Monitoring Infant Mortality in St. Louis City and County: Update for 2000-2004

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EXECUTIVE SUMMARY
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Approximately 4,000 non-Hispanic white and 6,000 non-Hispanic black infants are born every two years among St. Louis City residents, and about 16,000 non-Hispanic white and 7,000 non-Hispanic black infants are born during the same period among St. Louis County residents. The preliminary report updates the surveillance data for infant deaths occurring among St. Louis City and St. Louis County residents, based on information from Missouri Live Birth and Death Certificates. The report includes data from linked birth-death files for all births occurring from 1989 to 2004 and tracks intermediate outcomes from birth files through 2004. The purpose of the surveillance system is to track trends over time that are important for public health policy and practices related to risk of infant death.

Race-specific mortality, low birth weight (LBW), and preterm delivery (PTD) rates per 1,000 live births were computed for all St. Louis City and St. Louis County residents during the period January 1, 1989 – December 31, 2004. The fetal mortality rates have been consistent at 4.8-4.9 per 1,000 births for whites. African American rates have increased consistently over the last 8 years (1997-2004). Perinatal deaths (deaths at $\geq$ 28 weeks gestation or within 6 days of birth) have been stable to slightly decreasing for whites in all three areas. For African Americans, there was no consistent trend for the state and county but in the city rates have been stable at about 16.0 per 1000 fetal deaths and live births after increasing between 1995 and 1998.

Infant mortality rates have declined steadily over the 16 years for whites. Rates for African Americans increased over the 8 years from 1995-2002 in all three areas with higher rates in 2003-2004 than were observed a decade before. Analyses of neonatal and post neonatal mortality suggest that neonatal mortality accounts for trends in the African American infant mortality rates. Congenital anomalies have declined slightly for whites over the 16 years while African American rates have been stable for the state and county. Rates increased in the city in the early part of the decade and then declined between 2001 and 2004. SIDS rates continue to decline for both whites and African Americans although the rate of decline continues to be less for African Americans. Deaths in the "all other causes of death" category have been stable for whites and show a pattern similar to that observed for infant mortality for African Americans with the recent rate similar to the rate of 10 years earlier. The racial disparity in the city has been at 4:1 for the last decade compared to county or state disparities at 2:1.

While the most recent infant mortality rates are slightly better than the earliest rates, we have lost or at least not gained ground on infant mortality for all groups over the last 10 years tracked. The city and county trends have been similar to those of the state, although the increase in mortality in the last decade was sharper for African American infants in the city. At the most recent data point, there is little difference by locality within each

race group, but St. Louis City and County show greater racial disparity with 3 times as many African American infant deaths than white, compared to 2 times as many for the state as a whole.

Low birth weight has increased steadily in both races in all three areas with rates for whites of 68.4 per 1,000 live births for the county and 71.4 per 1,000 live births for the city in 2003-2004. For African Americans rates are about twice that of whites (135.2 per 1,000 live births for the county and 145.7 per 1,000 for the city). Examination of moderately low birth weight (1500 to <2500 grams) and very low birth weight (<1500 grams) suggests that white rates have increased in both categories but most of the difference in trends for African Americans occurs in the very low birth weight group. African American births show a gradually increasing rate of very low birth weight births in all three areas.

Preterm births have increased in all three areas for whites with a greater rate of increase over the last decade. African American rates have increased in the most recent four years (2000-2004). In the city, African-American rates increased for the decade from 1989-1998, although at a slower rate than for whites, and then decreased for several years with the most recent rates equal to the rates of a decade ago (123.6 per 1,000 live births). Sub-analyses suggest that moderately preterm births (32 to <36 weeks) account for most of the trend in preterm births. While moderately preterm births account for most of the increase in total preterm births, very preterm births have much higher mortality rates than moderately preterm so even modest trends can significantly affect mortality rates. Very preterm births have been largely stable among African American births but have been higher in the last decade for white births. Racial disparities in preterm births overall have decreased over time because the white rates are increasing at a greater rate than African American rates.

Small for gestational age births have been decreasing since the mid-90s for both African American and white births in all three geographic localities. White rates are slightly higher than African American. There is little racial disparity for this outcome.

Many influences simultaneously affect risk of infant death. To estimate the relative influence of *risk factors* in St. Louis and St. Louis County during the 5 years from 2000-2004, we used logistic regression to adjust statistically for the effects of a set of potential risk factors drawn from the literature. This allows estimation of the effect of each individual risk factor while holding constant the effects of the others. Risk factors significant in both time periods (2000-2004 and 1995-1999) include: the absence of father's information on the birth certificate (neonatal mortality for the city and county and post neonatal mortality in the city), mother enrolled in more than 1 of 3 government assistance programs (protective for neonatal mortality), inadequate prenatal care utilization, adequate plus prenatal care utilization (assumed to be medically complicated pregnancies), inadequate gestational weight gain, and multiple births. Missing father information probably indicates a high level of social distress and has increased in the most recent years. The number of government assistance programs in which mothers are enrolled, among those who are enrolled in at least one, has shown a protective effect with

2 being better than one and three showing the greatest protective effect. In the prior 5 years examined this was significant only in the city, for the more recent 5 years it was significant in both city and county. Inadequate prenatal care utilization was predictive of post neonatal mortality only. You would expect prenatal care utilization to have its greatest impact on neonatal mortality, but adequacy of prenatal care reflects both social risk factors associated with starting late or not keeping the recommended appointments and the effects of not being adequately medically monitored. The association with post neonatal mortality suggests the effect here reflects social circumstances.

Inadequate gestational weight gain predicted only neonatal mortality in the earlier analyses but in the current analyses (2000-2005) it predicted mortality in both the neonatal and post neonatal periods. This was in spite of declining prevalence in inadequate gestational weight gain although the rate of decline has slowed among African American women. Not surprisingly, multiple births remain an important predictive factor and they have been increasing among white births over the entire 16 years and among African American births since 1997-1998.

Trends over time in risk factors that do not contribute currently (as reflected in the multivariate analyses) are important in what they may reflect for future trends. For instance, the prevalence of births to young mothers has been declining for some time but that decline appears to be leveling off and may begin to increase again. In addition, while the prevalence of women giving birth who have had at least 5 children does not show a clear trend, the last prevalence (2003-2004) was the highest in the 16 years examined. Lastly, the apparent emerging trend of increasing tobacco use among pregnant African American women is of concern. Educational efforts, messages from prenatal care providers and warnings about pregnancy risk on tobacco products have brought about major declines in tobacco use in pregnancy in both races over the 16 year period. But, in recent years tobacco companies have targeted marketing to low-income minority communities and the observed trend of increasing use among African Americans may reflect the success of these marketing practices.

Geo-mapping

We used GIS software to map the coordinates for the residential addresses of all infant deaths within areas in St. Louis City and St. Louis County during 2001-2004. Mapping infant deaths and risk factors for infant death allowed identification of possible clustering of risk factors and infant deaths and identification of areas with the highest risk per 1,000 live births.

In the City of St. Louis, for all parameters except one, only 1 or 2 zip codes (6-13%) had met the 2010 objectives for the birth outcomes examined. These two zip codes were 63116 and 63109 in south city. Conversely, a high proportion (50-69%) of city zip codes showed rates of poor birth outcomes that were more than 2 ½ times the 2010 objective. The only exceptions were infant mortality with only 13% in this category, preterm birth with none in the highest category and low birth weight with only 18%.

In St. Louis County about 40% of the zip codes had met the 2010 objective (37-49%) for each birth outcome. The one exception was infant mortality where 65% of the zip codes in St. Louis County met the criteria. Unlike the city, St. Louis county showed few zip codes in the highest risk category (from 0 to 9%) for infant mortality, preterm and very preterm birth and for low birth weight. Other birth outcomes showed from 19 to 28% of the zip codes in the highest risk category with post neonatal death and preterm birth being the highest at 28% and 26% respectively.

Clearly the city of St. Louis remains at much higher risk overall than St. Louis County but St. Louis County has many areas that need intervention and monitoring. We have identified a set of five zip codes in each of the city and county which were found to have high rates of poor birth outcomes across the parameters examined suggesting they should be a high priority for intervention.

These results suggest priority areas for intervention and suggest that there is still much work to be done to move St. Louis City and St. Louis County closer to the 2010 objectives for birth outcomes and infant mortality.

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Population-based Infant Outcome Surveillance Update

The St. Louis infant outcome surveillance system was updated to continue monitoring birth-related outcomes for Missouri, St. Louis County and St. Louis City residents. The outcomes (listed below) were computed as race-specific rates per 1,000 live births. The rates were presented longitudinally by two-year intervals (1989-1990, 1991-1992, 1993-1994, 1995-1996, 1997-1998, 1999-2000, 2001-2002, 2003-2004) to increase the precision of the rates computed for the three targeted populations. All rates were estimated using data from linked birth-death certificate files that are maintained by the Missouri Department of Health and Senior Services. [1]

Outcome	*Definition*
• Fetal mortality	Rate of fetuses 20 or more weeks gestation dying *in utero* among all fetuses and live births during the same year
• Perinatal mortality	Rate of fetuses 28 or more weeks gestations dying *in utero* and of infants dying during their first six days of life among all fetuses and live births during the same year
• Infant mortality	Rate of infants dying before their first birthday among all live born infants during the same year
• Neonatal mortality	Rate of infants dying during the first 27 days of life among all live born infants during the same year
• Post neonatal mortality	Rate of infants dying after 27 days of life and before their first birthday among all live born infants during the same year
• Infant mortality - perinatal conditions	Rate of infants dying from perinatal conditions before their first birthday among all live born infants during the same year

[1] Why our infant death rates may not match other published rates for the same years: These data are based on a birth cohort (all babies born in a year and then matched case-by-case with death certificates for any babies that died within a year of birth). Infant mortality statistics released each spring from official sources are often calculated from the number of infant deaths that year occurring before the first birthday, divided by the total number of live births that year. So babies in the numerator (deaths that year) are not necessarily the same individuals included in the denominator (babies born that year) since some of the babies that died may have been born the previous year and some of the babies born may not have passed through the entire year of risk. Birth cohort mortality statistics, such as reported here, are the most accurate but take a year longer to produce.

• Infant morality - congenital anomalies	Rate of infants dying from congenital anomalies before their first birthday among all live born infants during the same year
• Infant morality - SIDS	Rate of infants dying from sudden infant death syndrome before their first birthday among all live born infants during the same year
• Infant morality - all other causes	Rate of infants dying from all other causes before their first birthday among all live born infants during the same year
• Low birth weight	Rate of infants weighing less than 2,500 grams among all live born infants during the same year
• Moderately low birth weight	Rate of infants weighing 1,500-2499 grams among all live born infants during the same year
• Very low birth weight	Rate of infants weighing less than 1,500 grams among all live born infants during the same year
• Preterm delivery	Rate of infants born before 37 weeks of gestation among all live born infants during the same year
• Preterm delivery 32-36 weeks	Rate of infants born 32-36 weeks of gestation among all live born infants during the same year
• Preterm delivery <32 weeks	Rate of infants born <32 weeks of gestation among all live born infants during the same year
• Small-for-gestational age	Rate of infants born below the 10th percentile on weight for gestational age in weeks, based on tables by race and gender published by Alexander et al. (1999).

Population-based Risk Factor Surveillance Update

The surveillance of risk factors associated with adverse birth-related outcomes was also updated with data from 2000-2004. The risk factors (listed below) were computed as the percentage of live births with the risk factor of interest. The percentages were presented longitudinally by two-year intervals (1989-1990, 1991-1992, 1993-1994, 1995-1996, 1997-1998, 1999-2000, 2001-2002, 2003-2004) to increase the precision of the estimates computed for all three targeted populations. All percentages were estimated data from linked birth-death certificate files that are maintained by the Missouri Department of Health and Senior Services.

Risk Factor	*Definition*
• Maternal age <18 years	Percentage of mothers less 18 years of age

• Maternal age 35+ years	Percentage of mothers 35 or more years of age
• Maternal education <12 years	Percentage of mothers with less than 12 years of formal education age
• No paternal information on birth certificate	Percentage of birth certificates with no paternal information listed
• Maternal participation in government programs	Percentage of mothers participating in one of three (Medicaid, WIC, Food Stamps) government programs
• Maternal cigarette use	Percentage of mothers who smoked cigarettes during pregnancy
• Maternal alcohol use	Percentage of mothers who drank alcohol during her during pregnancy
• Inadequate prenatal care utilization	Percentage of mothers with inadequate prenatal care based on Kotelchuck index
• Adequate plus prenatal care utilization	Percentage of mothers with adequate plus prenatal care utilization based on Kotelchuck index. These are assumed to be medically complicated pregnancies requiring more frequent medical supervision.
• No prenatal care	Percentage of mothers with no prenatal care.
• Maternal anemia	Percentage of mothers diagnosed with anemia<30 or hemoglobin <10
• Inadequate gestational weight gain	Percentage of mothers with inadequate gestational weight gain based on Institute of Medicine guidelines
• Multiple births	Percentage of mothers with multiple births
• Parity 5+	Percentage of mothers with parity 5 or more
• Male infant	Percentage of male infants among all live births

Infant Outcomes

Fetal Deaths. Examining infant mortality without also looking at pregnancy loss prior to birth can present an incomplete picture so we first examined trends in fetal deaths. These are deaths occurring at 20 or more weeks of gestation and prior to birth. Rates for white fetal deaths varied somewhat from period to period but overall rates were fairly stable in all of the 3 areas, with a slightly decreasing trend for the state (Table 1 and Figure 1). The rate for the most recent period (2003-2004) was nearly identical in each area for white pregnancies (4.8-4.9 per 1,000 live births plus fetal deaths). African American fetal deaths showed varying rates up to the 1995-1996 period, which showed the lowest rate in the 16 years, and then rates increased consistently in all three areas over the last 4 periods. The 2003-2004 rates were 11.9 state, 13.4, county, 15.0 per 1,000 live births and fetal deaths city). Racial disparities in fetal death rates were about 2:1 for the state and the county and 3:1 for the city in 2003-2004.

Perinatal Mortality. Perinatal mortality rates provide a way to examine deaths that occur around the time of birth: deaths later in pregnancy ($\geq$28 weeks) and deaths within the first 6 days of life. White perinatal mortality in each of the 3 areas has been fairly stable although there is a slight downward trend (Table 2 and Figure 2). African American rates in the state and county have fluctuated and show no clear trend, ending the 16 year period with rates very similar to those at the start. City African American rates have been higher in the last 6 years than in the previous 10 although they appear fairly stable currently (15.5-16.5 per 1,000 fetal deaths and infant deaths). Racial disparities are 3:1 for the city, 2.5:1 for the county, and 2:1 for the state.

Infant Mortality. Table 3 and Figure 3 show trends in infant mortality rates by race for the state of Missouri, St. Louis City and St. Louis County. The rate for white infants has declined slightly over the 16 year period and has varied little between the three geographic areas. The most recent 8 year period suggests stable rates from 5-6 deaths per 1,000 live births for all three areas. The white rates for St. Louis City show fluctuations due to low numbers of white births. African American infant mortality rates have been consistently 2-3 times higher than for whites. The pattern over time also differs from whites but is similar for the three localities. A decline in 1993-1994 from 1989-1990 is followed by a steady increase in the ensuing years to a high in 2001-2002. The 2003-2004 cohorts show a drop in the rates for all 3 areas with the sharpest drop in the city. From 1997 to 2002 African American's in St. Louis City experienced the greatest increases in infant deaths and the highest rates compared to African Americans in the county or the state. While there has been a 6-year increasing trend in the rate of African American infant deaths in all three areas and the most recent rates are higher than those 10 years ago, the current rates are still lower than the rates at the beginning of the 16 year period.

Neonatal Mortality. Infant deaths were divided into neonatal and post-neonatal deaths to determine whether the observed pattern was attributable to infant deaths in the first month of life or to deaths occurring later. Table 4 and Figure 4 show that the pattern for neonatal mortality is similar in both race groups to that found for infant mortality.

