the SIDS rate with three-year rolling averages). However, this trend is not statistically significant. The apparent increase in SIDS accounts for most of the increase in African American infant mortality rate observed between the 1992-1994 period to the 1993-1995 period. Determining whether the increase in SIDS represents either a true change in trend or random variation will require data from future years.

In contrast to the rate among African Americans, the SIDS rate among whites has not increased.

[a] Figure 3.3 shows five-year rolling averages which further smoothed out the year-to-year fluctuations. Figure 3.4 shows three-year rolling averages, which better illustrates the upward trend in recent years.

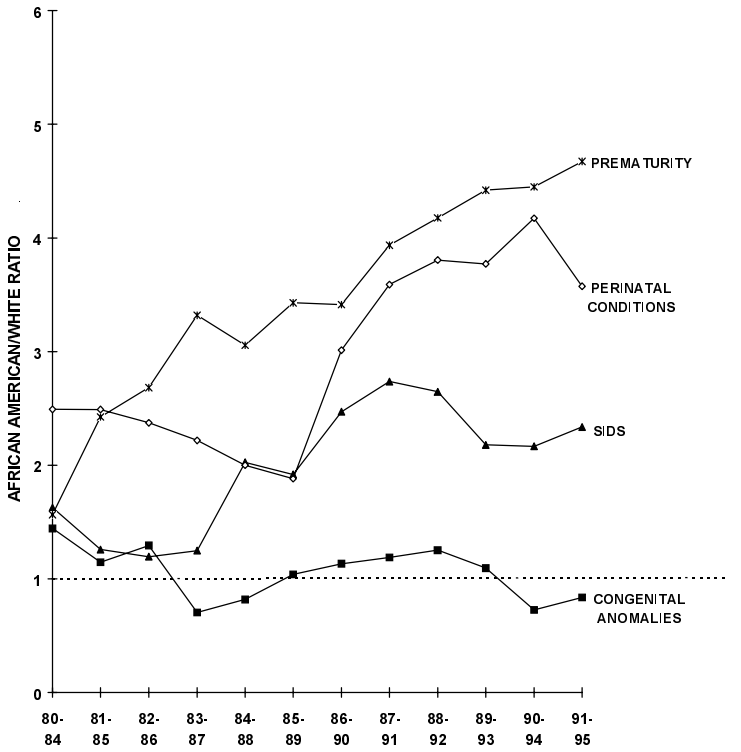
FIGURE 3.5: CAUSES OF INFANT MORTALITY FOR WHITES IN KING COUNTY FIVE YEAR ROLLING AVERAGES, 1980-1995



* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

There was no change in the trends for the four major causes of infant mortality for whites (Figure 3.5).

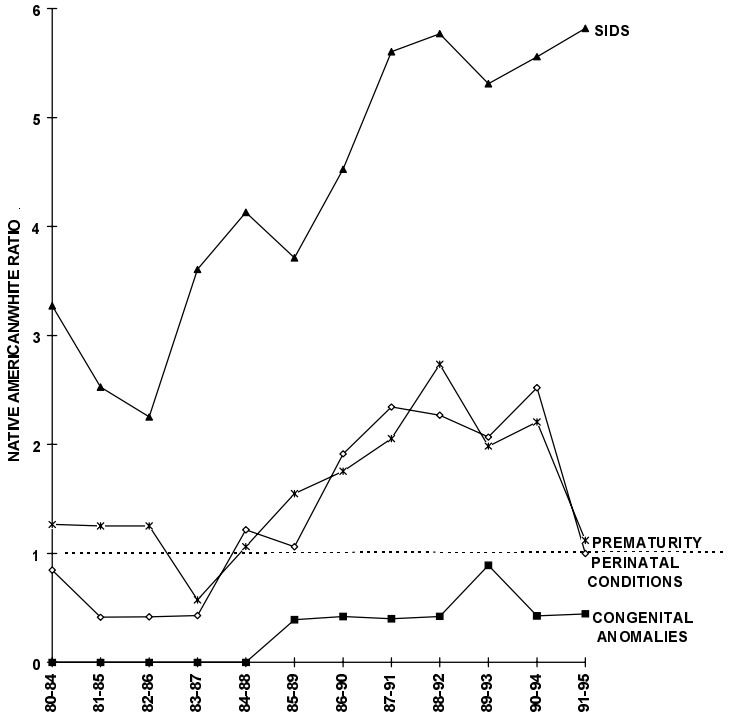
FIGURE 3.6: CAUSES OF INFANT MORTALITY RATIO OF AFRICAN AMERICANS TO WHITES IN KING CO. FIVE YEAR ROLLING AVERAGES, 1980-1995



SOURCE: BIRTH AND DEATH CERTIFICATES.

Despite the overall favorable trend for the major causes of infant death in both African Americans and white races, the rates of prematurity and SIDS among African Americans have increased relative to whites and the higher rate of deaths due to perinatal conditions has persisted (Figure 3.6). Efforts to improve access to health and social services for preconceptual and pregnant African American women and increased educational programs regarding sleep safety and SIDS prevention in the African American community are needed.

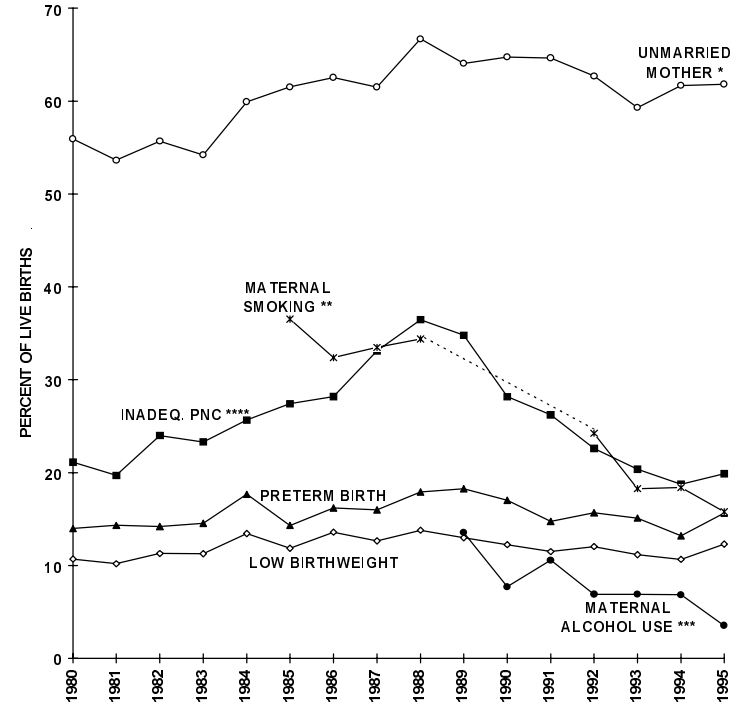
FIGURE 3.7: CAUSES OF INFANT MORTALITY RATIOS OF NATIVE AMERICANS TO WHITES IN KING CO. FIVE YEAR ROLLING AVERAGES, 1980-1995



SOURCE: BIRTH AND DEATH CERTIFICATES.

Relative to whites, Native Americans continued to have much higher rates of SIDS (a ratio of 5.8 during the 1991-1995 period). These SIDS deaths account for nearly all of the difference between Native American and white infant mortality rates (Figure 3.7). Despite the relatively small number of Native American infant mortality cases, further investigation of this difference is warranted, particularly pertaining to infant sleep position and sleep safety issues among Native Americans.

FIGURE 3.8: BIRTH RISK FACTORS FOR AFRICAN AMERICANS IN KING COUNTY 1980-1995



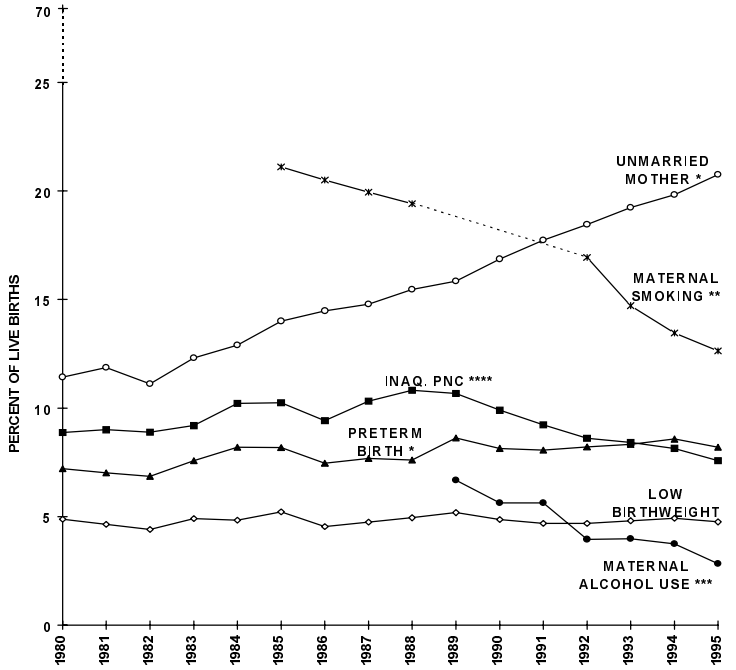
* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT INCREASE.
** THIS TREND FROM 1985-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
*** THIS TREND FROM 1989-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
**** THIS TREND FROM 1980-1988 IS A STATISTICALLY SIGNIFICANT INCREASE AND FROM 1988-1995 A STATISTICALLY SIGNIFICANT DECREASE.

SOURCE: BIRTH AND DEATH CERTIFICATES.

3. Changing Risk Factors For Infant Mortality Among African Americans And Whites

Among African Americans, recent downward trends in most birth risk factors have continued during the 1993-1995 period, with the exception that low birthweight and preterm birth rates have leveled (Figure 3.8). The decline in the rate of inadequate prenatal care for African Americans has slowed during 1993-1995 period while it has continued to decline for whites.

FIGURE 3.9: BIRTH RISK FACTORS IN KING COUNTY FOR WHITES IN KING COUNTY 1980-1995

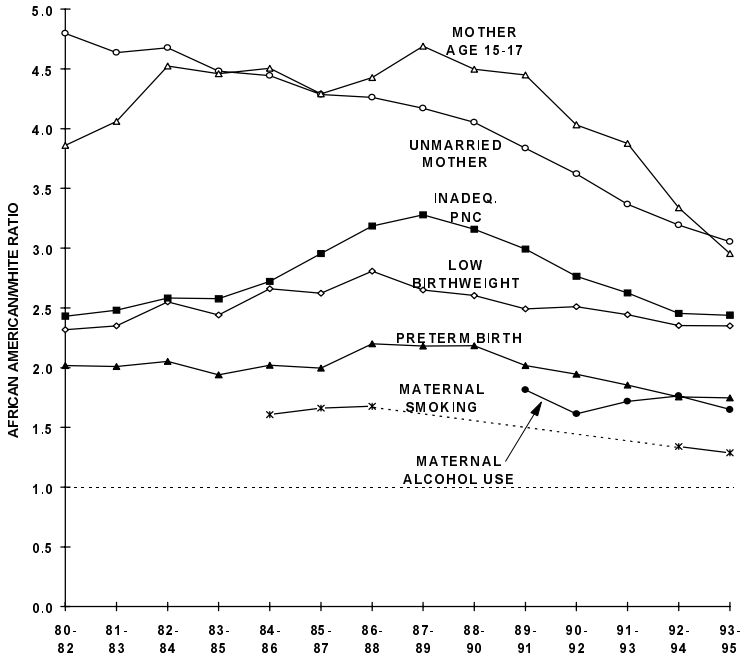


* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT INCREASE.
** THIS TREND FROM 1985-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
*** THIS TREND FROM 1989-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
**** THIS TREND FROM 1980-1988 IS A STATISTICALLY SIGNIFICANT INCREASE AND FROM 1988-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.

SOURCE: BIRTH AND DEATH CERTIFICATES.

Among whites, recent trends in birth risk factors have continued during the 1993-1995 period (Figure 3.9). The rates for maternal smoking and alcohol consumption continued to decline, whereas the rates for preterm birth and low birthweight have leveled. The proportion of unmarried mothers continued to increase. After an increase from 1980-1988, the trend for inadequate prenatal care has since declined.

FIGURE 3.10: BIRTH RISK FACTORS RATIO OF AFRICAN AMERICANS TO WHITES IN KING CO. THREE YEAR ROLLING AVERAGES, 1980-1995



SOURCE: BIRTH AND DEATH CERTIFICATES.

Relative to whites, the rates of unmarried mothers, preterm birth, maternal smoking, and adolescent births among African Americans have continued to decline, while the rate ratios for inadequate prenatal care, low birthweight, and maternal alcohol use remained the same (Figure 3.10).[b] However, all birth risk factors continue to be more common among African Americans.

Further efforts to reduce the rates of birth risk factors among African Americans are indicated, especially in providing access to prenatal care, and in reducing low birthweight and prematurity.

[b] Although the rates for African Americans and whites are presented in single years (Figures 3.8 and 3.9), the ratio between them showed great year-to-year fluctuations. Thus three-year rolling averages are shown, to smooth out these fluctuations.

SUMMARY

- During the 1991-1995 period, the infant mortality rates for African Americans and Native Americans were 2.4 and 1.9 times higher, respectively, than the rate among whites.
- The infant mortality rate for African Americans in the 1993-1995 period appeared higher than that during the 1992-1994 interval. However, data from forthcoming years are needed before drawing any conclusions that the declining trend of recent years has ended.
- The leading causes of death for white infants in the 1993-1995 period continued to be congenital anomalies, SIDS, deaths due to perinatal conditions, and deaths due to prematurity.
- The leading causes of death for African American infants in the 1993-1995 period were SIDS, deaths due to perinatal conditions, and prematurity. The increase in the proportion of deaths due to SIDS (30 percent in 1993-1995 period versus 21 percent in 1992-1994 period) accounted for most of the possible increase in African American infant mortality rate observed between the periods of 1992-1994 and 1993-1995.
- Relative to whites, Native Americans continued to have much higher rates of SIDS (a ratio of 5.8 during the 1991-1995 period).
- Among whites, recent downward trends in birth risk factors have continued during the 1993-1995 period. Among African Americans, recent downward trends in birth risk factors have continued during the 1993-1995 period, except for low birthweight and preterm births, where the rates have leveled. Furthermore, the decline in the rate of inadequate prenatal care for African Americans has slowed during 1993-1995 period.