However, the relative increase in the city's neonatal death rate for African American births from 1995-1996 to 2001-2002 is greater than that for infant mortality and the decrease for the most recent period was less. In addition, unlike white infant mortality rates, the neonatal death rates for white births stayed elevated for the two periods following the 1995-1996 increase. The state and county white neonatal rates show a consistent gradual decline to 1999-2000 followed by a gradual increase to the most recent period (2003-2004). The city white rates are unstable and are based on smaller numbers but show increasing rates in the most recent period. The most recent rates for both white and African American neonatal deaths for both the city and the county were higher for the 2003-2004 birth cohort than the corresponding rates at the start of the decade (1993-1994).

Post Neonatal Mortality. Post neonatal mortality (Table 5, Figure 5) has been stable across the most recent decade in all groups examined. This suggests that the observed trends in African American infant mortality rates are due to deaths in the first month of life rather than to those occurring later.

Causes of Death. We examined trends in causes of infant death in the same three localities and race groups to see whether changes in rates of death for particular causes might account of the observed patterns. Infant deaths were categorized into the 4 groups used by the State of Missouri: perinatal conditions, congenital anomalies, sudden infant death syndrome (SIDS), and all other causes.

Perinatal Conditions. As one might expect the trends over time for perinatal conditions (Table 6, Figure 6) resemble those for neonatal deaths and for the birth rates for most preterm infants. The white mortality rates in all three areas (state, county and city) were fairly stable and the African American rates rose from the first to the second period, dropped to the third and then increased gradually to the most recent period. For all three areas, the rates for the most recent period are higher than those at the beginning of the most recent decade (1993-1994) and the beginning of the 16 year period. The disparities of African American to white death rates for neonatal conditions were from 3 to 3.5:1 for all groups at the most recent period.

Congenital Anomalies. Deaths of infants attributed to congenital anomalies have declined slightly over the 16 year period for whites in all areas (Table 7, Figure 7). However, for African American infants the rates have been stable at about 2 deaths per 1,000 live births in the county and the state. In the city the rates declined from the first to the second period, increased for the next 4 periods (1991-1992 to 1999-2000) and then decreased in the most recent two periods to rates equal to or lower than the 1989-1990 rate. In recent years there has been little disparity between African American and white rates except in the county (1.8:1). While the shape of the curve describing the trend in African American infant deaths for congenital anomalies does not resemble the pattern observed for neonatal infant mortality, the elevated rates during the 1995-2000 period probably contributes to the overall elevation in mortality among African American infants during that period.

SIDS. Deaths from SIDS (Table 8, Figure 8) have declined slightly among white infants over the 16 years in all areas. Death rates from SIDS for African American infants have declined more slowly and in a less consistent pattern. In general, racial disparities have declined over the period as well running from about 3:1 or 4:1 at the beginning of the 16 years to about 1.5: 1 at the most recent point, although they have fluctuated over time.

All Other Causes of Death. Deaths from all others causes (Table 9, Figure 9) have been fairly stable over the decade among white infants in all three areas. The trend among African American infants is similar to that observed for infant mortality and neonatal mortality with an initial increase and then drop followed by a steady increase to rates at the end of the 16 year period that are close to those at the start of the observation period (3.8, 3.5 and 5.1 per 1,000 live births respectively for the state, county and city). The racial disparity has increased over the 16 year period in the city, from 2.5:1 (African American to white) to 4.3:1 although the disparity has been about 4:1 over the last decade. The county and state disparities have been consistent at about 2:1 over time.

Low Birth Weight. Since low birth weight is a major contributor to infant mortality risk, the rates were calculated and plotted for low birth weight and then for two subcategories within the usual definition of low birth weight to see if there were differences in trends over time between the subgroups. Table 10 and Figure 10 show that the rate of low birth weight births, defined as infants born weighing less than 2500 grams, has increased steadily over the 16 year period in both race groups and in all 3 localities. This parallels national trends. African American babies continue to be born at low birth weight twice as often as white infants.

Moderately Low Birth Weight. Among infants born at moderately low birth (1500 to <2500 grams) (Table 11 and Figure 11) there has been a steady slight increase in the rate for white infants in the state and the county. The city rates suggest such an increase but with greater fluctuation. For African Americans, the trends are not clear.

Very Low Birth Weight. The rate of white infants born at <1500 grams in the state have increased slightly, steadily over the 16 years (Table 12 and Figure 12). In the county the rate has been fairly stable from 1991-2000 but has increased in the last two periods with the 2003-2004 rate the highest in the 16 year period (12.4 per 1,000 live births). The county white rate has been fairly steady except for increases in the last two periods to 12.0 and 13.8 per 1,000 births respectively. The city rate for whites has increased gradually except for a drop at the most recent period. African American rates have been similar in the 3 areas and have varied over time but show an overall gradually increasing rate in all three areas whether looking at the most recent decade or the full 16 years. The rates for the most recent period were very similar in all 3 areas (34.2 for the state, 35.8 county, and 34.4 for the city). The African American to white disparities have been about 2.5 to 3.0 to 1 over time except for the most recent period in the city which had a ratio of 3.8 to 1. This increase in the disparity was due to a sharp drop in the white rate of very low birth weight.

Preterm Birth. Birth before 36 completed weeks of gestation (Table 13, Figure 13) has increased over the 16 year period but with an increasing rate over the most recent decade

for whites in the city, the county and the state of Missouri. Among African Americans, rates have fluctuated for the state and the county although they have increased in the most recent two periods. In the city the rates have increased consistently from 1989-1990 to 1997-1998, although at a slower rate than occurred for whites, then decreased for 2 years and at the most recent period are equal to the rate a decade ago (123.6 per 1,000 live births). While African American rates are greater than white, racial disparities have decreased as the white rates have increased more rapidly than the African American rates.

Moderately Preterm (32 to <36 weeks). To explore differing patterns by race or locality, preterm birth was further divided into moderately preterm and very preterm. Moderate preterm (Table 14, Figure 14) mirrored trends over time displayed for the large preterm birth category (<36 weeks) with increasing prevalence among white births and no clear trend among African Americans. While African American rates are greater than white, racial disparities have decreased as the white rates have increased more rapidly than the African American rates.

Very Preterm (<32 weeks). For whites the overall trend is for increasing rates of very preterm birth births (Table 15, Figure 15). Rates for the most recent period are 14.0, 12.5 and 11.2 per 1,000 births for the state, the county and the city respectively, up from 11.7, 8.5 and 10.6 respectively a decade earlier. Among African American births, the rates are two to three times the white rates. The state rates have been stable at about 31-33 per 1,000 births except for higher rates for the last three periods (36.8, 35.5 and 36.4 respectively). The county rates have been stable over the 16 years (20-23 per 1,000 births); however, in the city there has not been a clear trend although the 1995-2002 rates have been higher (26-29.5 per 1,000 births) than the earlier rates. The most recent period (2003-2004) is the lowest rate observed and is essentially equivalent to the rate at the beginning of the 16 year period. Racial disparities have been fairly consistent over time and are about 2 to 2.5:1 for the most recent period

Small for Gestational Age. Infants who are born small for gestational age (SGA) are assumed to have had restricted growth in utero (Table 15b, Figure 15b). They are at greater risk of morbidity and mortality than infants whose growth had been within normal bounds. In all groups monitored, the prevalence of SGA births had been fairly stable until the mid-1990's when it began to decline modestly. There is little difference by race in this outcome. The highest prevalence occurs among white infants in the city of St. Louis (10% of live births) and the state as a whole (10.2% of live births). African American births are similar (9.8% in the city and 9.7% in the city). County rates are slightly lower for both race groups tracked (8.0% white and 9.1% African American)

Risk Factors

Tracking factors known or suspected to be associated with adverse pregnancy outcomes and infant mortality allow us to spot changes in communities that may precede important changes in morbidity and mortality.

Percent of Births to Mothers Under Age 18 (Table 16, Figure 16) *Note: This is not a true rate since it is affected by the number of older mothers that give birth in each year.*

The proportion of all births which can be attributed to mothers under the age of 18 has declined over the 16 year period in all groups and that trend is continuing. Among blacks in all three areas the decline began in 1995-1996 and among whites the trend began from 2-4 years later (1997-1998 for the city and the state and 1999-2000 for the county). Blacks in all 3 areas have experienced the highest proportion of young age births as well as the sharpest declines. The City of St. Louis showed almost 14% of births to teens under 18 in 1989-1990 and that percentage had fallen to 10.1% by 2003-2004. Racial disparities are high in the city (6.3:1) and county (5.1:1) but lower for the state as a whole (2.9:1).

Maternal Age Over 35 Years (Table 17, Figure 17). Older maternal age is associated with higher rates of Down's Syndrome and complications of pregnancy and birth (CDC, 1994). Older age at first and subsequent births is also associated with higher education and greater affluence. In our data, this risk factor has a higher prevalence in whites in all three geographic areas. Reflecting national trends, the prevalence has increased over the 16 year period; however, in all groups the increase appears to have leveled off and has been declining in the more recent years. The decline appears to have started earlier in the least affluent groups (1997-1998 among city blacks), and more recently among the most affluent (2003-2004 in county whites).

Mother's Not Completing High School (Table 18, Figure 18) The education level of women is considered a key health indicator for populations worldwide . All groups show a decreasing prevalence of births to mothers who did not complete high school. In each of the 3 geographic areas, Blacks have the highest rates but experienced a steeper decline than whites in the 6 years between 1991 and 1996. Since 1996 the rate of decline has been modest in all groups. Among births to black women in St. Louis City in 2003-2004, 35.8% were to women with fewer than 12 years of school. This figure was 27.4% for the state and 18.7% for the county. Racial disparity is highest in St. Louis County (3.1: 1), followed by the city (2.2: 1) and lowest in the state at large (1.7:1). However, the disparity has declined over this period in the county (from a high of 3.5:1 in 1991-1992 to 3.1 in 2003-2004) and increased in the city (1.6:1 in 1989-1990 to 2.2 in the 2003-2004).

No Paternal Information on the Birth Certificate (Table 19, Figure 19) Several studies have shown that infant mortality occurs more frequently when the paternal information on the birth certificate is not completed. The prevalence of this risk factor peaked in 1991-1992 and then declined in almost all time periods except in the most recent period (2003-2004) when the rate increased in all but one of the groups (white city births). As Figure 19 shows, black rates in all 3 geographic areas are considerably higher than the white rates. In 2003-2004, the disparities were 4.6 :1 in the city, 4.5:1 in the state and 6.3:1 for St. Louis County.

Participation in 1 of 3 Government Assistance Programs (Table 20, Figure 20) In earlier analyses we demonstrated that women living in St. Louis City who were enrolled in one of 3 poverty assistance programs (Medicaid, WIC or Foodstamps), yet were not enrolled in all 3, and were at higher risk of having an infant die in the first year of life.

While white women in the county have the lowest percentage who have this risk factor among the groups tracked, their rate has been gradually increasing since 1994 and the most recent figure (7.4% in 2003-2004) is the highest in the 16 years covered. Rates for black women in all 3 areas have tracked together; peaking in 1999-2000 and declining since. Rates for black women are highest in St. Louis County (18.0% for 2003-2004), followed by the state (15.7%) and the city (14.2%).

Maternal Cigarette Use (Table 21, Figure 21) Tobacco use in pregnancy is considered the single most important modifiable risk factor in pregnancy (CDC, 2004). Historically tobacco use among Missouri black pregnant women of childbearing age has been low and rates for white women much higher (Land & Stockbauer, 1993; Flick et al., 2006). At the beginning of the 16 year period, the highest rates of maternal cigarette use were among St. Louis City whites. By the end of the period (2003-2004), prevalence among white mothers in the city had declined so that it was below the rate for white women in the state and equivalent to the rate for black women giving birth in the city. Over the same period black cigarette use rates dropped considerably as well although proportionally less. The most recent prenatal cigarette use rates across the groups are from 10% to almost 50% lower than the rates obtained for 1989-1990. While this represents important progress statewide and regionally over the 16 years, this declining trend does not appear to be continuing in the most recent data for black mothers in all 3 areas (see Figure 21) and for white mothers in all areas except the city, where rates were the highest. Cigarette use rates for whites in the county and across the state have leveled off for the last two periods (2001-2002 and 2003-2004) and for black mothers these rates have increased between the last two periods. While the increases are small, this may represent a reversal or at best an end to a 16 year trend toward lower use rates. Racial disparities on cigarette use in pregnancy have decreased over the 16 years tracked so that they have nearly disappeared in the city (black rate is 16.7% while the white rate is 17.3%) and the county (black rate is 9.5% and white rate is 10.0%) although a higher proportion of whites continue to use in the state at large (1.44 white smokers in pregnancy for every black smoker).

Maternal Alcohol Use (Table 22, Figure 22) Alcohol use reported on birth certificates is notoriously under reported but assuming the degree of under reporting is consistent across time tracking reported use should be useful. Alcohol use even at relatively low levels has been shown to be harmful to the fetus (Frid, 2002). At the beginning of the 16 year period black and white rates of alcohol use in Missouri were very similar to each other at 3.3% for whites and 3.6 % for blacks. In the St. Louis area, however, the white rate was higher than the rate among blacks. In St. Louis County, whites reported drinking alcohol during pregnancy more than twice as often as did blacks (6.3% compared to 2.7%). In the city, use among black pregnant mothers was reported at 2.8% of births while among white mothers the reported rate was 4.2%. In the city and county the rate among white mothers fell steadily for 10-12 years but then appears to have leveled off in the last two periods. Among black mothers rates increased until 1993-1994 (4.5%) in the city when they surpassed the white rate and then fell to a low of 0.7% for 2003-2004. In the county, black rates have fallen steadily only since 1995-1996 but reached the lowest reported level of use in pregnancy at 0.3 % for 2003-2004. In 2003-2004 reported use in

all groups is quite low with all below 1% except for white pregnant women in St. Louis City with 1.3% reporting use.

Inadequate Prenatal Care Utilization (Table 23, Figure 23) Inadequate prenatal care utilization has been associated with higher rates of preterm birth, low birth weight and infant mortality (CDC, 1994). In Missouri, St. Louis County and St. Louis City the rates of inadequate prenatal care have fallen throughout the 16 year period such that the rate for 2003-2004 is about 50% of the initial (1989-1990) rate. Of concern however, is that most of that decline had occurred by 1999-2000 in all groups. Among black births the rate of decline decreased for the last 3 time periods and among white births the decline had leveled off or fallen only slightly in the last 2 or 3 two-year periods in all 3 areas.

Adequate Plus Prenatal Care Utilization (Table 24, Figure 24) This category on the Kotelchuck prenatal care index (1994) identifies cases where the mothers total number of prenatal care visits exceed those recommended for the length of gestation at delivery. These pregnancies are assumed to have been identified prenatally as medically complicated and therefore to require more frequent medical supervision. Even with more prenatal visits the expectation is that complicated pregnancies would have poorer birth outcomes than uncomplicated pregnancies. In all groups the rates of adequate plus prenatal care utilization has increased markedly over the 16 years. Rates have increased steadily for Missouri whites and for both race groups in the county. Among both race groups in the city and for blacks in the state, rates hit a peak in 1997-1998 and then leveled off or increased only slightly thereafter. At the most recent period, 2003-2004, county blacks showed the highest rates of this characteristic at 48.5% with all other groups having from 42-44% of pregnancies receiving adequate plus prenatal care. One cannot tell from these data whether the increase in adequate plus prenatal care utilization is a consequence of increasing rates of medical complications in pregnancies, better detection or changing standards of care where women with certain conditions are seen on a more frequent basis now that

No Prenatal Care (Table 25, Figure 25) Women who receive no prenatal care have higher rates of complications and adverse outcomes than women in care. While the majority of this effect is due to social risks associated with women who do not enter care (greater likelihood of drug use, very young age or high parity or women in chaotic social circumstances) some of the effect is due to not receiving the early detection and preventive services in prenatal care (CDC, 1994). Rates of receiving no prenatal care are usually quite low but are important because of the strong association with poor birth outcomes and infant mortality. Rates of receiving no prenatal care have been declining consistently for all groups over the 16 year period. Rates are markedly higher for black women than White women in all 3 areas (the state, St. Louis County and St. Louis City). For white women in the state, rates went from 0.9% in 1989-1999 to 0.5% in 2003-2004. St. Louis County shows the lowest rates for whites and a very small decline, 0.4% to 0.3%, while the City rates among white women went from 1.5% to 0.7% of births. The degree of decline in the rate of births without prenatal care was greater for blacks than whites in all areas, with the sharpest declines occurring from 1991-1992 to 1997-1998. However, rates have been and remain higher among blacks. In the most recent period

(2003-2004), the disparity between the black and white rates was 5.7 to 1 for St. Louis County and 4.6 to 1 for St. Louis City births.