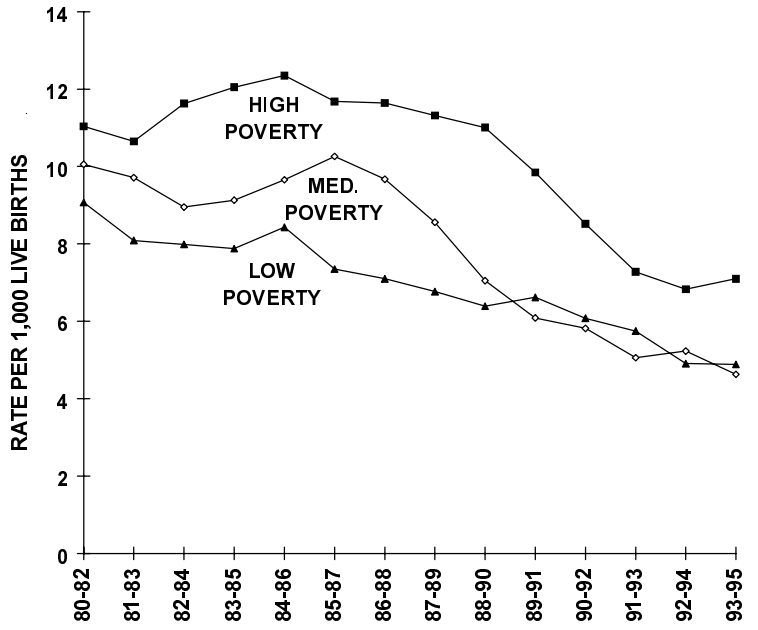
CHAPTER IV: TRENDS IN INFANT MORTALITY BY POVERTY AREAS

Universally, infants of low socioeconomic status have higher mortality rates.[1-5] Few measures of socioeconomic status, though, are currently available from birth certificates. The number of years of education completed by the infant's mother and source of payment for labor and delivery services are available. However, both of these variables were added only recently to vital records (in 1992), and therefore cannot be used to examine trends.

Another measure of socioeconomic status is low income. While no easily accessible data[a] exist indicating how many King County infants are born into poverty, we can compare infant mortality rates between those living in the poor areas and the more affluent areas within the county. The U.S. Census provides data for each census tract on the proportion of female residents age 12 to 64 who live in households with incomes below the poverty line.[b] A census tract is a geographic area which contains approximately 4,000 residents; there were 285 census tracts in King County in 1980. We created three equal size groups of census tracts based on the proportion of females age 12 to 64 years old living in households with income below poverty, and called these the high, medium, and low poverty areas. The high poverty group of tracts therefore contains the third of census tracts with the highest proportion of low-income households.

In this chapter we evaluate trends of infant mortality, causes of death, and birth risk factors among different poverty level groups.

FIGURE 4.1: INFANT MORTALITY IN KING COUNTY BY CENSUS TRACT POVERTY LEVELS THREE YEAR ROLLING AVERAGES, 1980-1995



NOTE: ALL TRENDS FROM 1980-1995 AND FROM 1985-1995 SHOW A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

1. Trends In Infant Mortality In High And Low Poverty Areas

While the infant mortality rate has declined consistently in recent years in the low and medium poverty areas, it appears that the period of marked decline in the high poverty areas ended in 1993. During the 1993-1995 period, the rate in the high poverty areas was 1.5 times higher than that of the low poverty areas (Figure 4.1). This difference is statistically significant.

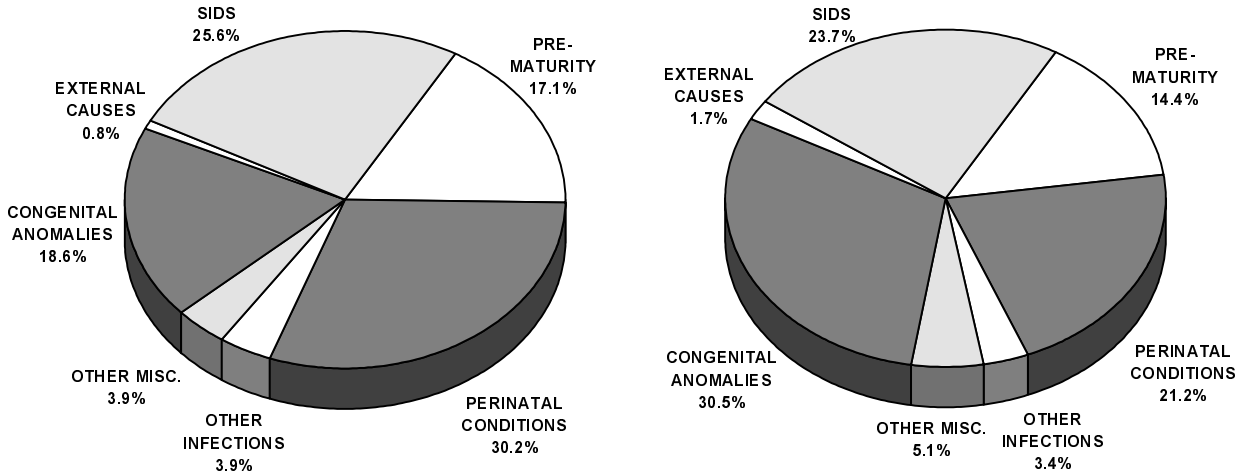
[a] Birth certificates do not assess maternal income. Information on source of payment for prenatal care has been collected since 1992. Source of payment can serve as a proxy for income because mothers whose source is classified as Medicaid or charity care are likely to have low incomes. The birth certificate also contains information on the educational attainment of the mother, which is an important measure of socioeconomic status. However, information on education is missing on 15.5 percent of birth certificates.

[b] $12,674 per year for a four-person household in 1989, the year for which the U.S. Census collected information.

2. Trends In Specific Causes Of Infant Mortality In High And Low Poverty Areas

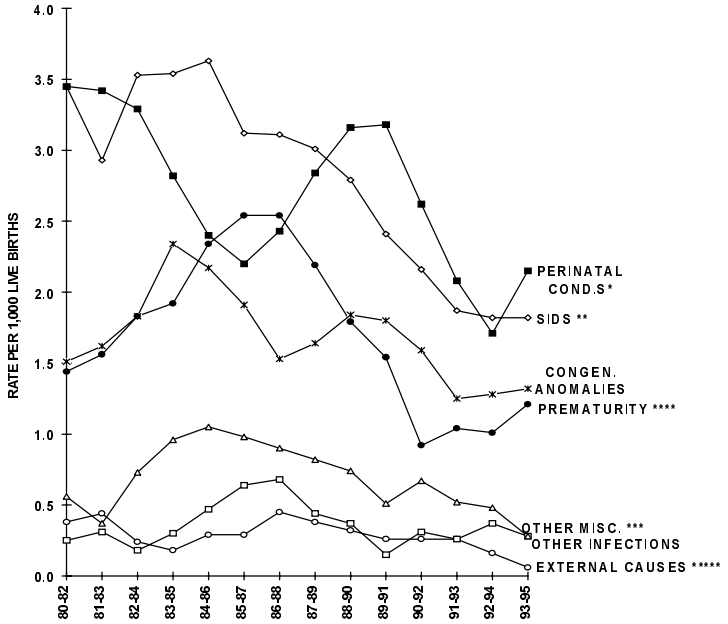
The infant mortality rates for most causes of death in the high poverty areas exceeded that of the low poverty areas in King County. In the low poverty areas, the leading cause of infant death in the 1993-1995 period was congenital anomalies, followed by SIDS, deaths due to perinatal conditions, and deaths due to prematurity (Figure 4.2). In contrast, the leading cause of infant death in the same period among the high poverty areas was deaths due to perinatal conditions, followed by SIDS, congenital anomalies, and deaths due to prematurity.

FIGURE 4.2: MAJOR CAUSES OF INFANT MORTALITY
HIGH POVERTY AREAS COMPARED TO LOW POVERTY AREAS
KING COUNTY, 1993-1995



SOURCE: BIRTH AND DEATH CERTIFICATES.

FIGURE 4.3: CAUSES OF INFANT MORTALITY
HIGH POVERTY AREAS IN KING COUNTY
THREE YEAR ROLLING AVERAGES, 1980-1995

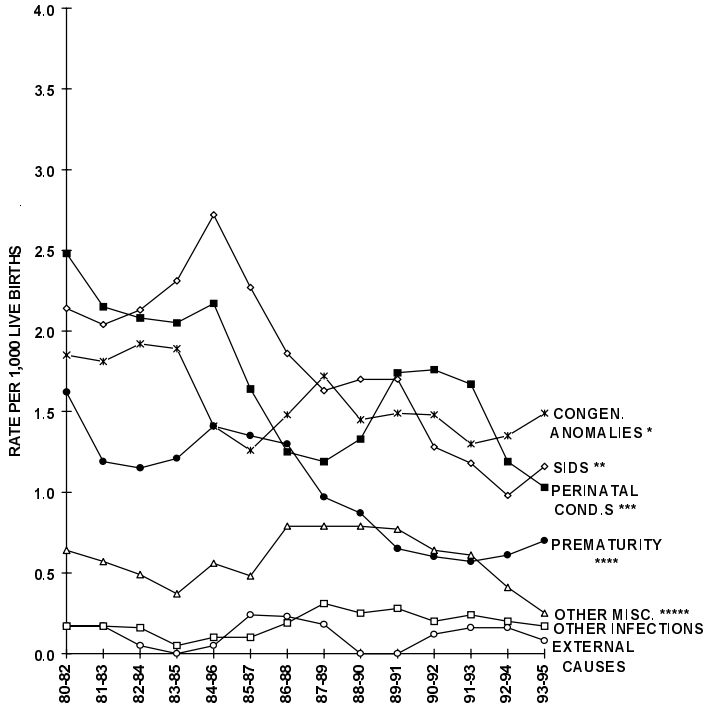


* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
** THIS TREND FROM 1984-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
*** THIS TREND FROM 1985-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
**** THIS TREND FROM 1980-1986 IS A STATISTICALLY SIGNIFICANT INCREASE, AND FROM 1986-1992 IS A STATISTICALLY SIGNIFICANT DECREASE.
***** THIS TREND FROM 1986-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.

SOURCE: BIRTH AND DEATH CERTIFICATES.

The overall trends in the four major causes of death (congenital anomalies, SIDS, perinatal conditions, and prematurity) differed between the high and low poverty areas (Figures 4.3 and 4.4). The death rate due to congenital anomalies in the high poverty areas has fluctuated and decreased slightly since the 1980-1982 period, and has leveled off since the 1991-1993 period. The SIDS rate in the high poverty areas declined significantly since the mid-1980s, although in recent years the rate of change seems to have leveled. The decline observed in death rates due to prematurity and perinatal conditions in the late 1980s and early 1990s seems to have ended recently in the high poverty areas. The slowing decline in infant mortality rate in the high poverty areas appears to be due mainly to increased rates of death from prematurity and perinatal conditions.

FIGURE 4.4: CAUSES OF INFANT MORTALITY
LOW POVERTY AREAS IN KING COUNTY
THREE YEAR ROLLING AVERAGES, 1980-1995



* THIS TREND FROM 1993-1995 IS A STATISTICALLY SIGNIFICANT INCREASE.
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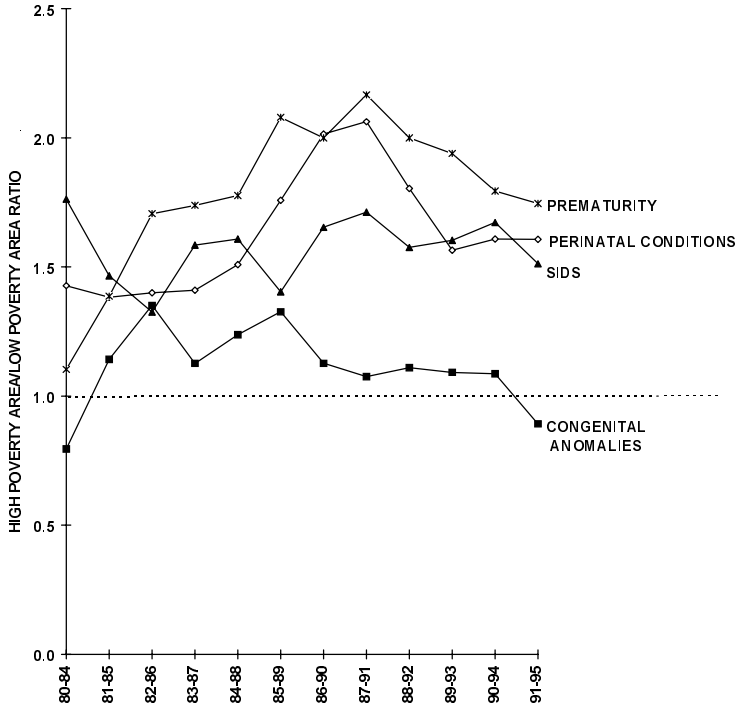
*** THIS TREND FROM 1991-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
**** THIS TREND FROM 1986-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
***** THIS TREND FROM 1988-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

The death rate due to congenital anomalies in the low poverty areas decreased in the mid-1980s and then has fluctuated around a new lower plateau since. The SIDS rate in the low poverty areas showed a similar trend as in the high poverty areas, except that it indicates an increase in the 1993-1995 period as compared to 1992-1994 period. Deaths due to perinatal conditions continued to decline in the low poverty areas.

FIGURE 4.5: CAUSES OF INFANT MORTALITY
RATIO OF HIGH TO LOW POVERTY AREAS IN KING CO.
FIVE YEAR ROLLING AVERAGES, 1980-1995



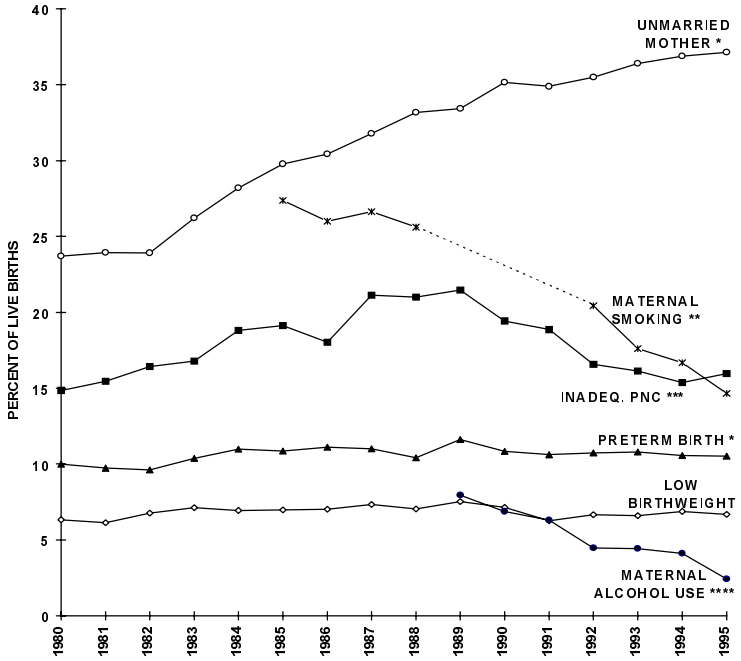
SOURCE: BIRTH AND DEATH CERTIFICATES.

The relative rates for each cause of death between the high and low poverty areas have not changed significantly in recent years (Figure 4.5).

The persistence of the differences between the high and the low poverty areas for the major causes of infant death (such as deaths due to prematurity, deaths due to perinatal conditions, and SIDS) should prompt attention to programs providing health and social services to low income pregnant women, in addition to assessing educational programs which address sleep safety issues.