Maternal Anemia (Table 26, Figure 26) Maternal anemia as reported on the birth certificate shows no clear trend in any of the groups assessed and has been shown to underestimate the true prevalence of maternal anemia. Rates vary from one two-year period to another across time and the rates at the most recent period are not appreciably different from those at the beginning of the period of surveillance. Blacks, however, do show higher rates in all groups although the disparity for a given area varies from 2 to 1 to 5 to 1 depending on the years examined.

Inadequate Gestational Weight Gain (Table 27, Figure 27) Inadequate weight gain is an important contributor to low birth weight. Using the mother's pre-pregnancy weight and her height we calculated her prepregnancy body mass index (BMI) and whether she was underweight, normal weight, overweight or obese prior to conception. Then we identified mother's whose weight gain in pregnancy was adequate or inadequate using ACOG's weight gain recommendations. Inadequate weight gain was defined as gaining less weight during pregnancy compared to the recommendation for the pre-pregnancy BMI category. This risk factor declined in all geographic areas and race groups but the most marked decline was observed among black women in all 3 geographic areas. Black women had experienced a higher prevalence of inadequate gestational weight gain compared to white women in all of the 3 areas. Rates for black women declined more rapidly than did white rates during the first 6 2-year periods (1989-1990 to 1999-2000). Since 1999-2000 the rates have declined but at a slower rate for all groups.

Multiple Gestations (Table 28 and Figure 28) Twin, triplet and higher order multiple births increase the likelihood of giving birth preterm, or to a small infant and increases the risk of infant mortality. Over the 16 years examined, multiple births have gradually increased in Missouri in both race groups (from 2.3% to 3.3% among whites and from 3.0% to 3.7% among blacks). The increase among white births has been steady throughout the period while among blacks the increase did not begin until 1997-1998.The rate among black births has been consistently higher than the rate for whites at the state level. In St. Louis County the rate also increased gradually throughout the period but rates have been consistently higher than for the state among white births. For St. Louis County whites, the most recent rate (4.8% of live births in 2003-2004) is 46% higher than the rate observed in 1989-1990 (3.3% of live births). Among County blacks the rates fluctuate although the overall trend is increasing. Black births in the city remained at about 3% until 1997-1998 when they started to increase slightly to a rate of 3.4% for 2003-2004. The city multiple birth rate for whites fluctuated due to low numbers of births and showed no clear trend.

Five or More Prior Live Births (Table 29, Figure 29) Few women report having had five or more prior live births but high parity is associated with poor birth outcomes and greater mortality risk to the infant. In Missouri rates for whites were 1.1% in 1989-1990 and increased slightly but steadily in each period for a final rate of 1.5% in 2003-2004. In all other groups, the 2003-2004 rates were higher than the rates for the initial year, 1989-

1990, but it was difficult to see a clear trend. Rates for blacks were consistently from 2-3 times higher than for whites although this also fluctuated with no clear trend. Among black mothers in the city 5.9% reported 5 or more prior live births, in the state the figure was 3.3% and in the county it was 3.3%.

Epidemiologic Study of Risk Factors for Infant Mortality (2000-2004)

To determine which risk factors were most important in predicting neonatal mortality and post neonatal mortality in St. Louis City and in St. Louis County, we fit separate logistic regression models for each of the two localities (St. Louis City and St. Louis County) and for each of the two infant outcomes for the most recent 5 years of data. Included in each initial model were the following potential risk factors: maternal age (<18, 18-35, >35 years), maternal education (<12 years,≥12 years), paternal information not included, mother in 0,1,2, or 3 of 3 government assistance programs (WIC, Medicaid and food stamps). Maternal cigarette use , maternal alcohol use, prenatal care (adequate, inadequate and adequate plus), maternal anemia, inadequate maternal weight gain for pre-pregnancy weight category (underweight, normal, overweight, obese), and ≥5 prior live births (Model 1). Adjusted odds ratios (aOR) were calculated for each risk factor, adjusting for the effects of all other factors simultaneously, along with their 95% confidence intervals (CI). The results are reported in tables 30-33. To estimate the contribution each risk variable had to each infant mortality outcome (neonatal and post neonatal) over and above what they contributed to preterm birth or SGA (the two components of low birth weight), the same models were run again while adjusting for the effects of gestational age at birth and small-for-gestational age status (Model 2). While these two variables are presumed to be on the causal pathway between many of the risk factors and infant death, these analyses suggest what each variable might contribute to the variance in infant death in addition to what they contribute to preterm birth or growth retardation.

Neonatal mortality, St. Louis County. Table 30 shows that African American infants born in St. Louis County were almost 3 times more likely to die in their first 30 days of life than white infants (OR 2.9, CI 1.8-4.8). Infants had an elevated risk when the father's information was missing from the birth certificate (aOR 2.3, CI 1.6-3.4). Among mothers who were enrolled in at least one of the 3 poverty programs (WIC, Medicaid and foodstamps), those who were enrolled in 2 of the 3 had only half the risk (aOR 0.5, CI 0.4-0.8) and those enrolled in all three had only 20% (aOR 0.2, CI 0.1-0.3) of the risk of death experienced by infants whose mothers were enrolled in only one. This suggests a progressive protective effect from being enrolled in these government assistance programs. Cigarette use also predicted a 2-fold greater risk of neonatal death (aOR 1.9, CI 1.3-2.8). Alcohol use showed a protective effect (aOR 0.5, CI 0.4-0.8). This result is counter intuitive but may be a consequence of the lack of reliability in the measure. Alcohol use is greatly under reported in pregnancy, and there is so little confidence in the trust worthiness of this variable that it has been dropped from the newly revised birth certificate forms. While inadequate prenatal care utilization did not reach significance for neonatal mortality, adequate plus prenatal utilization did. Women who attended more than the standard recommendation for the number of prenatal visits (adjusted by length of gestation at birth) had almost twice (aOR 1.8, CI 1.2-2.6) the risk of a neonatal death than

women with the recommended number. These women are assumed to have medical complications of pregnancy warranting greater medical surveillance so would be expected to have poorer infant outcomes in spite of more than adequate care utilization. In addition women whose weight gain in pregnancy fell below the recommended level for her prepregnancy BMI were 4.5 times (CI 3.3-6.2) more likely to lose their infant within a month of birth. As expected, male gender (aOR 1.5, CI 1.1-2.0), having a multiple birth (aOR 6.3, CI 3.9-10.0) or having a life-threatening congenital anomaly (such as anencephaly, microcephaly or renal agenesis) (aOR 197.7, CI 45.9-852.4) also added to neonatal mortality risk. When gestational age and small for gestational age were added to the model (Model 2), absence of father's information, enrollment in 3 government assistance programs and male gender each continued to predict a significant amount of variance in infant mortality in the first month of life.

Neonatal mortality, St. Louis City. Table 31 reports the same results for neonatal infant deaths in the City of St. Louis. Being African American was an even stronger predictor than in the previous analyses (aOR 3.6, CI 2.7-4.9). Mothers who were under the age of 18 had risk of death which was less than a third that of mothers between 18-34. While this seems paradoxical, it is consistent with some other research that shows that when poverty, minority status, and education are held constant that young maternal age (but not below 15) is associated with greater infant survival (Markovitz et al., 2005). Education less than 12 years (aOR 2.5, CI 1.7-3.7) and father's information missing (aOR 2.1, CI 1.6-3.0) also contributed significantly to neonatal mortality risk. The number of poverty programs also contributed in a dose-response manner although the odds ratios showed a slightly lower contribution to risk (aOR 0.6 for 2 of 3, CI 0.4-0.9, and aOR 0.3 for 3 of 3, CI 0.2-0.6. Adequate plus prenatal care utilization was also associated, as was inadequate gestational weight gain, although each of these contributed more to the overall risk than they did in the county (aOR 2.5 for adequate plus, CI 1.9-3.4 and aOR 5.4 for inadequate weight gain, CI 4.2-6.9). While male gender did not achieve significance, multiple gestations contributed a nearly 7-fold increase in risk (aOR 6.7, CI 4.9-9.2). Congenital anomalies contributed a great increase in risk (aOR 197.7, CI 45.9-852.4) as they had for deaths in the county.

Post neonatal mortality, St. Louis County. Between 2000 and 2004, 131 infants were born in St. Louis County who lived through their first month of life but died before their first birthday. Table 32 reports the results of analyses that identify which risk factors that are associated with the likelihood of these deaths. Race predicts risk such that African American infants have 2.4 times the risk (CI 1.5-3.9) of post neonatal death than white infants. For these later deaths, the number of government assistance programs did not predict mortality risk. Both inadequate prenatal care (OR 2.4, CI 1.3-4.6) and inadequate plus care utilization (OR 1.7, CI 1.1-2.6) contributed to risk. That is, women who started care late or reported fewer than the recommended number of visits were at almost 2.5 times the risk of losing their infant before their first birthday and women with more than recommended level (and therefore assumed to have a medically complicated pregnancy) were twice as likely to have their infant die in the post neonatal period. Women whose gestational weight gain was less than recommended also had nearly twice the risk (OR 1.9, CI 1.3-2.9) as women who gained the recommended amount or more. Other

significant risk factors included male gender (aOR 1.8, CI 1.2-4.5), multiple births (aOR 2.3, CI 1.2-4.5), and life threatening congenital anomalies (aOR 215.3, CI 39.5->999.9). When the model was run again with the effects of gestational age at birth and being small for gestational age held constant (Model 2), all of the risk factors already listed remained significant except for multiple births, adequate plus prenatal care utilization and inadequate gestational weight gain. This suggests that the effects of these last 3 variables work through preterm birth and growth retardation.

Post neonatal mortality, St. Louis City. Post neonatal mortality in the city (Table 33) shows only 3 significant risk factors: Black race (aOR 2.9, CI 1.4-6.2), inadequate gestational weight gain (aOR 1.7, CI 1.1-2.7) and multiple gestations (aOR 2.6, 1.2-5.7).When gestational age and small for gestational age were added (Model 2) these factors were highly significant but the only risk factor that predicted post neonatal mortality while also controlling for these factors was maternal African American race (aOR 1.2, CI 1.2-5.4).

Trends. Table 34 summarizes the trends observed in infant mortality and intermediate outcomes like low birth weight and preterm birth over the 16 years of surveillance (1989 to 2004, as displayed in Tables and Figures 1-15a) and the trends in risk factors reported in the literature as associated with infant mortality such as maternal age or education (Tables and Figures 16-29).

Discussion

Infant mortality, the primary focus of these analyses, is any death within the first year of life. Rates have been declining in the US for many years. In the three areas compared in this report, infant mortality was slightly lower at the end of the 16 year period than at the start. However, in all three localities and both races, the rates hit their lowest point for the 16 years in the mid-nineties, and by the end of our surveillance period only the white city rate has returned to those low levels. Since the mid-1990s, the infant mortality rates have increased in each area and race group for varying lengths of time before beginning to decline again. For African American births in all areas and for whites in the city, this decline did not begin until the second to last period (2001-2002). So, while the last infant mortality rates are slightly better than the earliest rates, we have lost or at least not gained ground on infant mortality for all groups over the last 10 years tracked. The city and county trends have been similar to those of the state, although the increase in mortality in the last decade was sharper for African American infants in the city. At the most recent period, there is little difference by locality within each race group, but St. Louis City and County show greater racial disparity with 3 times as many African American infant deaths than whites, compared to 2 times as many for the state.

We determined when infant deaths occurred to look for clues that may help explain trends in infant mortality. Fetal deaths are not included in the infant mortality rate but trends in these deaths before birth may provide hints about what influences the infant mortality rate. While fetal deaths have fluctuated, they have been essentially stable for whites. For African Americans, fetal death rates have been consistently about 2 times higher than the white rate. African American fetal death rates were similar at the

beginning and end of the 16 year period, but fell (9-10 deaths per 1,000 live births/fetal deaths) to a low during 1995-1996 and have been increasing gradually since.

Neonatal mortality (death in the first 28 days of life) trends for whites are fairly similar to fetal mortality. The rates are largely stable, with a slight downward trend, hitting lows in the mid-1990s followed by increasing rates which have again declined in the last 4-6 years. The 2003-2004 rates for all groups were very similar to the rate in 1989-1999 so the overall trend was pretty stable but with some decline in the more recent periods. Neonatal mortality trends for African American infants were similar to the patterns for infant mortality in that the lowest rates for the 16 years were reached in 1993-1994, followed by increasing rates to 1999-2000. Only in the last two periods (2001-2004) did the rate begin to fall again. The neonatal mortality rates at the end of the observation period are slightly higher than in 1989-1990 for African Americans in the city and for the state. Only for St. Louis County is the 2003-2004 rate slightly lower than the rate 16 years before.

While neonatal mortality historically reflected health during pregnancy and birth, postneonatal mortality is believed to be more influenced by the conditions after birth than neonatal mortality. Overall trends in postneonatal mortality have been more muted than for neonatal mortality or infant mortality. Postneonatal mortality among white infants showed fluctuations without a clear trend in the city; for the county and state they declined to a low of from 1-2% of births in 1999-2000, and then showed little change to the end of the observation period (2003-2004). African American postneonatal deaths have fluctuated in the city of St. Louis and have shown no clear trend. In the county rates fluctuated until the mid-nineties and then have been fairly stable. In the state, rates declined to 1995-1996 and have been stable since. For all groups, post neonatal mortality rates has been stable for the last 10 years so it would appear that neonatal mortality contributes more to the current trends in infant mortality than post neonatal mortality. This, in turn, suggests that it is health prior to and during pregnancy and birth that is most reflected in current trends.

Intermediate outcomes like preterm birth and small-for-gestational-age births also give us clues about infant mortality since their etiology can be quite different. Low birth weight births are made up of births that are either preterm, small-for-gestational-age, or both. Preterm births have increased in all three areas for whites with a greater rate of increase over the last decade. African American rates have increased in the most recent four years (2000-2004). In the city, African-American rates increased for the decade from 1989-1998, although at a slower rate than for whites, and then decreased for several years with the most recent rates equal to the rates of a decade ago (123.6 per 1,000 live births). Sub-analyses suggest that moderately preterm births (32 to <36 weeks) account for most of the trend in preterm births. Racial disparities have decreased over time because the white rates are increasing at a greater rate than African American rates. Small-for-gestational-age births have been decreasing since the mid-1990s for both African American and white births in all three geographic localities. Although white rates are slightly higher than African American, there is little racial disparity for this outcome. In summary,

preterm birth appears to be increasing in its relative influence on infant mortality and has greater influence than does small-for-gestational-age births.