3. Changing Risk Factors For Infant Mortality In High And Low Poverty Areas

FIGURE 4.6: BIRTH RISK FACTORS FOR HIGH POVERTY AREAS IN KING COUNTY 1980-1995



* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT INCREASE.
** THIS TREND FROM 1985-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
*** THIS TREND FROM 1980-1987 IS A STATISTICALLY SIGNIFICANT INCREASE AND FROM 1987-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
**** THIS TREND FROM 1989-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

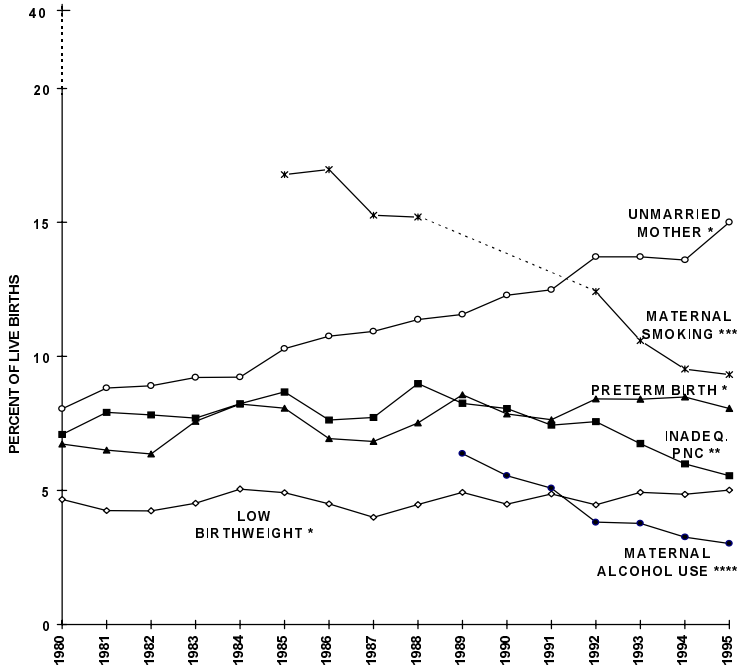
In the high poverty areas, recent trends in birth risk factors have continued in the 1993-1995 period, except for a slowing of improvement in prenatal care access (Figure 4.6).

One potential explanation of the lack of improvement in access to prenatal care in the high poverty areas may be related to changes in Medicaid policies.

Medicaid provides government-sponsored health coverage for low income persons. Initially, coverage was available only to women and children who had incomes below 90% of the federal poverty level and were on Aid For Dependent Children (AFDC), but in recent years the program was expanded to include women and children with incomes up to 185% of the federal poverty level ("expanded eligibility group"). From the time Medicaid-managed care was implemented in October 1993 until February 1995, only families on AFDC were required to enroll in a managed care plan. This meant that families chose their health plan when they were enrolled in AFDC, so many had on-going health care before becoming pregnant. Pregnant women in the "expanded eligibility group" were still covered by Medicaid in the fee-for service system, but received health care coverage only after becoming pregnant.

In February 1995, the "expanded eligibility group" was also required to enroll in a managed care plan. This made the process of accessing prenatal care more complex for that group of women. Once a woman became pregnant she had to get a pregnancy verification and apply for Medicaid. When found eligible, she had to choose a managed care plan, choose a primary care provider in that plan, and then either begin prenatal care with that primary care provider or be referred by the provider to prenatal care. Both a delay in the initiation of care as well as fewer visits to a prenatal care provider may have resulted from this process, as reflected in the 1995 data. The data indicate a need for continued evaluation of the appropriateness of a managed care financing mechanism for a population that does not have continuous eligibility.

FIGURE 4.7: BIRTH RISK FACTORS FOR LOW POVERTY AREAS IN KING COUNTY 1980-1995



* THIS TREND FROM 1980-1995 IS A STATISTICALLY SIGNIFICANT INCREASE.
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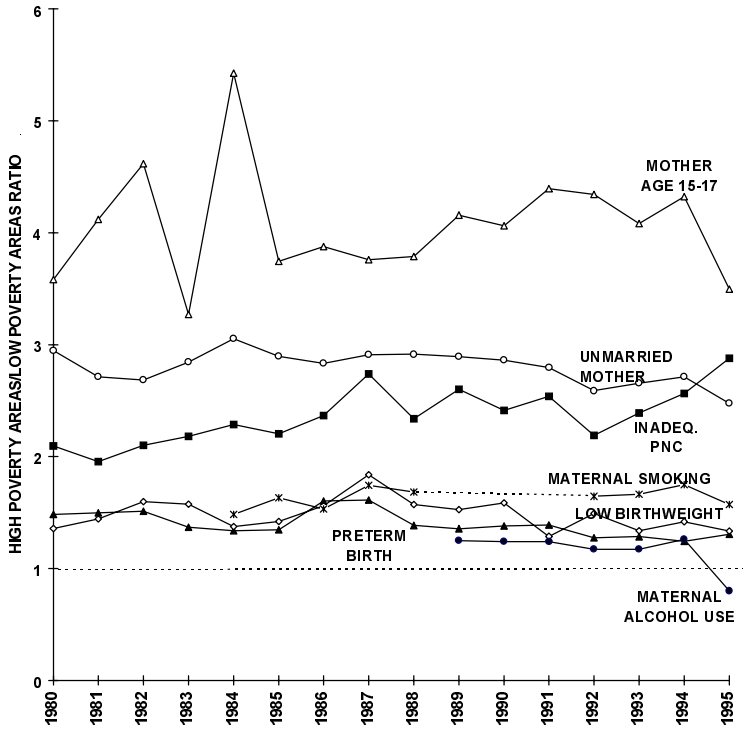
*** THIS TREND FROM 1985-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
**** THIS TREND FROM 1989-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

Access to prenatal care has continued to improve steadily in the low poverty areas (Figure 4.7). Since the early 1990s, the rate for unmarried mothers continued to increase while the rates for maternal smoking and alcohol use continued to decline. No significant changes occurred for preterm birth and low birthweight rates.

FIGURE 4.8: BIRTH RISK FACTORS RATIO OF HIGH TO LOW POVERTY AREAS IN KING CO. 1980-1995



SOURCE: BIRTH AND DEATH CERTIFICATES.

The continued improvement of access to prenatal care in low poverty areas has resulted in an increasing difference in access to prenatal care between low and high poverty areas (Figure 4.8).

Women living in high poverty areas are 2.6 times more likely to receive inadequate prenatal care than those living in low poverty areas. The differences in other birth risk factors have slowly decreased in recent years, but residents of high poverty areas still have higher rates of all risk factors.

All of the measured risk factors discussed above explain only a portion of the increased infant mortality in high poverty areas. Many other unmeasured risk factors also occur (see discussion of unmeasured risk factors on pages 7-9).

SUMMARY

- The period of marked decline in infant mortality in the high poverty areas appears to have ended in 1993.

- The leading cause of death for infants living in the high poverty areas during the 1993-1995 period was death from perinatal conditions. Among infants living in the low poverty areas, death from congenital anomalies was the leading cause of death. For causes of infant death during 1993-1995, the largest ratio between the high and low poverty areas was found in prematurity and perinatal conditions.

- Recent trends in birth risk factors have continued into the 1993-1995 period in the high poverty areas except for a slowing of improvement in access to prenatal care. Women living in the high poverty areas are 2.6 times more likely to receive inadequate prenatal care than those living in the low poverty areas. The differences in other birth risk factors have slowly decreased in recent years, but residents of the high poverty areas still have higher rates of all risk factors.

- Despite the overall decline in the infant mortality rate and the improving trends for most risk factors in the high poverty areas, the differences between the high and low poverty areas for the major causes of infant death and birth risk factors still persist. This should prompt attention to programs providing health and social services to low income pregnant women, in addition to assessing educational programs which address sleep safety issues.

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[4] Gould JB, LeRoy S. Socioeconomic status and low birthweight: a racial comparison. Pediatrics 1988; 82(6):896-904.
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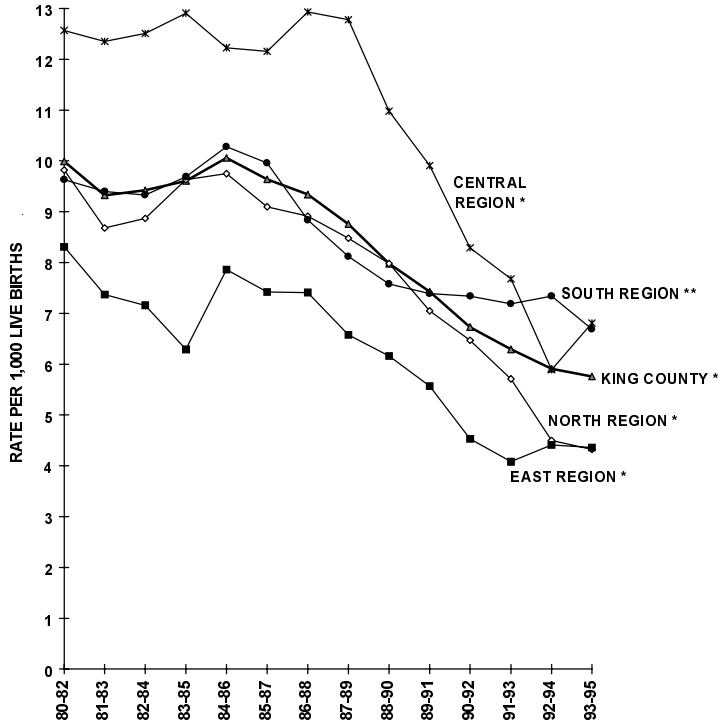
CHAPTER V: REGIONAL VARIATION OF INFANT MORTALITY WITHIN KING COUNTY

King County is quite large and diverse. Consequently, the health status of its population varies among its different regions. This chapter describes trends in infant mortality, causes of infant death and birth risk factors by region.

1. Trends In Infant Mortality by Region

The infant mortality rate during the 1993-1995 period was higher in the Central and South Regions than in the North and East Regions. Only the differences between the South and East Regions were statistically significant (Figure 5.1).

FIGURE 5.1: INFANT MORTALITY RATES IN KING CO. SOUTH, CENTRAL, NORTH, AND EAST REGIONS THREE YEAR ROLLING AVERAGES, 1980-1995



* THIS TREND FROM 1989-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
** THIS TREND FROM 1985-1995 IS A STATISTICALLY SIGNIFICANT DECREASE.
SOURCE: BIRTH AND DEATH CERTIFICATES.

Trends in infant mortality also varied across the regions. All of the regions experienced slight increases in the early 1980s and subsequent decreases in the late 1980s. While the South Region rate stopped declining in the late 1980s, the 1993-1995 period may be the beginning of an improving trend, although data from future years are needed to distinguish between a true improvement and a random fluctuation in the rate.

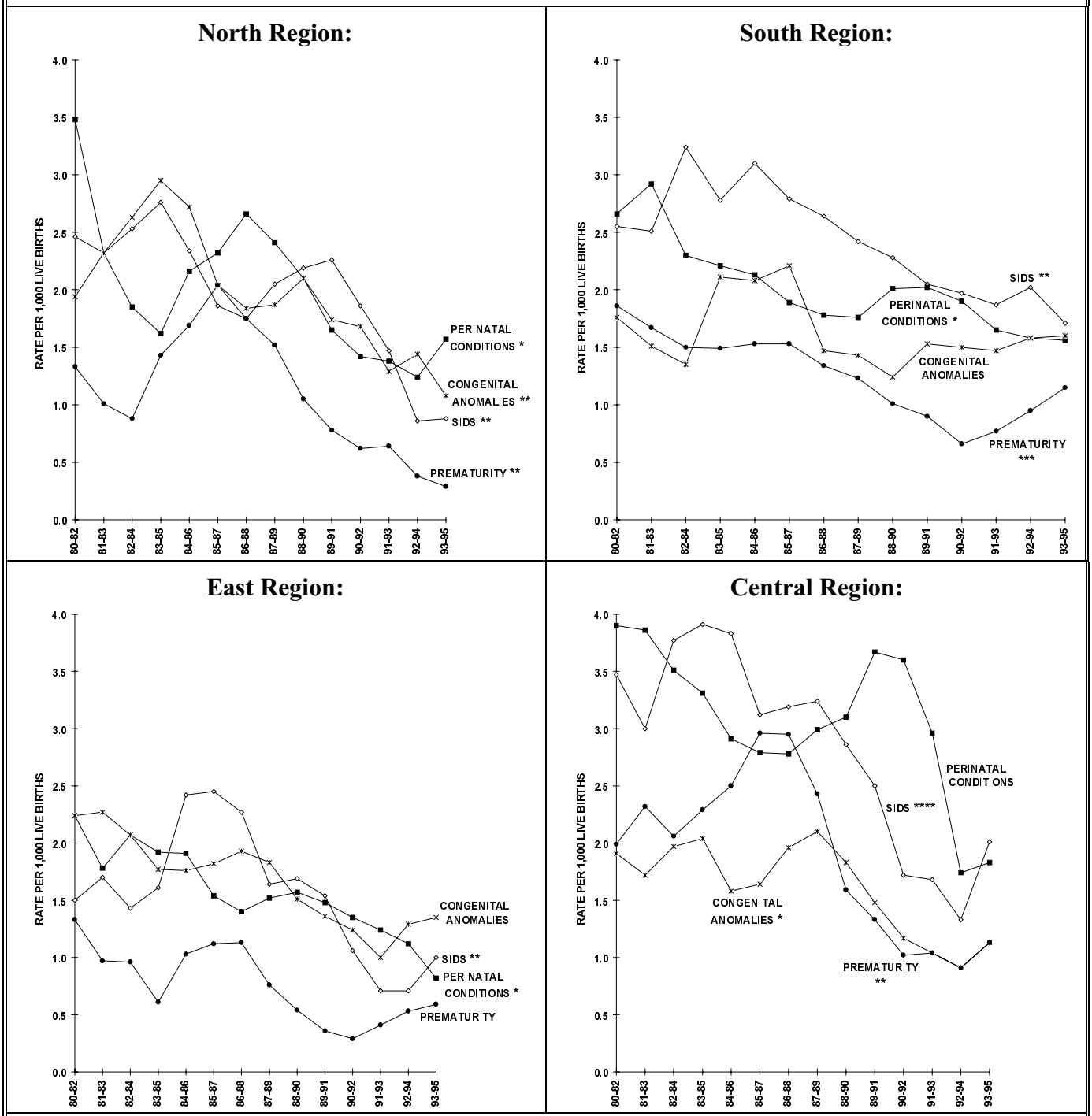
After a sustained decline, the rate in the Central Region appears to have increased in the 1993-1995 period. Data from future years are needed to determine whether this is a random variation around a declining trend or a true change.

The declining trend in the East and North Regions may also have plateaued.

2. Trends In Causes of Infant Death

Trends in specific causes of infant death for all four regions are shown in Figure 5.2 on the following page. The increase in infant mortality rate in the Central Region seems to be due primarily to an increase in SIDS, with smaller contributions by deaths due to perinatal conditions and prematurity. The decline in the infant mortality rate in the South Region appears to be due to a decrease in all causes of death, with the exception of deaths due to prematurity which continued to increase, however non-significantly. In the North Region, declining trends in prematurity have continued while deaths due to SIDS, perinatal conditions, and congenital anomalies seem to have leveled. In the East Region, trends in deaths due to SIDS and prematurity appear to have increased, although non-significantly. Furthermore, trends in deaths due to congenital anomalies have leveled and those due to perinatal conditions have continued to decline.

FIGURE 5.2: MAJOR CAUSES OF INFANT MORTALITY IN KING COUNTY NORTH, SOUTH, EAST, AND CENTRAL REGIONS THREE YEAR ROLLING AVERAGES, 1980-1995



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*** THIS TREND FROM 1980-1992 IS A STATISTICALLY SIGNIFICANT DECREASE.