Many influences simultaneously affect risk of infant death and to estimate the relative influence of *risk factors* in St. Louis and St. Louis County. We used logistic regression methods to adjust statistically for the effects of a set of potential risk factors drawn from the literature. This allows estimation of the effect of each individual risk factor while holding constant the effects of the others. Table 35 summarizes the results for the period 2000-2004 and compares them to results obtained for the deaths that occurred in the previous 5 years (1995-1999). It also describes the trend in each risk factor over the 16 years of surveillance. Risk factors significant in both time periods include: the absence of father's information on the birth certificate (neonatal mortality for the city and county and post neonatal mortality in the city), mother enrolled in more than 1 of 3 government assistance programs (protective for neonatal mortality), inadequate prenatal care utilization, adequate plus prenatal care utilization (assumed to be medically complicated pregnancies), inadequate gestational weight gain, and multiple births. Missing father information probably indicates a high level of social distress and has increased in the most recent years. The number of government assistance programs in which mothers are enrolled, among those who are enrolled in at least one, has shown a protective effect with 2 being better than one and three showing the greatest protective effect. In the prior 5 years examined this was significant only in the city, for the more recent 5 years it was significant in both city and county. Inadequate prenatal care utilization was predictive of post neonatal mortality only. You would expect prenatal care utilization to have its greatest impact on neonatal mortality, but adequacy of prenatal care reflects both social risk factors associated with starting late or not keeping the recommended appointments and the effects of not being adequately medically monitored. The association with post neonatal mortality suggests the effect here reflects social circumstances. Inadequate gestational weight gain predicted only neonatal mortality in the earlier analyses but in the current analyses (2000-2005) it predicted mortality in both the neonatal and post neonatal periods. This was in spite of declining prevalence in inadequate gestational weight gain although the rate of decline has slowed among African American women. Not surprisingly, multiple births remain an important predictive factor and they have been increasing among white births over the entire 16 years and among African American births since 1997-1998.

Trends in risk factors that do not contribute currently (as reflected in the multivariate analyses) are important in what they may reflect for future trends. For instance, the prevalence of births to young mothers has been declining for some time but that decline appears to be leveling off and may begin to increase again. In addition, while the prevalence of women giving birth who have had at least 5 children does not show a clear trend, the last prevalence (2003-2004) was the highest in the 16 years examined. Lastly, the apparent emerging trend of increasing tobacco use among pregnant African American women is of concern. Educational efforts, messages from prenatal care providers and warnings about pregnancy risk on tobacco products have brought about major declines in tobacco use in pregnancy in both races over the 16 year period. But, in recent years tobacco companies have targeted marketing to low-income minority communities and the

observed trend of increasing use among African Americans may reflect the success of these marketing practices.

TABLES

Table 1 Fetal Deaths (defined as all fetal deaths ≥ 20 weeks gestation)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	639	5.2	643	5.3	552	4.8	584	5.0	587	5.0	518	4.4	533	4.7	557	4.8
MO Black	290	11.1	284	10.6	288	11.7	199	9.1	228	10.3	251	11.2	237	10.9	261	11.9
County White	100	4.5	78	3.6	71	3.5	88	4.5	91	5.0	79	4.6	63	3.9	77	4.9
County Black	65	10.9	89	13.6	80	12.4	59	9.8	70	11.0	69	10.2	83	12.6	90	13.4
City White	18	3.1	26	5.2	18	4.2	22	5.9	19	5.3	20	5.8	21	6.2	16	4.8
City Black	118	11.1	110	10.2	110	11.6	66	8.6	81	11.1	90	12.9	74	11.4	98	15.0

Rate = number of deaths per 1,000 live births and fetal deaths

2010 Objectives
(4.1 / 1000)

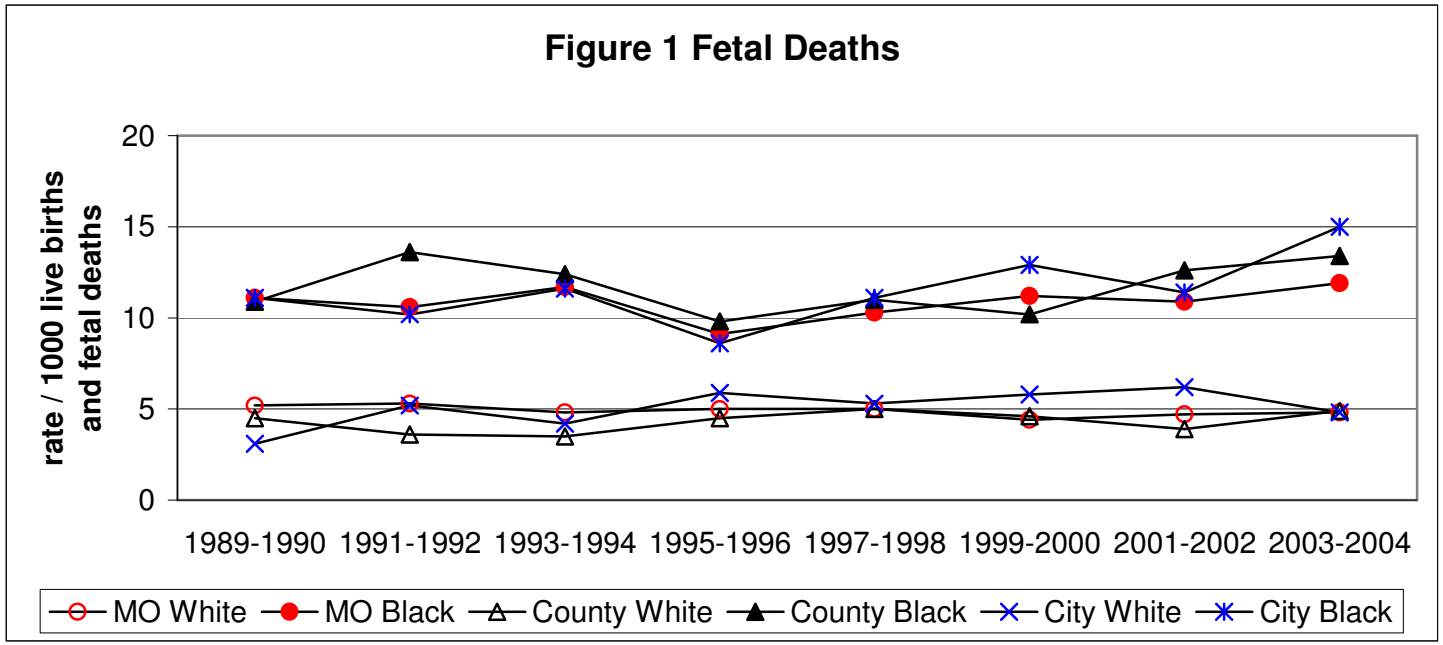


Table 2 Perinatal Mortality (defined as all fetal deaths ≥28 weeks gestation and deaths among life births during first 6 days of life)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	878	7.1	817	6.8	712	6.1	681	5.9	685	5.9	657	5.6	679	5.9	708	6.1
MO Black	355	13.5	381	14.2	327	13.2	266	12.1	291	13.1	302	13.5	313	14.4	301	13.7
County White	151	6.8	115	5.4	105	5.1	84	4.3	113	6.2	81	4.7	84	5.2	99	6.3
County Black	84	14.1	110	16.8	84	13.0	71	11.8	92	14.4	87	12.9	105	15.9	99	14.7
City White	32	5.6	32	6.4	25	5.9	23	6.1	26	7.2	21	6.0	19	5.6	15	4.5
City Black	134	12.6	135	12.5	120	12.6	85	11.1	100	13.7	115	16.5	101	15.5	102	15.6

Rate = number of deaths per 1,000 live births and fetal deaths

2010 Objectives
(4.5 / 1000)

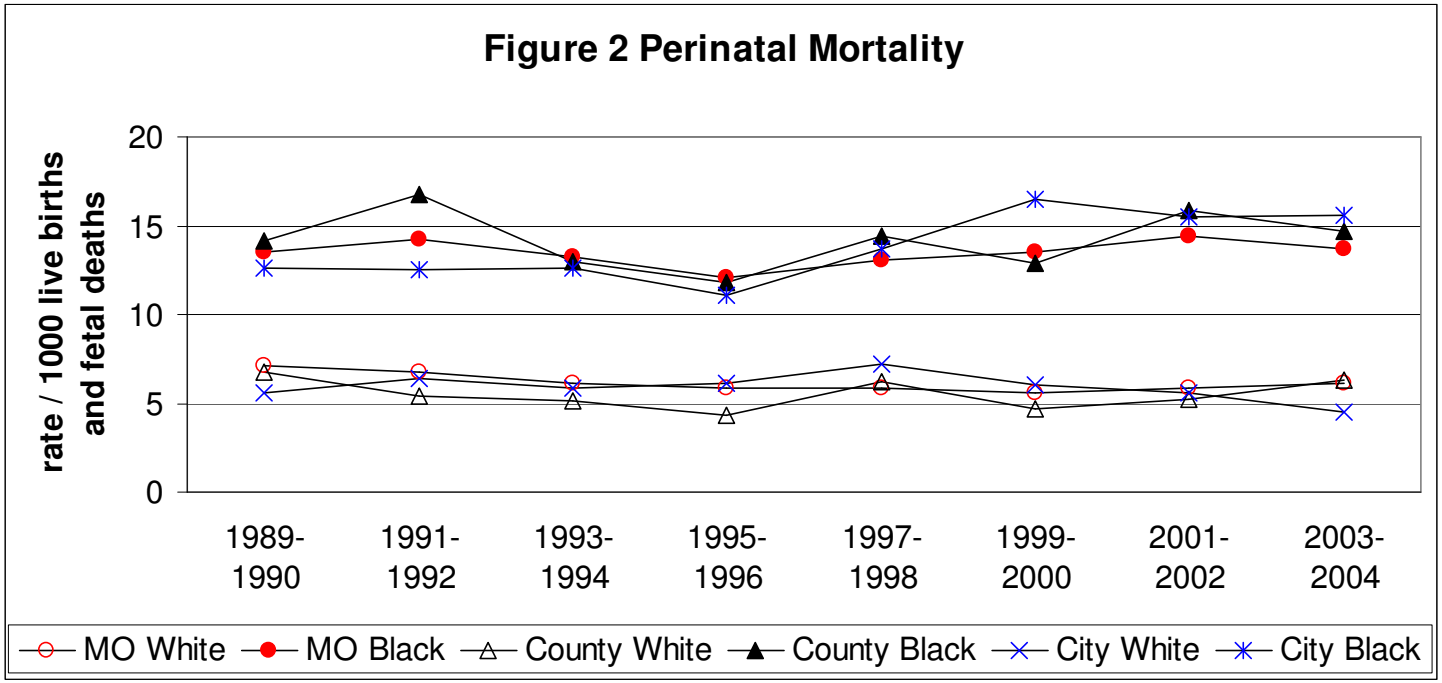


Table 3 Infant Mortality (defined as all deaths among live births during first year of life)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	952	7.8	857	7.2	760	6.6	717	6.2	706	6.1	693	6.0	727	6.4	756	6.5
MO Black	447	17.3	469	17.7	342	14.0	312	14.4	359	16.3	343	15.5	352	16.4	315	14.6
County White	141	6.3	123	5.8	110	5.4	83	4.3	110	6.1	72	4.2	77	4.8	83	5.3
County Black	95	16.2	113	17.5	71	11.1	83	14.0	102	16.2	105	15.7	114	17.5	103	15.5
City White	41	7.2	32	6.5	21	5.0	33	8.8	25	7.0	22	6.4	21	6.2	16	4.8
City Black	189	18.0	187	17.5	140	14.9	107	14.2	132	18.3	127	18.5	122	19.0	98	15.3

Rate = number of deaths per 1,000 live births

2010 Objectives
(4.5 / 1000)

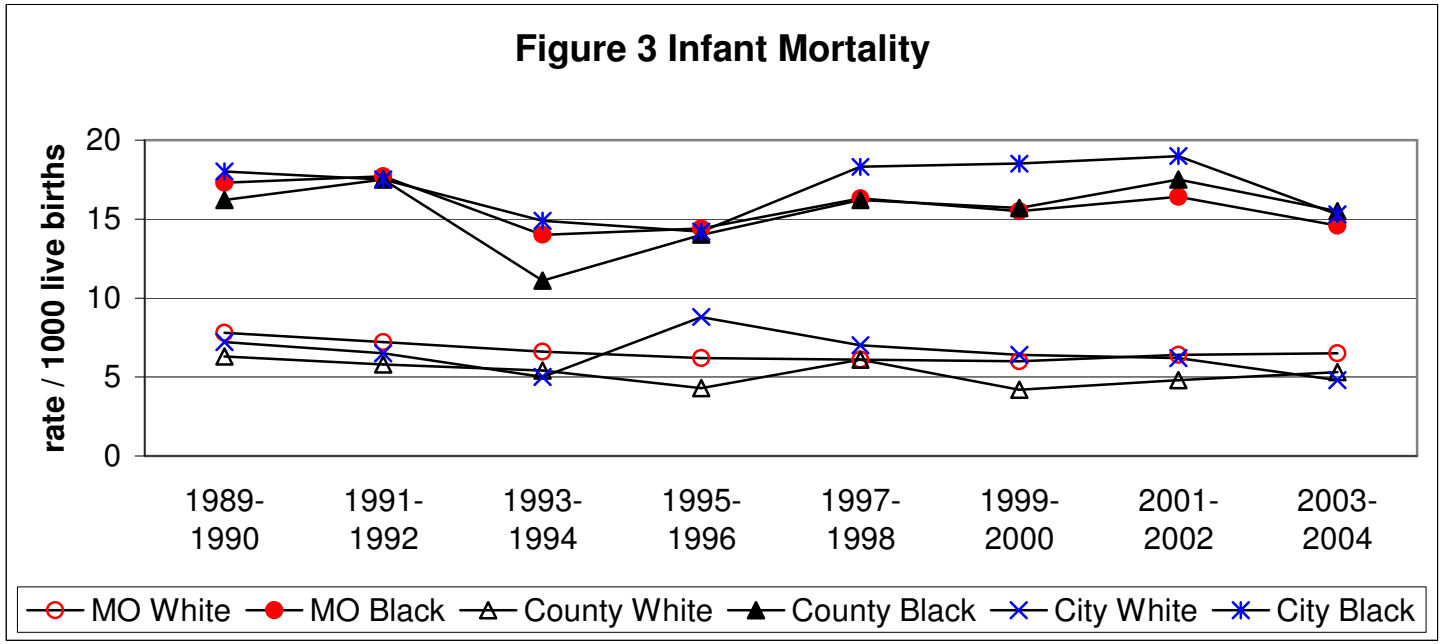


Table 4 Neonatal Mortality (defined as all deaths among live births through the first 27 days of life)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	600	4.9	533	4.5	481	4.2	452	3.9	459	4.0	458	3.9	478	4.2	507	4.4
MO Black	252	9.7	300	11.3	218	8.9	203	9.3	232	10.6	240	10.9	239	11.1	216	10.0
County White	99	4.5	85	4.0	80	3.9	53	2.8	80	4.4	51	3.0	56	3.5	64	4.1
County Black	65	11.1	74	11.5	51	8.0	52	8.7	75	11.9	74	11.1	82	12.6	73	11.0
City White	26	4.5	20	4.0	13	3.1	20	5.4	20	5.6	20	5.8	12	3.6	14	4.2
City Black	96	9.1	116	10.9	81	8.6	64	8.5	79	10.9	95	13.8	80	12.4	62	9.6

Rate = number of deaths per 1,000 live births

2010 Objectives
(2.9 / 1000)

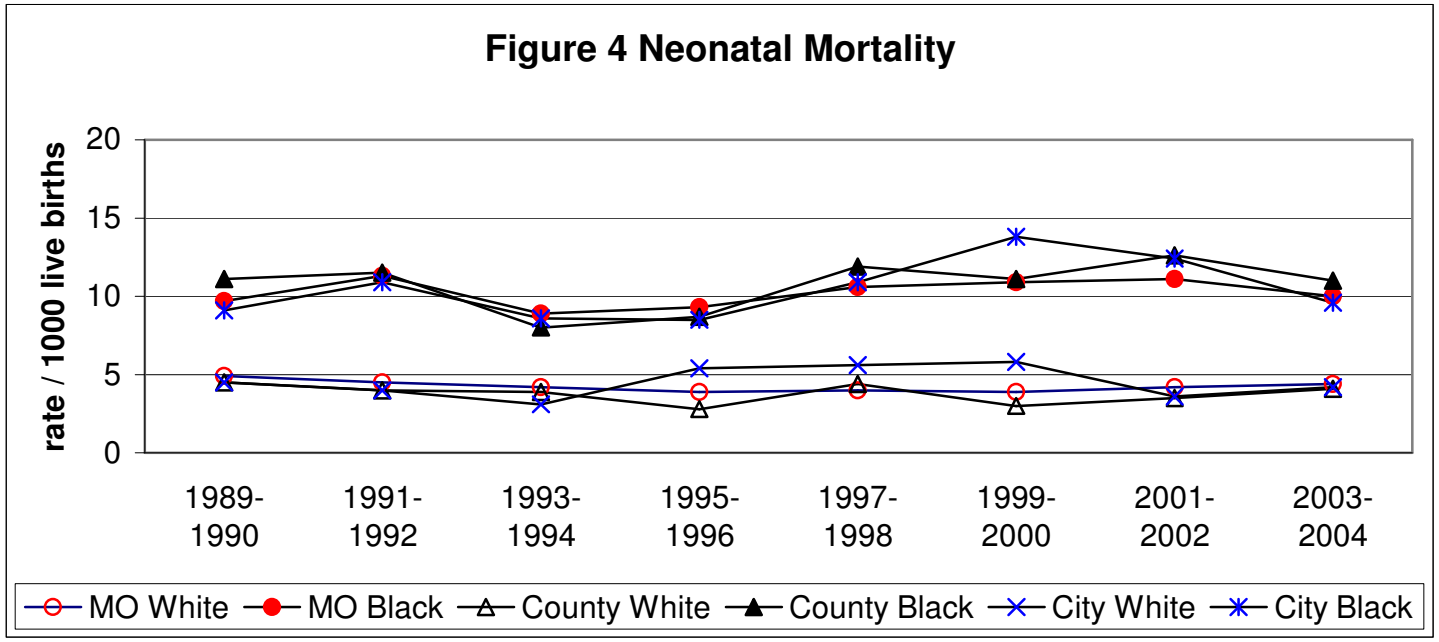


Table 5 Postneonatal Mortality (defined as all deaths among live borns from 28 days through first year of life)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	352	2.9	324	2.7	279	2.4	265	2.3	247	2.1	235	2.0	249	2.2	249	2.2
MO Black	195	7.5	169	6.4	124	5.1	109	5.0	127	5.8	103	4.7	113	5.3	99	4.6
County White	42	1.9	38	1.8	30	1.5	30	1.6	30	1.7	21	1.2	21	1.3	19	1.2
County Black	30	5.1	39	6.0	20	3.1	31	5.2	27	4.3	31	4.6	32	4.9	30	4.5
City White	15	2.6	12	2.4	8	1.9	13	3.5	5	1.4	2	0.6	9	2.7	2	0.6
City Black	93	8.8	71	6.7	59	6.3	43	5.7	53	7.3	32	4.7	42	6.5	36	5.6

Rate = number of deaths per 1,000 live borns

2010 Objectives
(1.2 / 1000)

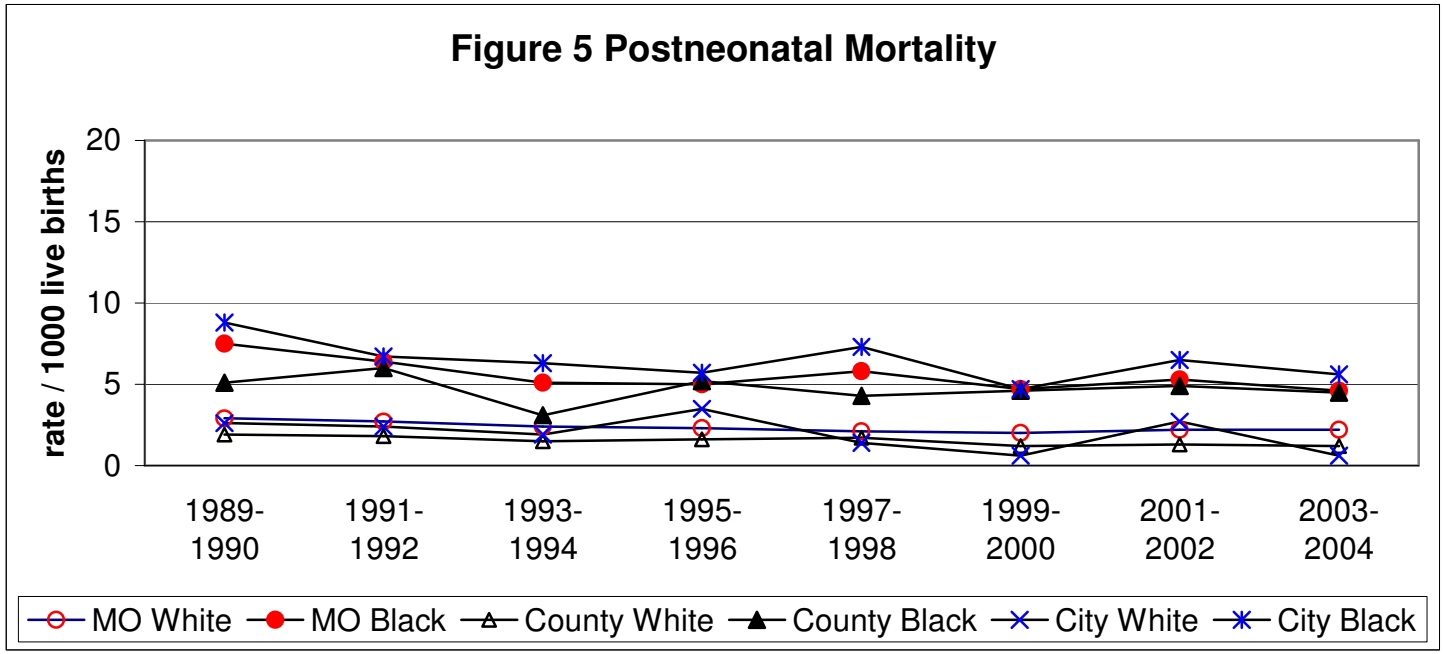


Table 6 Infant Mortality / Perinatal Conditions

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	309	2.5	253	2.1	235	2.0	213	1.8	232	2.0	258	2.2	270	2.4	320	2.8
MO Black	178	6.9	235	8.9	146	6.0	141	6.5	163	7.4	164	7.4	195	9.1	179	8.3
County White	48	2.2	48	2.3	38	1.9	28	1.5	41	2.3	31	1.8	32	2.0	45	2.9
County Black	43	7.3	55	8.5	34	5.3	41	6.9	62	9.8	49	8.1	69	10.6	67	10.1
City White	9	1.6	12	2.4	6	1.4	9	2.4	10	2.8	12	3.5	9	2.7	9	2.7
City Black	74	7.0	96	9.0	57	6.1	40	5.3	55	7.6	69	10.0	65	10.1	53	8.2

2010 Objectives
(NA)

Rate = number of deaths per 1,000 live births

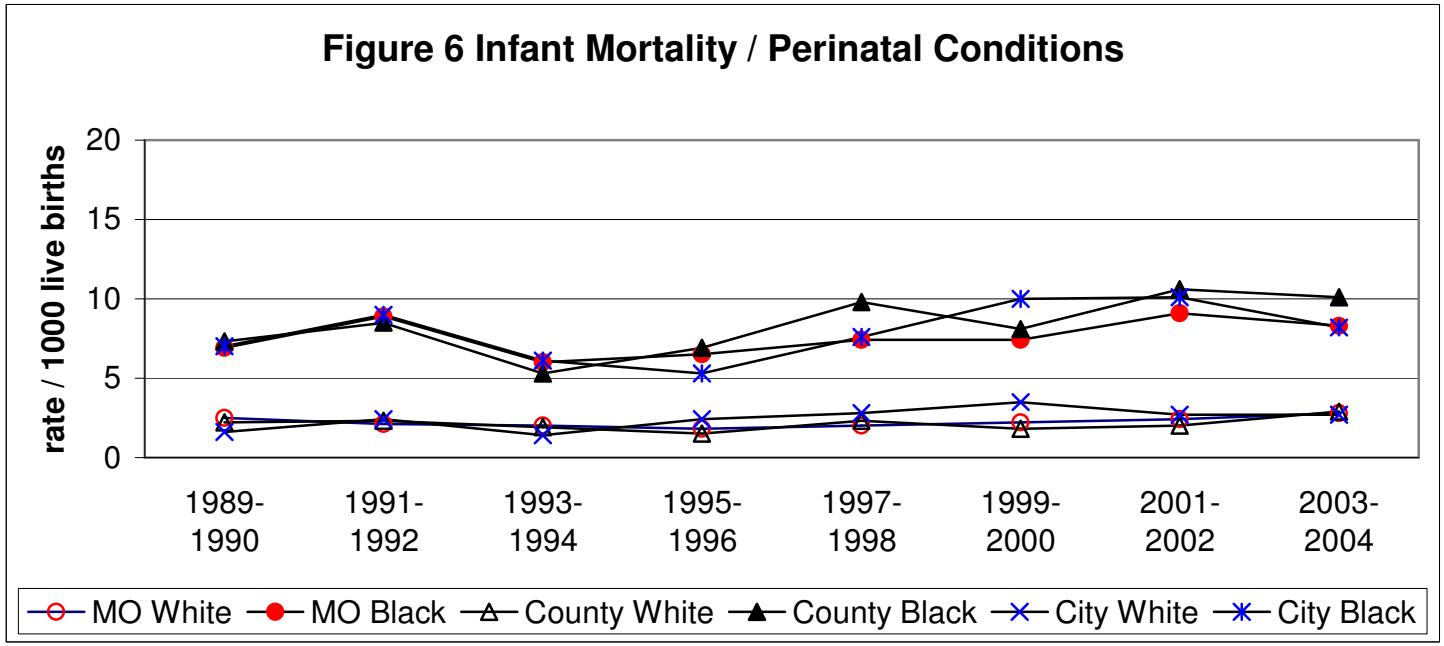


Table 7 Infant Mortality / Congenital Anomalies

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	247	2.0	249	2.1	211	1.8	210	1.8	216	1.9	169	1.5	177	1.6	175	1.5
MO Black	56	2.2	43	1.6	61	2.5	49	2.3	48	2.2	44	2.0	40	1.9	37	1.7
County White	43	1.9	36	1.7	42	2.1	22	1.1	38	1.7	23	1.3	26	1.6	16	1.0
County Black	12	2.0	12	1.9	11	1.7	12	2.0	16	2.4	17	2.5	13	2.0	12	1.8
City White	12	2.1	5	1.0	7	1.7	8	2.1	7	1.9	6	1.7	4	1.2	3	0.9
City Black	20	1.9	14	1.3	21	2.2	22	2.9	19	2.7	19	2.8	9	1.4	6	0.9

Rate = number of deaths per 1,000 live borns

2010 Objectives
(1.1 / 1000)

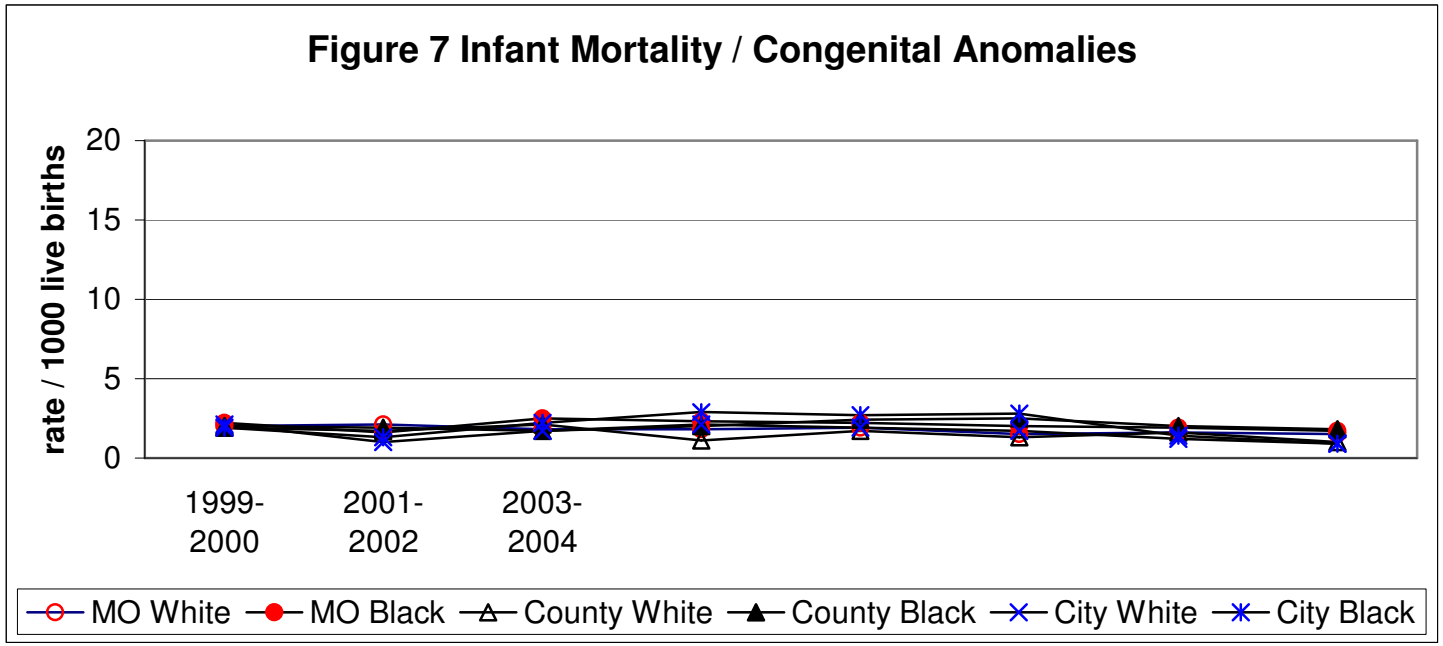


Table 8 Infant Mortality / Sudden Infant Death Syndrome (SIDS)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	159	1.3	172	1.4	128	1.1	97	0.8	101	0.9	71	0.6	78	0.7	60	0.5
MO Black	103	4.0	60	2.3	53	2.2	37	1.7	60	2.7	32	1.4	28	1.3	17	0.8
County White	18	0.8	17	0.8	9	0.4	15	0.8	10	0.6	8	0.5	4	0.2	4	0.3
County Black	17	2.9	11	1.7	6	0.9	10	1.7	17	2.7	8	1.2	4	0.6	1	0.2
City White	8	1.4	10	2.0	4	0.9	5	1.6	3	0.8	0	0.0	2	0.6	0	0.0
City Black	40	3.8	28	2.6	25	2.7	14	1.9	23	3.2	9	1.3	15	2.3	6	0.9