**** THIS TREND FROM 1980-1992 IS A STATISTICALLY SIGNIFICANT DECREASE AND FROM 1992-1995 A STATISTICALLY SIGNIFICANT INCREASE.

SOURCE: BIRTH AND DEATH CERTIFICATES.

3. Changing Risk Factors For Infant Mortality In The Four Regions Of King County

The measured risk factors for infant death did not change uniformly across the regions of King County (Figure 5.3).

Recent trends in all of the birth risk factors in the North Region continued in the 1993-1995 period.

In the South Region the recent trends continued, with increasing proportions of unmarried mothers, preterm births, and low birthweight births, and decreasing rates of smoking, alcohol use, and inadequate prenatal care (Figure 5.3). The rate of improvement in prenatal care slowed somewhat in the 1993-1995 period. The southwest sub-region of the South Region had either the smallest decreases or largest increases in all risk factors (except for preterm birth, where the East Region showed a higher increase in rate) and tended to have the second highest rates of occurrence of most risk factors after the Central Region (Table 5.1).

All birth risk factors in the Central Region either continued to decline slowly or to remain level in the 1993-1995 period. Despite these favorable changes, this Region had the highest rates of risk factors, except for maternal smoking. In addition, the rate of improvement in access to prenatal care continued to slow in the 1993-1995 period.

The East Region had lowest levels of all birth risk factors. Recent trends in birth risk factors in the East Region continued in the 1993-1995 period. Table 5.1 below summarizes the changes in birth risk factors in King County and in all four regions between the periods of 1984-1986 and 1993-1995.

TABLE 5.1: CHANGES IN BIRTH RISK FACTORS FOR INFANT MORTALITY BY REGION IN KING COUNTY, 1984-1986 VERSUS 1993-1995

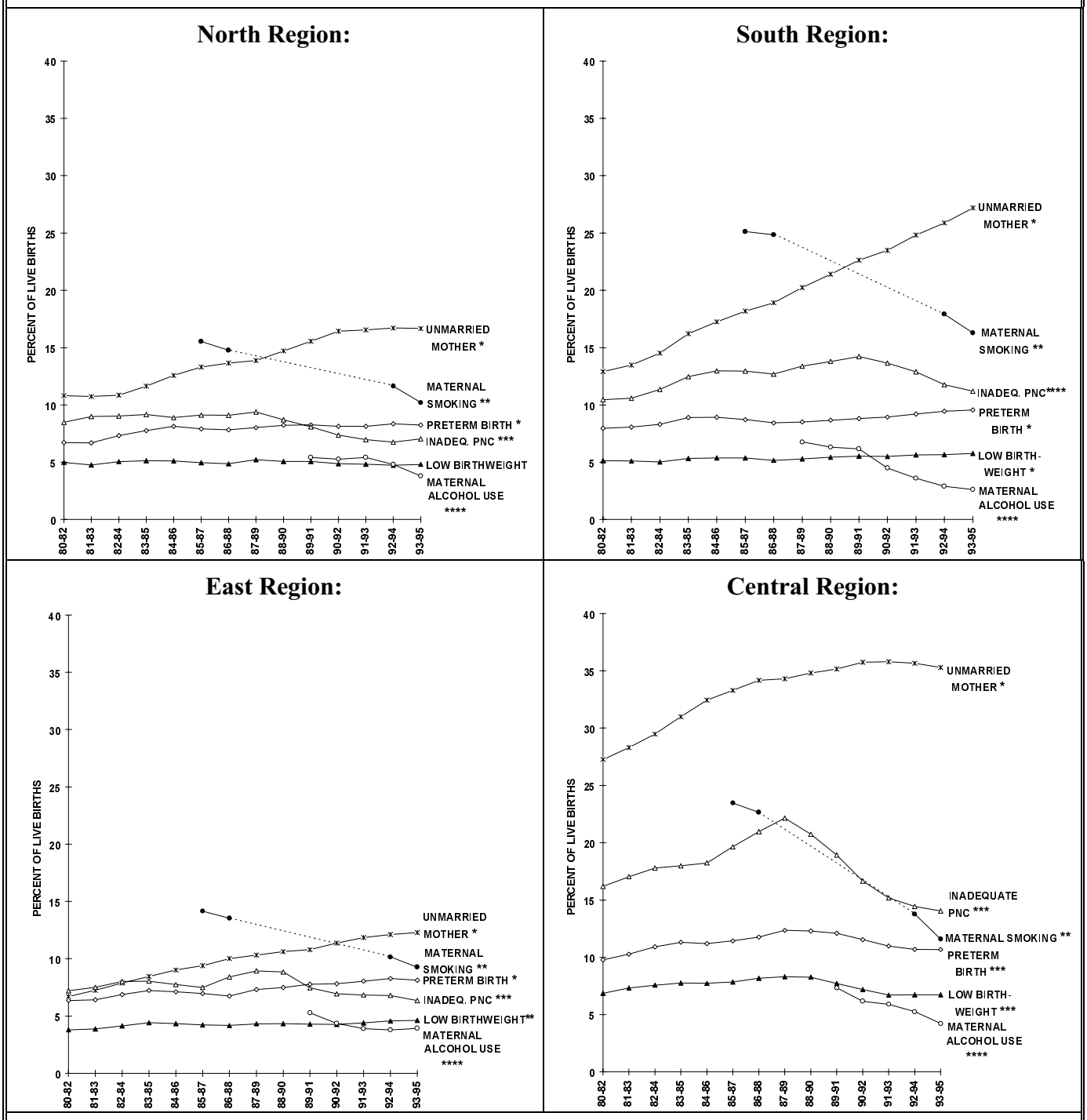
	Infant Mortality*			Low Birth Weight**			Preterm Birth**		
AREA	84-86	93-95	PERCENT CHANGE	84-86	93-95	PERCENT CHANGE	84-86	93-95	PERCENT CHANGE
King County	10.06	5.76	- 43%	5.55	5.48	- 1%	8.79	9.18	+ 4%
South Region	10.28	6.69	- 35%	5.37	5.76	+ 7%	8.92	9.56	+ 7%
Southwest Sub-Region	8.52	7.27	- 15%	5.59	6.52	+ 17%	8.99	10.11	+ 12%
Southeast Sub-Region	11.50	6.29	- 45%	5.21	5.23	+ 0%	8.88	9.16	+ 3%
Central Region	12.23	6.81	- 44%	7.73	6.73	- 13%	11.20	10.68	- 5%
North Region	9.75	4.32	- 56%	5.11	4.81	- 6%	8.12	8.24	+ 1%
East Region	7.86	4.36	- 45%	4.33	4.62	+ 7%	7.11	8.12	+ 14%

	Inadequate Prenatal Care**			Single Marital Status**			Births to Adolescents Age 15-17***		
AREA	84-86	93-95	PERCENT CHANGE	84-86	93-95	PERCENT CHANGE	84-86	93-95	PERCENT CHANGE
King County	12.01	9.78	- 19%	17.56	23.16	32%	18.43	20.90	+ 13%
South Region	12.96	11.20	- 14%	17.25	27.19	58%	18.09	26.26	+ 45%
Southwest Sub-Region	13.62	13.91	+ 2%	18.64	32.25	73%	17.56	32.04	+ 82%
Southeast Sub-Region	12.52	9.29	- 26%	16.29	23.70	45%	18.44	22.80	+ 24%
Central Region	18.23	14.04	- 23%	32.44	35.28	9%	40.79	36.08	- 12%
North Region	8.89	7.03	- 21%	12.57	16.66	33%	13.15	14.19	+ 8%
East Region	7.75	6.36	- 18%	9.02	12.28	36%	8.55	8.81	+ 3%

	Maternal Smoking**			Maternal Alcohol Use**		
AREA	84-86	93-95	PERCENT CHANGE	84-86	93-95	PERCENT CHANGE
King County	19.59	12.76	- 35%	---	3.48	---
South Region	23.82	16.28	- 32%	---	2.61	---
Southwest Sub-Region	24.50	17.43	- 29%	---	2.91	---
Southeast Sub-Region	23.35	15.47	- 34%	---	2.36	---
Central Region	22.34	11.59	- 48%	---	4.22	---
North Region	14.94	10.20	- 32%	---	3.92	---
East Region	14.16	9.26	- 35%	---	3.80	---

* Rates are per 1000 live births.
** Rates are percent of live births.
*** Rates are per 1000 women age 15-17.
- means percent decrease, and + means percent increase

FIGURE 5.3: BIRTH RISK FACTORS IN KING COUNTY NORTH, SOUTH, EAST, AND CENTRAL REGIONS THREE YEAR ROLLING AVERAGES, 1980-1995



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SOURCE: BIRTH AND DEATH CERTIFICATES.