Rate = number of deaths per 1,000 live births

2010 Objectives
(0.25 / 1000)

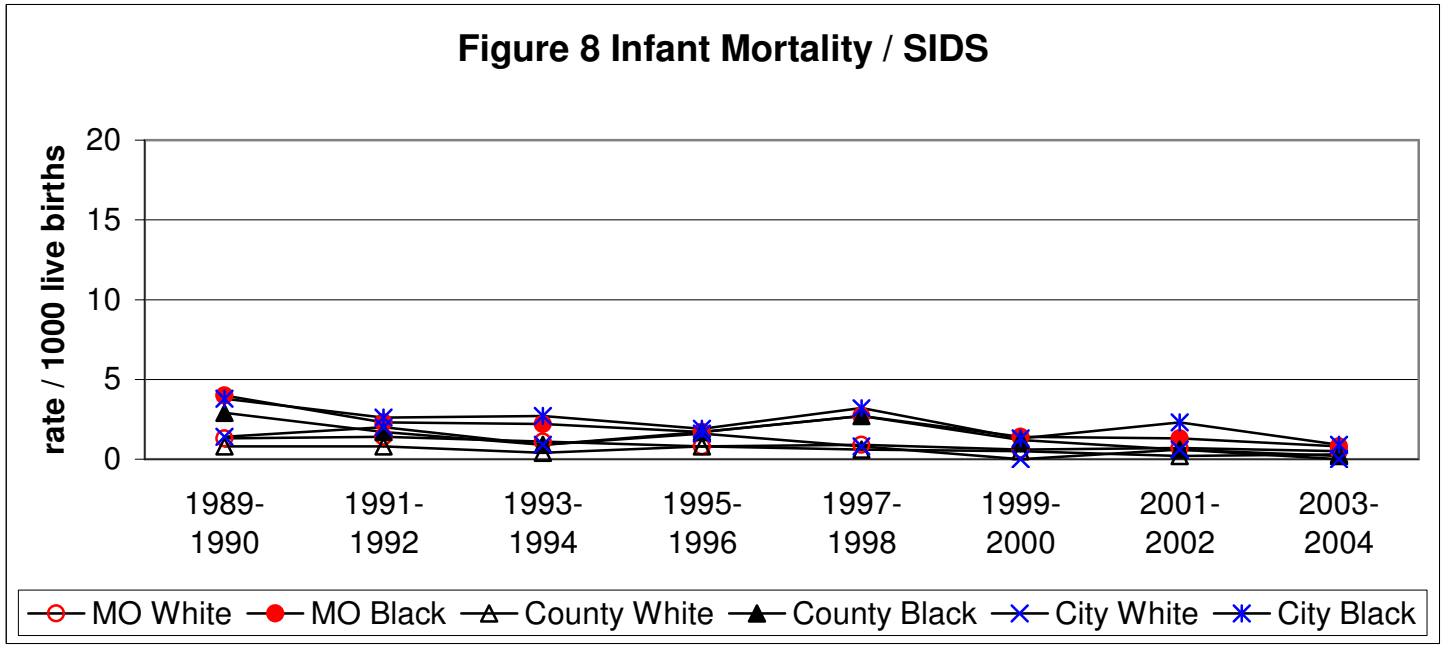


Table 9 Infant Mortality / All Other Deaths

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	237	1.9	183	1.5	186	1.6	197	1.7	157	1.4	195	1.7	202	1.8	201	1.7
MO Black	110	4.2	131	4.9	82	3.4	85	3.9	88	4.0	103	4.7	89	4.2	82	3.8
County White	32	1.4	22	1.0	21	1.0	18	0.9	21	1.2	10	0.6	15	0.9	18	1.2
County Black	23	3.9	35	5.4	20	3.1	20	3.4	7	1.1	31	4.6	28	4.3	23	3.5
City White	12	2.1	5	1.0	4	0.9	11	2.9	5	1.4	4	1.2	6	1.8	4	1.2
City Black	55	5.2	49	4.6	37	3.9	31	4.1	43	6.0	30	4.4	33	5.1	33	5.1

2010 Objectives
(NA)

Rate = number of deaths per 1,000 live births

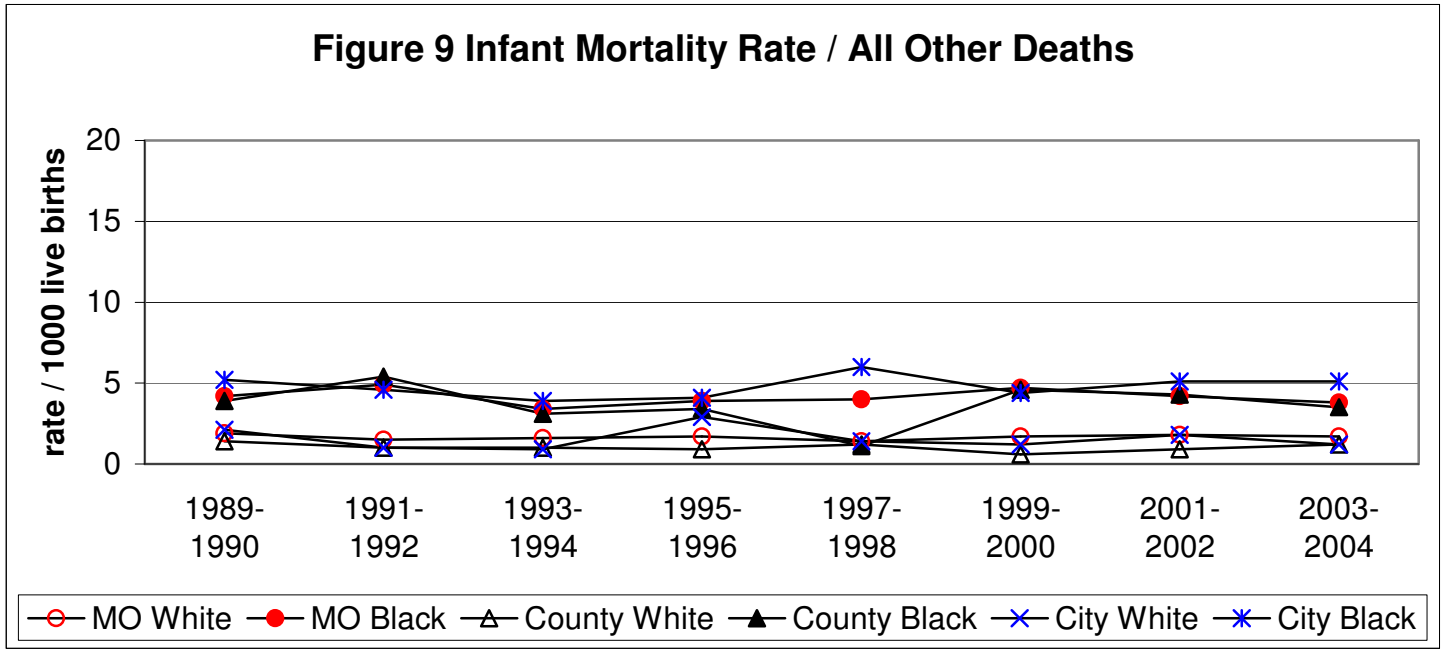


Table 10 Low Birth Weight (defined as all live births weighing less than 2500 grams)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	7,042	57.6	7,287	60.9	7,300	63.3	7,473	64.9	7,783	67.0	7,717	66.3	7,881	69.3	8,356	72.2
MO Black	3,420	132.0	3,630	136.8	3,294	134.9	2,909	133.9	3,028	137.8	2,991	135.3	2,867	133.7	2,976	137.6
County White	1,117	50.3	1,170	54.9	1,094	53.5	1,112	57.7	1,112	61.3	1,069	62.2	1,139	70.5	1,063	68.4
County Black	687	116.8	840	130.1	776	121.7	736	123.8	831	131.7	894	133.7	847	130.1	899	135.2
City White	381	66.5	323	65.4	310	73.1	278	74.5	278	77.6	251	72.7	256	75.9	237	71.7
City Black	1,443	137.2	1,548	145.2	1,340	142.9	1,098	145.2	1,052	145.6	993	144.4	944	146.7	936	145.7

2010 Objectives
(50 / 1000)

Rate = number of deaths per 1,000 live births

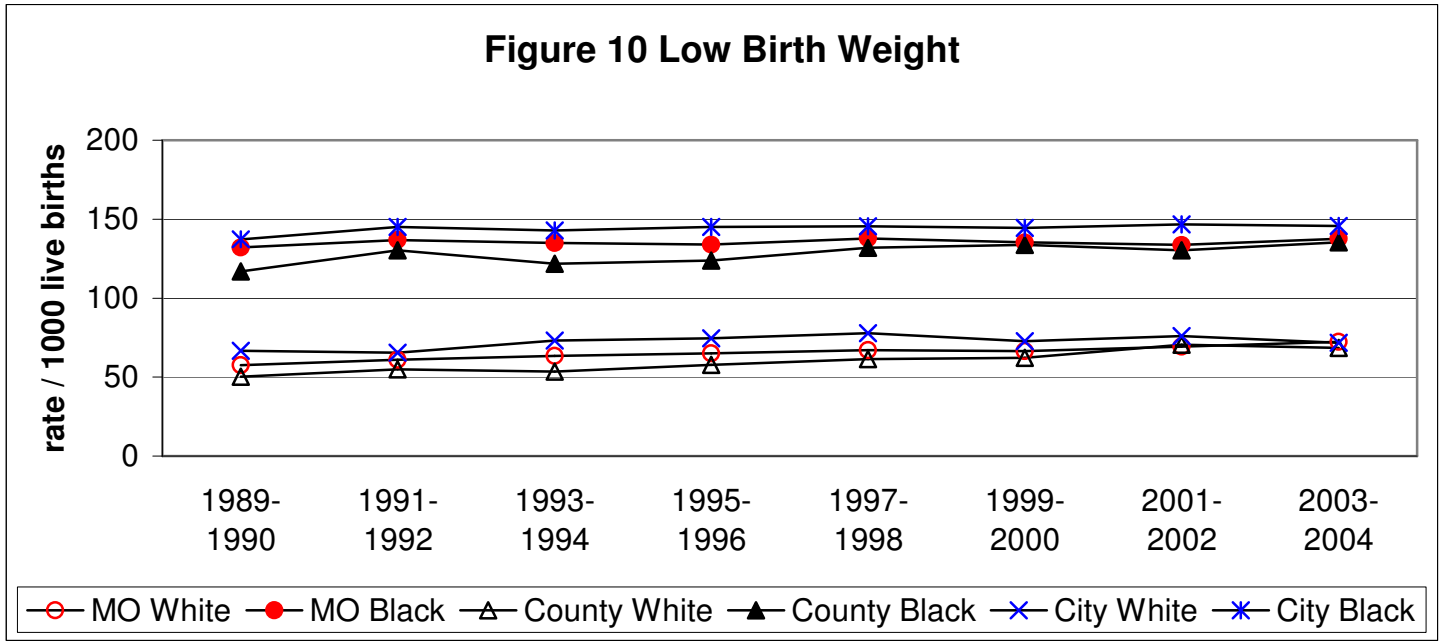


Table 11 Moderately Low Birth Weight (defined as all live births weighing 1500-2499 grams)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	5,932	48.5	6,131	51.2	6,112	53.0	6,296	54.6	6,495	55.9	6,359	54.6	6,498	57.2	6,922	59.8
MO Black	2,710	104.6	2,840	107.0	2,632	107.8	2,302	106.0	2,355	107.2	2,258	102.1	2,191	102.2	2,236	103.4
County White	938	42.2	968	45.4	906	44.3	948	49.3	940	51.8	909	52.9	945	58.5	848	54.5
County Black	543	92.3	654	101.3	613	96.1	583	98.1	645	102.2	682	102.0	646	99.2	661	99.4
City White	321	56.0	269	54.4	261	61.6	225	60.3	225	62.8	205	59.4	206	61.1	207	62.6
City Black	1,131	107.5	1,221	114.6	1,084	115.6	883	116.8	812	112.4	741	107.8	729	113.3	715	111.3

2010 Objectives
(NA)

Rate = number of infants with low birth weight per 1,000 live births

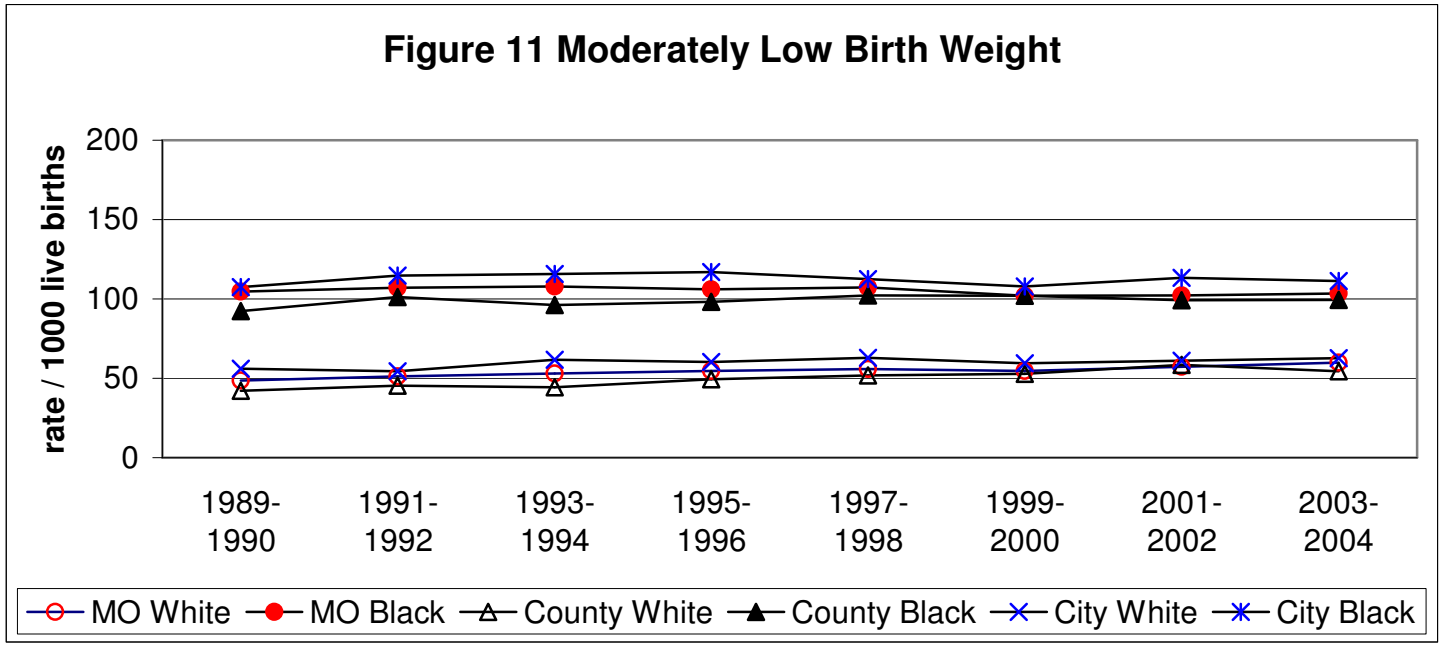


Table 12 Very Low Birth Weight (defined as all live births weighing less than 1500 grams)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	1,110	9.1	1,156	9.7	1,188	10.3	1,177	10.2	1,288	11.1	1,358	11.7	1,383	12.2	1,434	12.4
MO Black	710	27.4	790	29.8	662	27.1	607	27.9	673	30.6	733	33.2	676	31.5	740	34.2
County White	179	8.1	202	9.5	188	9.2	164	8.5	172	9.5	160	9.3	194	12.0	215	13.8
County Black	144	24.5	186	28.8	163	25.6	153	25.7	186	29.5	212	31.7	201	30.9	238	35.8
City White	60	10.5	54	10.9	49	11.6	53	14.2	53	14.8	46	13.3	50	14.8	30	9.1
City Black	312	29.7	327	30.7	256	27.3	215	28.4	240	33.2	252	36.7	215	33.4	221	34.4

Rate = number of infants with moderately low birth weight per 1,000 live births

2010 Objectives
(9 / 1000)

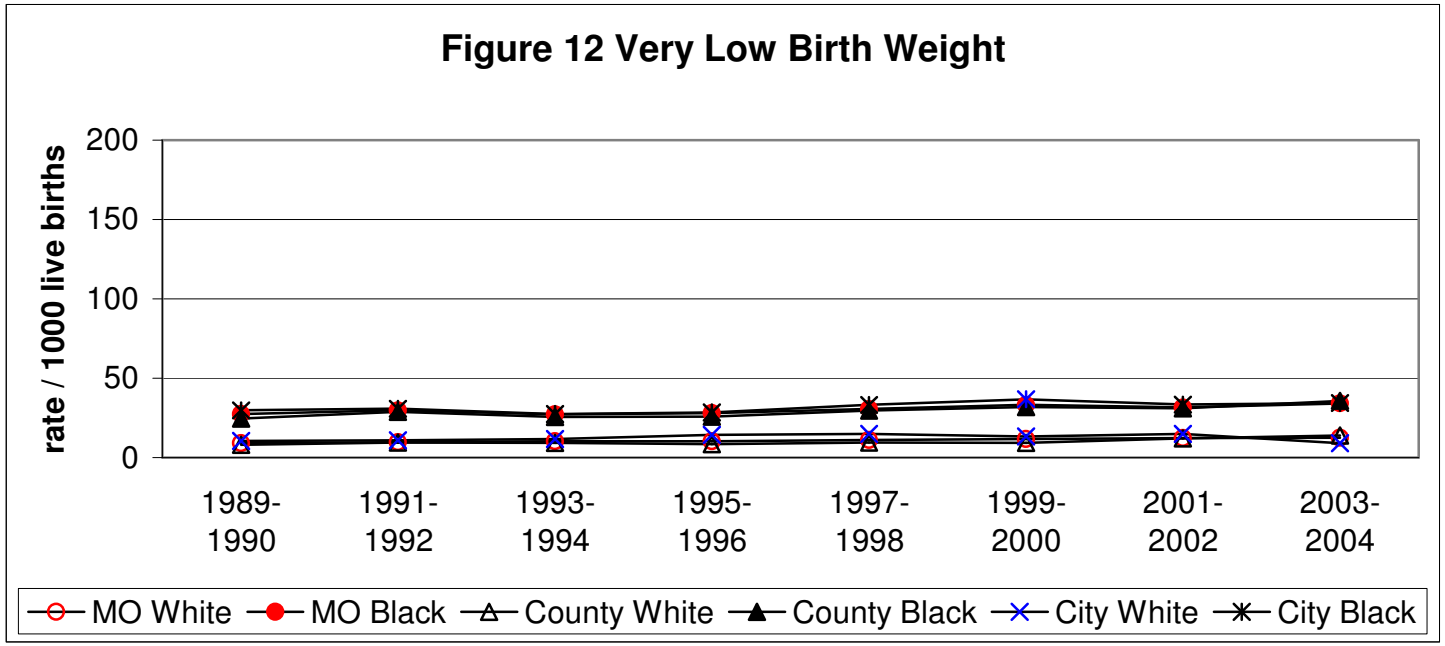


Table 13 Preterm Delivery (defined as all live births delivered at less than 37 weeks gestation)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	8,230	67.4	8,446	70.6	8,634	74.8	9,397	81.5	9,685	83.4	10,219	87.8	10,554	92.8	11,487	99.2
MO Black	3,637	140.4	3,828	144.2	3,491	143.0	3,085	142.0	3,075	140.0	3,091	139.8	3,202	149.4	3,208	148.3
County White	1,502	67.6	1,449	68.0	1,385	67.7	1,561	81.0	1,501	82.8	1,533	89.2	1,645	101.9	1,678	107.9
County Black	772	131.2	880	136.3	816	128.0	791	133.1	859	136.2	962	143.9	984	151.2	1,023	153.9
City White	437	76.3	388	78.5	342	80.7	336	90.0	368	102.7	323	93.5	331	98.2	352	106.5
City Black	1,569	149.1	1,688	158.4	1,491	159.1	1,194	157.9	1,192	165.0	1,056	153.6	1,110	172.4	1,030	160.3

2010 Objectives
(76 / 1000)

Rate = number of preterm deliveries per 1,000 live births

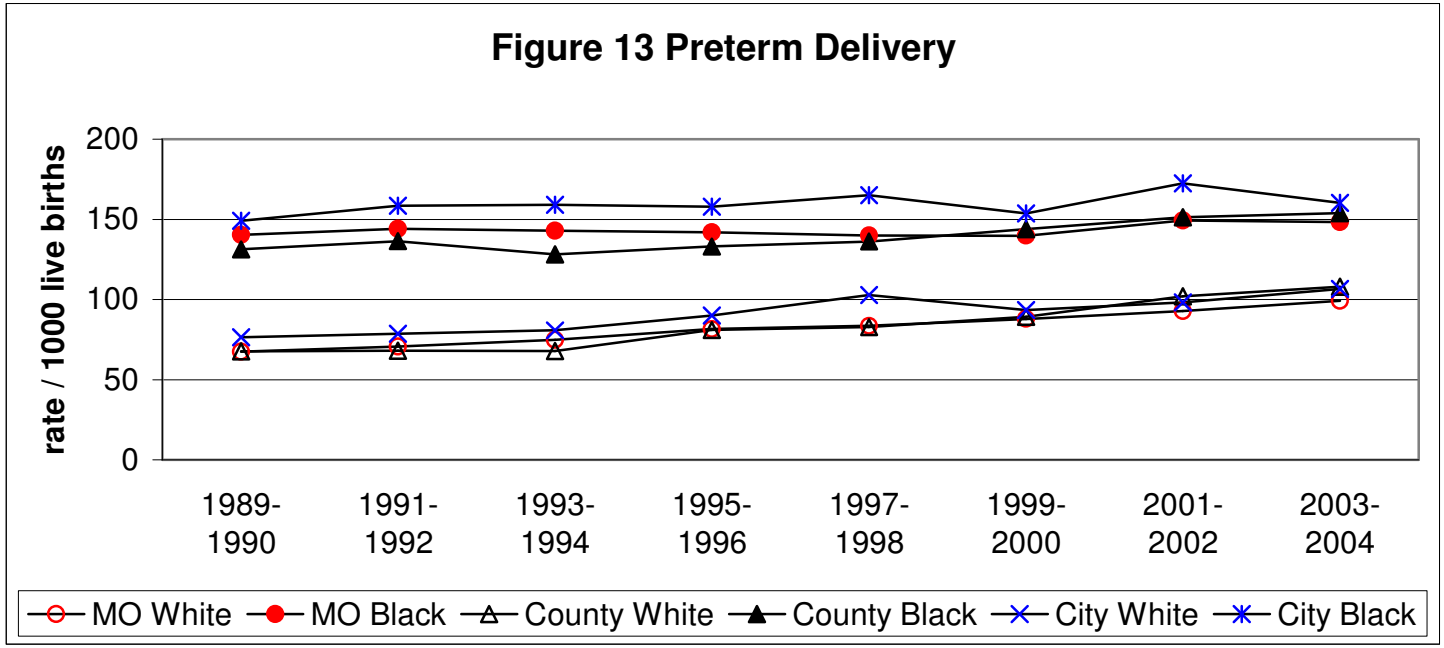


Table 14 Preterm Delivery 32-36 weeks (defined as all live births delivered at 32-36 weeks gestation)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	6,951	56.9	7,092	59.3	7,286	63.2	8,069	70.0	8,230	70.9	8,686	74.6	8,999	79.2	9,862	85.2
MO Black	2,773	107.0	2,914	109.8	2,734	112.0	2,413	111.1	2,353	107.1	2,278	103.0	2,440	113.8	2,420	111.9
County White	1,281	57.6	1,214	56.9	1,173	57.4	1,385	71.9	1,292	71.2	1,354	78.7	1,437	89.0	1,437	92.4
County Black	594	101.0	675	104.6	634	99.4	624	105.0	653	103.5	729	109.1	758	116.4	769	115.7
City White	372	64.9	326	66.0	292	68.9	281	75.3	306	85.4	273	79.0	267	79.2	311	94.1
City Black	1,202	114.2	1,280	120.1	1,177	125.6	947	125.2	928	128.4	776	112.9	856	113.0	794	123.6

2010 Objectives
(64 / 1000)

Rate = number of moderately preterm deliveries per 1,000 live births

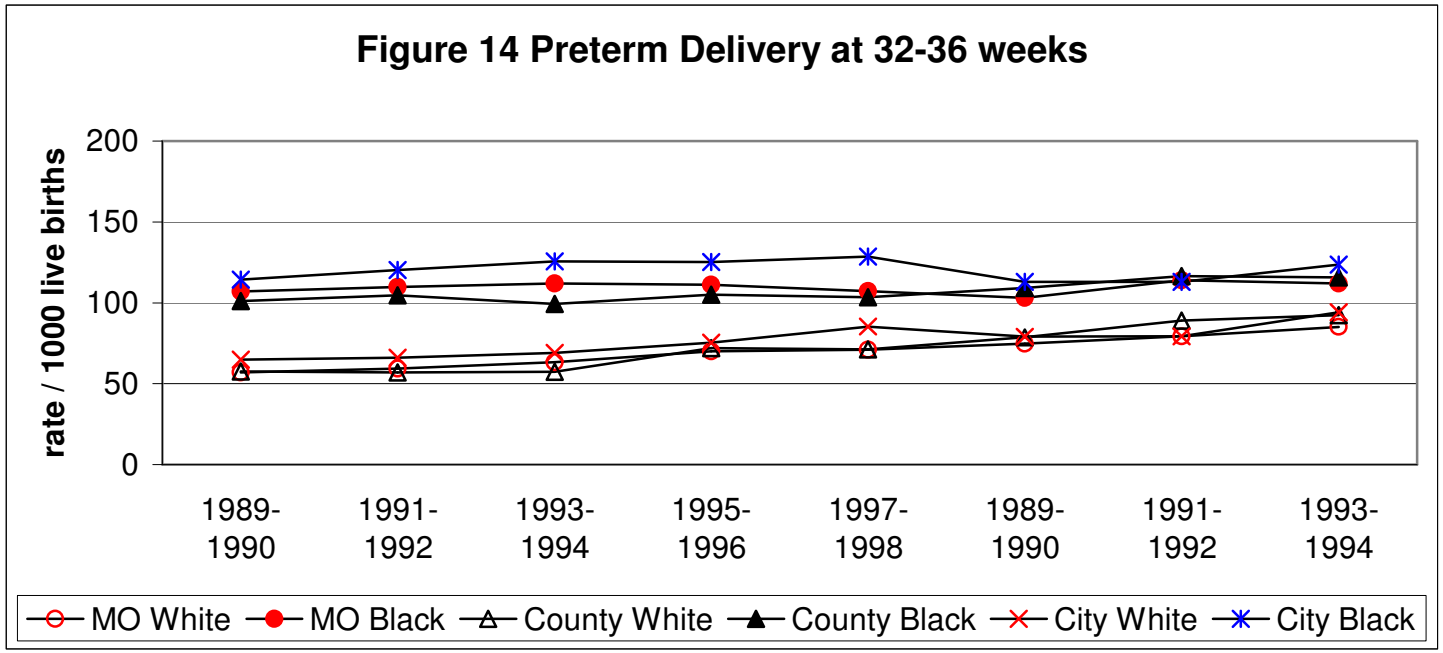


Table 15 Preterm Delivery <32 weeks (defined as all live births delivered at <32 weeks gestation)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	1,279	10.5	1,354	11.3	1,348	11.7	1,328	11.5	1,455	12.5	1,533	13.2	1,555	13.7	1,625	14.0
MO Black	864	33.3	914	34.4	757	31.0	672	30.9	722	32.9	813	36.8	762	35.5	788	36.4
County White	169	7.6	213	10.0	174	8.5	162	8.4	200	11.0	183	10.6	177	11.0	195	12.5
County Black	137	23.3	131	20.3	134	21.0	121	20.4	137	21.7	136	20.3	148	22.7	148	22.3
City White	62	10.8	43	8.7	45	10.6	35	9.4	50	14.0	38	11.0	54	16.0	37	11.2
City Black	259	24.6	275	25.8	227	24.2	206	27.1	187	25.9	180	26.2	190	29.5	155	24.1

Rate = number of extreme preterm deliveries per 1,000 live births

2010 Objectives
(11 / 1000)

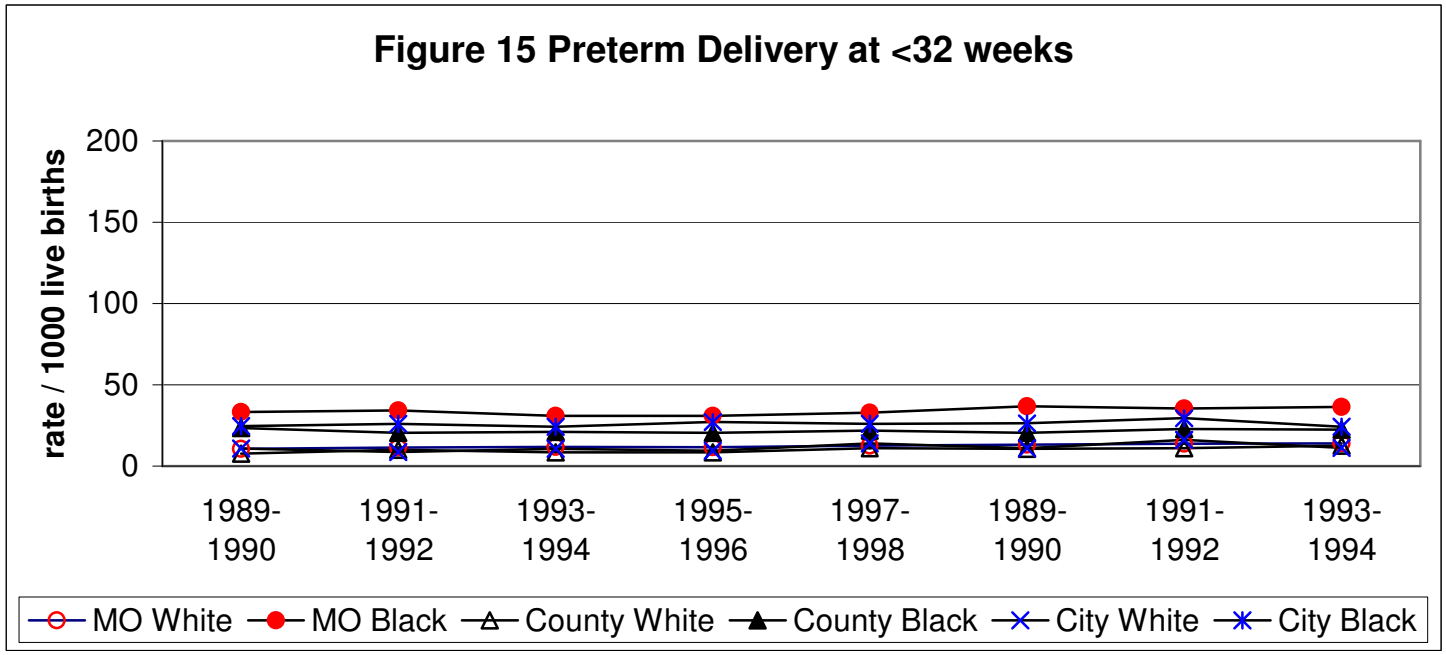


Table 15b SGA (defined as gestational age-specific birthweight < 10 percentile)

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**	**n**	**rate**
MO White	13,020	11.1	13,192	11.2	12,747	11.1	12,493	10.9	12,467	10.8	11,774	10.1	11,526	10.2	11,805	10.2
MO Black	2,679	10.6	2,788	10.6	2,519	10.4	2,187	10.2	2,272	10.4	2,181	9.9	1,986	9.3	2,100	9.7
County White	1,979	9.1	1,940	9.2	1,925	9.4	1,643	8.5	1,499	8.3	1,422	8.3	1,394	8.6	1,249	8.0
County Black	553	9.6	624	9.8	602	9.5	555	9.5	562	9.1	643	9.7	569	8.8	602	9.1
City White	684	12.5	614	12.5	503	11.9	458	12.4	423	11.8	364	10.6	339	10.1	329	10.0
City Black	1,083	10.7	1,100	10.4	933	10.0	781	10.6	735	10.2	689	10.1	596	9.3	631	9.8