4. INFANT MORTALITY BY HEALTH PLANNING AREA

To further understand the regional variation in infant mortality, we analyzed the infant mortality rate for each of the 21 Health Planning Areas in King County. During the 1991-1995 period, the Central and Southeast Seattle areas were the only ones whose rates significantly exceeded the county average of 6.1 per 1000 live births, while Bellevue was the only area whose rate was significantly lower than average. All areas within the South Region were above the King County average, with the exception of Kent. Recent trends in infant mortality continued in most of the areas, except for Bellevue, East/Northeast King County, North King County, North Central Seattle, Southeast Seattle, and Federal Way, where rates have leveled in 1993-1995 period, and Auburn, where a declining trend appears to have begun. Data from forthcoming years are needed before drawing any conclusions about changing trends.

The map in Figure 5.4 illustrates the variation in infant mortality rates by Health Planning Area. The areas with the darkest shading have rates that exceed the county average by one standard deviation (refer to Chapter I "How to Read This Report" for explanation of standard deviation).

FIGURE 5.4: INFANT MORTALITY RATE BY HEALTH PLANNING AREA IN KING COUNTY
5 YEAR AVERAGE, 1991 - 1995

SUMMARY

- The 1993-1995 period for the South Region may mark the beginning of an improving trend. The rate in the Central Region appears to have increased in the 1993-1995 period. The declining trend in the East region appears to have plateaued.
- The possible increase in the infant mortality rate in the Central Region seems to be primarily due to an increase in SIDS. The decline in the infant mortality rate in the South Region seems to be due to a decrease in all causes of death, except for deaths due to prematurity which continued to increase.
- Recent trends in birth risk factors in the East, North, Central, and South Regions continued in the 1993-1995 period. The rate of improvement in prenatal care slowed in both the Central and South Regions. The East Region had the lowest levels and the Central Region had highest levels of birth risk factors during the period of 1993-1995. The southwest area of the South Region tended to have the second highest rates of occurrence of risk factors after the Central Region.
- The Central and Southeast Seattle areas were the only ones whose rates significantly exceeded the county average during the 1991-1995 period, while the Bellevue area exhibited a significantly lower rate.

APPENDIX: SUPPLEMENTAL TABLES

TABLE A.1: INFANT MORTALITY RATES
UNITED STATES, WASHINGTON, KING COUNTY, SEATTLE, 1980-1995

YEAR	UNITED STATES			WASHINGTON		
	NUMBER OF INFANT DEATHS	NUMBER OF LIVE BIRTHS	INFANT MORTALITY RATE	NUMBER OF INFANT DEATHS	NUMBER OF LIVE BIRTHS	INFANT MORTALITY RATE
1980	45,514	3,612,258	12.6	801	67,996	11.8
1981	43,188	3,629,238	11.9	735	69,688	10.6
1982	42,326	3,680,537	11.5	755	69,488	10.9
1983	40,756	3,638,933	11.2	656	68,672	9.6
1984	39,627	3,669,141	10.8	702	68,939	10.2
1985	39,862	3,760,561	10.6	749	70,217	10.7
1986	39,068	3,756,547	10.4	676	69,423	9.7
1987	38,475	3,809,394	10.1	683	70,339	9.7
1988	39,095	3,909,510	10.0	656	72,604	9.0
1989	39,601	4,040,958	9.8	694	75,586	9.2
1990	38,256	4,158,212	9.2	622	79,465	7.8
1991	36,587	4,110,907	8.9	603	79,949	7.5
1992	34,553	4,065,014	8.5	540	79,833	6.8
1993	33,466	4,000,240	8.4	495	78,762	6.3
1994	31,400	3,979,000	7.9	478	77,341	6.2
1995	29,300	3,855,263	7.6	449	77,240	5.8

YEAR	KING COUNTY			SEATTLE		
	NUMBER OF INFANT DEATHS	NUMBER OF LIVE BIRTHS	INFANT MORTALITY RATE	NUMBER OF INFANT DEATHS	NUMBER OF LIVE BIRTHS	INFANT MORTALITY RATE
1980	185	17,696	10.5	79	6,115	12.9
1981	188	18,546	10.1	77	6,256	12.3
1982	177	18,840	9.4	66	6,497	10.2
1983	157	18,607	8.4	69	6,406	10.8
1984	198	19,015	10.4	82	6,550	12.5
1985	197	19,789	10.0	74	6,752	11.0
1986	196	19,954	9.8	71	6,806	10.4
1987	187	20,430	9.2	78	6,765	11.5
1988	192	21,203	9.1	84	6,909	12.2
1989	182	22,384	8.1	65	7,192	9.0
1990	157	22,949	6.8	55	7,117	7.7
1991	167	22,796	7.3	64	7,203	8.9
1992	139	23,036	6.0	41	6,957	5.9
1993	123	22,326	5.5	40	6,536	6.1
1994	136	21,972	6.2	30	6,480	4.6
1995	122	21,817	5.6	45	6,279	7.2

NOTE: RATES ARE PER 1,000 LIVE BIRTHS.
SOURCE: BIRTH AND DEATH CERTIFICATES.

TABLE A.2: INFANT MORTALITY RATES BY HEALTH PLANNING AREA IN KING COUNTY FIVE YEAR AVERAGE, 1991-1995

PLACE	AVERAGE # OF INFANT DEATHS PER YEAR	AVERAGE # OF LIVE BIRTHS PER YEAR	INFANT MORTALITY RATE PER 1,000 LIVE BIRTHS
AUBURN	11	1,506	7.17
BELLEVUE	3	928	3.45
BOTHELL/WOODINVILLE	4	894	4.47
CENTRAL SEATTLE	5	516	10.46
EAST/NORTHEAST COUNTY	2	525	3.43
EASTGATE/ISSAQUAH	5	1,088	4.78
FEDERAL WAY	9	1,382	6.51
HIGHLINE/BURIEN	9	1,173	8.01
KENT	9	1,508	5.97
KIRKLAND/REDMOND	10	2,037	4.71
MERCER ISLAND	<1	171	1.17
NORTH CENTRAL SEATTLE	3	783	4.34
NORTH KING COUNTY	4	838	4.54
NORTH OF CANAL AREA	10	1,887	5.40
NORTH SEATTLE	4	803	4.98
RENTON	9	1,235	7.13
SOUTHEAST KING COUNTY	9	1,112	7.91
SOUTHEAST SEATTLE	15	1,552	9.79
VASHON ISLAND	<1	83	2.42
WEST SEATTLE	6	1,149	5.05
WHITE CENTER/SKYWAY	8	1,036	7.34
UNKNOWN AREA	2	182	10.99
KING COUNTY TOTAL	**137**	**22,389**	**6.14**

NOTE: RATES ARE PER 1,000 LIVE BIRTHS.
SOURCE: BIRTH AND DEATH CERTIFICATES.