2010 Objectives
(NA)

Rate = number of SGA infants per 100 live births

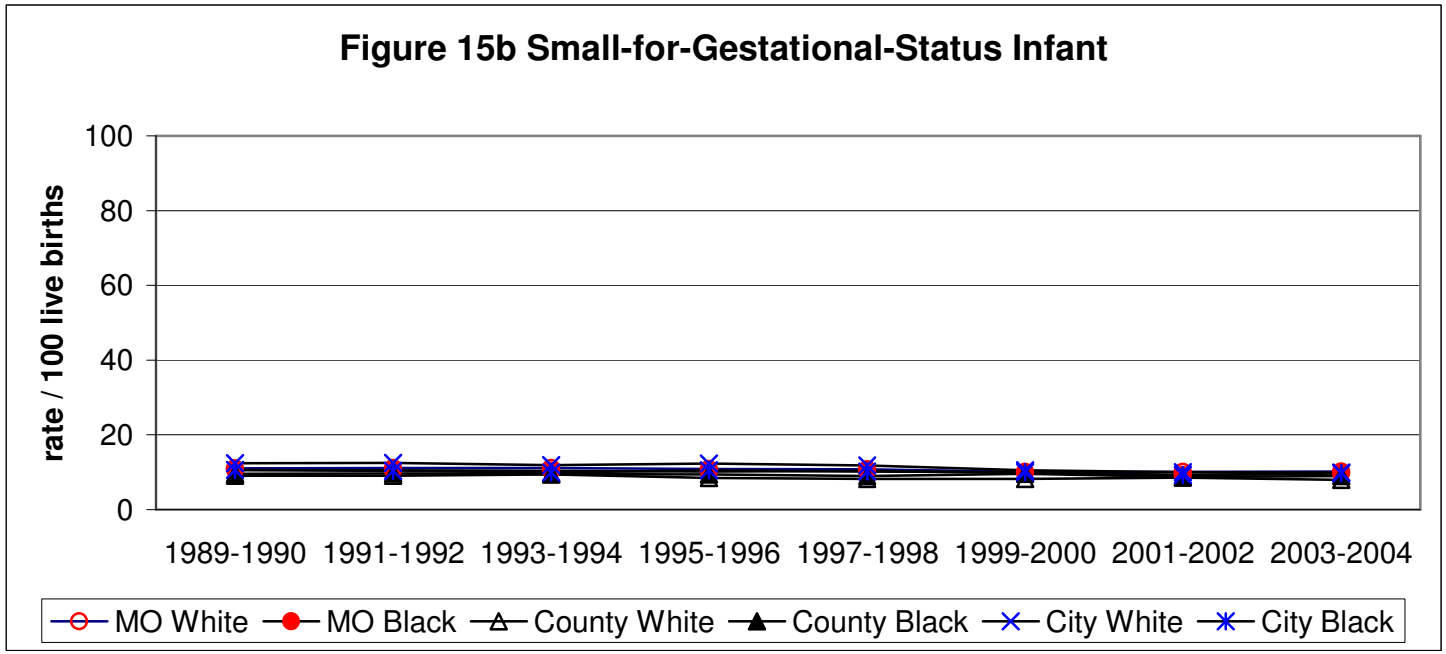


Table 16: Maternal Age < 18 Years

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	4,592	3.8	4,625	3.9	4,675	4.1	4,682	4.1	4,569	3.9	4,175	3.6	3,411	3.0	3,215	2.8
MO Black	3,174	12.3	3,255	12.3	3,118	12.8	2,610	12.0	2,323	10.6	2,083	9.4	1,797	8.4	1,722	8.0
County White	350	1.6	318	1.5	328	1.6	308	1.6	292	1.6	260	1.5	190	1.2	179	1.2
County Black	575	9.8	608	9.4	622	9.8	537	9.0	481	7.6	484	7.2	441	6.8	405	6.1
City White	249	4.4	220	4.5	189	4.5	166	4.5	130	3.6	93	2.7	78	2.3	54	1.6
City Black	1,446	13.8	1,496	14.0	1,409	15.0	1,001	13.2	919	12.7	751	10.9	640	9.9	647	10.1

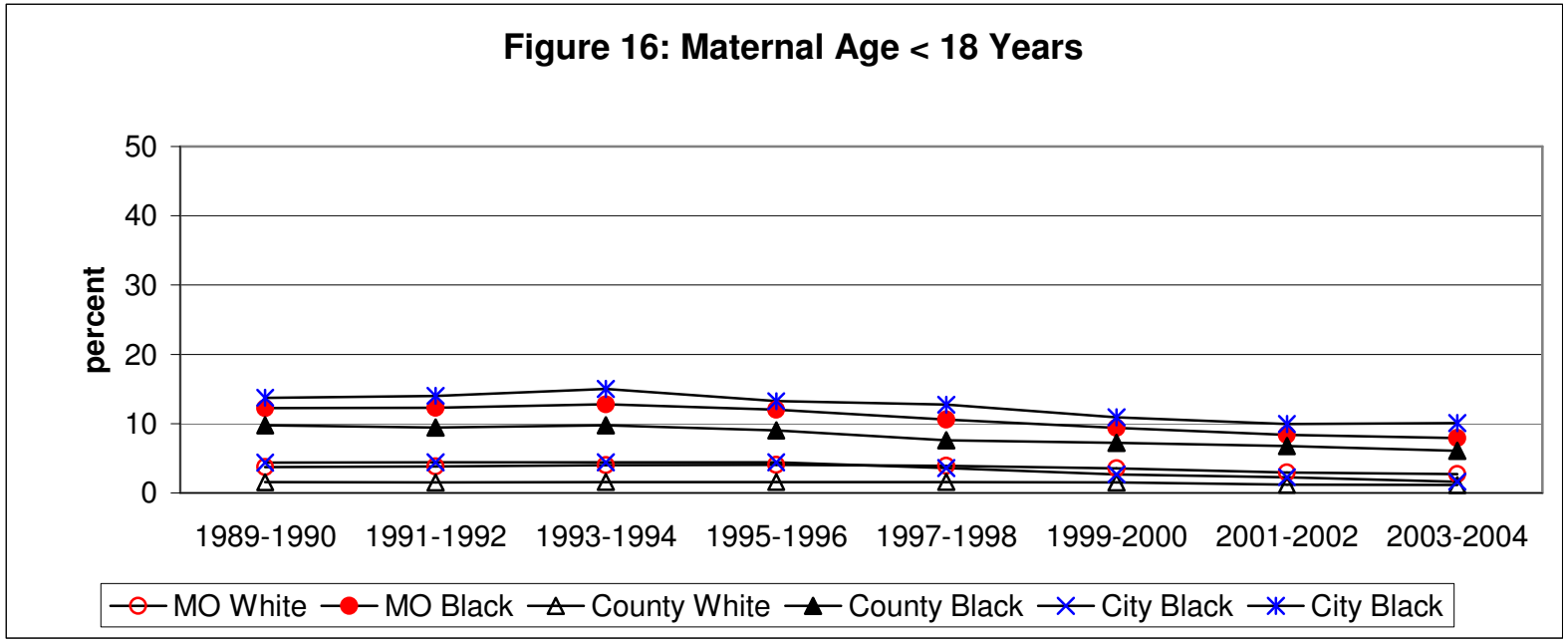


Table 17: Maternal Age ≥35 Years

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	9,145	7.5	10,032	8.4	10,925	9.5	12,162	10.6	13,173	11.3	13,525	11.6	13,112	11.5	13,216	11.4
MO Black	1,190	4.6	1,383	5.2	1,481	6.1	1,464	6.7	1,572	7.2	1,535	6.9	1,623	7.6	1,556	7.2
County White	2,806	12.6	3,010	14.1	3,341	16.3	3,563	18.5	3,690	20.4	3,664	21.3	3,511	21.7	3,329	21.4
County Black	346	5.9	427	6.6	475	7.5	489	8.2	574	9.1	570	8.5	593	9.1	599	9.0
City White	506	8.8	531	10.8	521	12.3	520	13.9	522	14.6	480	13.9	460	13.6	440	13.3
City Black	484	4.6	530	5.0	546	5.8	521	6.9	485	6.7	450	6.5	431	6.7	365	5.7

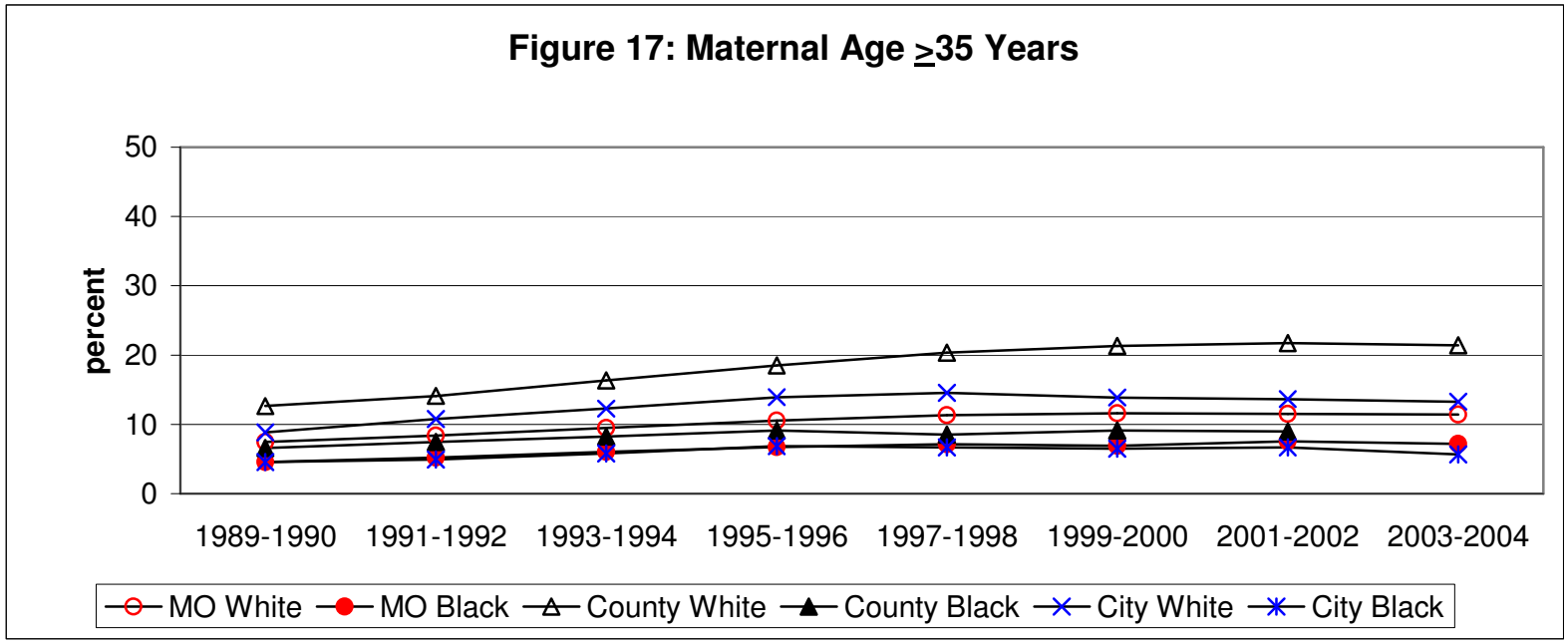


Table 18: Maternal Education <12 Years

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	21,866	18.0	21,376	18.0	19,643	17.1	19,042	16.6	19,613	17.0	19,654	16.9	18,678	16.5	18,647	16.2
MO Black	8,525	33.5	8,985	34.7	8,124	33.7	6,791	32.0	6,633	30.7	6,526	29.8	6,034	28.5	5,820	27.4
County White	1,612	7.3	1,509	7.1	1,427	7.0	1,221	6.4	1,203	6.7	1,189	6.9	991	6.2	927	6.0
County Black	1,419	24.2	1,578	24.8	1,533	24.3	1,338	22.8	1,354	21.8	1,347	20.2	1,268	19.6	1,230	18.7
City White	1,520	26.6	1,280	26.0	1,022	24.3	783	21.2	751	21.2	694	20.3	639	19.2	524	16.1
City Black	4,351	41.6	4,588	44.1	4,055	43.1	2,993	40.7	2,743	38.6	2,639	38.7	2,370	37.3	2,242	35.8

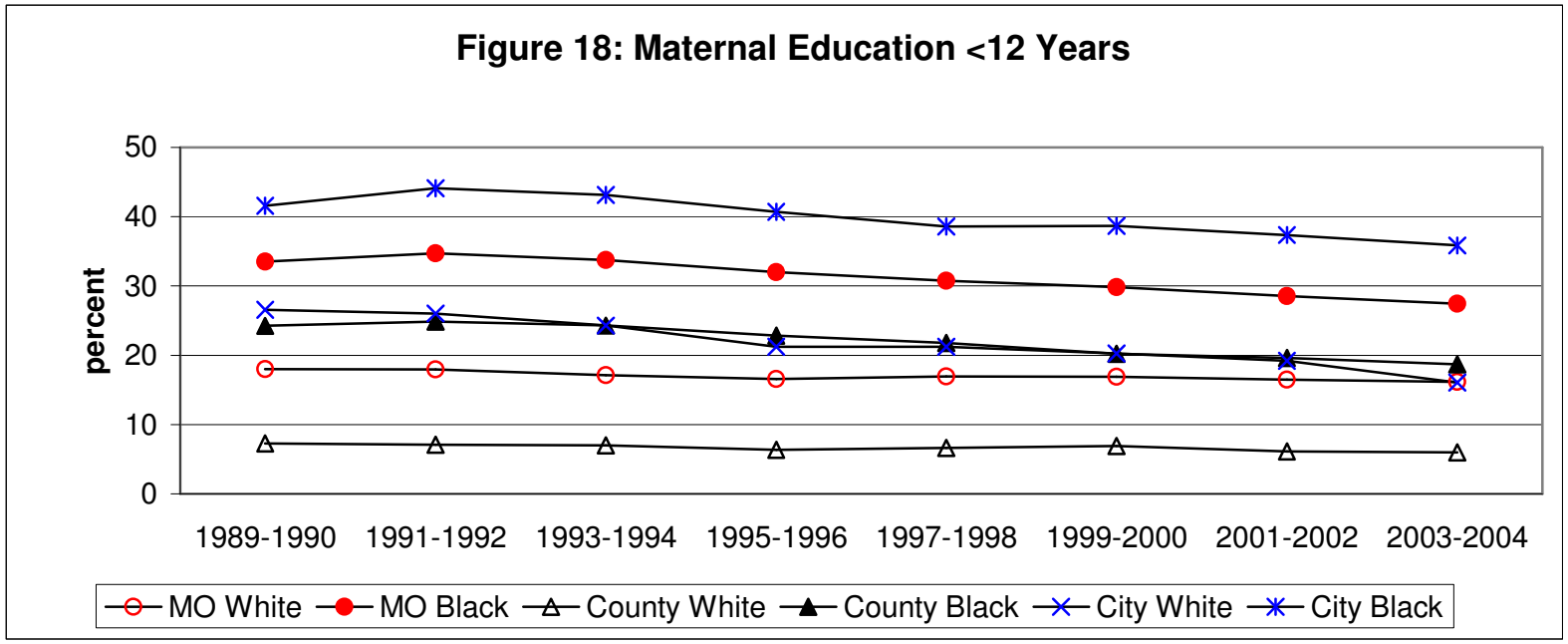


Table 19: No Paternal Information On Birth Certificate

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	17,794	14.6	17,214	14.4	14,754	12.8	13,396	11.6	12,342	10.6	12,054	10.3	11,728	10.3	13,174	11.4
MO Black	18,657	72.0	19,344	72.9	15,682	64.2	12,664	58.3	12,132	55.2	11,373	51.3	10,546	49.1	11,097	51.2
County White	1,769	8.0	1,812	8.5	1,681	8.2	1,520	7.9	1,197	6.6	1,036	6.0	972	6.0	1,026	6.6
County Black	3,536	60.1	4,084	63.3	3,630	56.9	2,917	49.1	2,872	45.5	2,740	40.9	2,517	38.6	2,783	41.8
City White	1,364	23.8	1,293	26.2	990	23.4	771	20.7	680	19.0	517	15.0	447	13.3	438	13.2
City Black	8,473	80.5	8,732	81.9	6,503	69.4	4,961	65.6	4,676	64.7	4,219	61.2	3,761	58.4	3,892	60.5

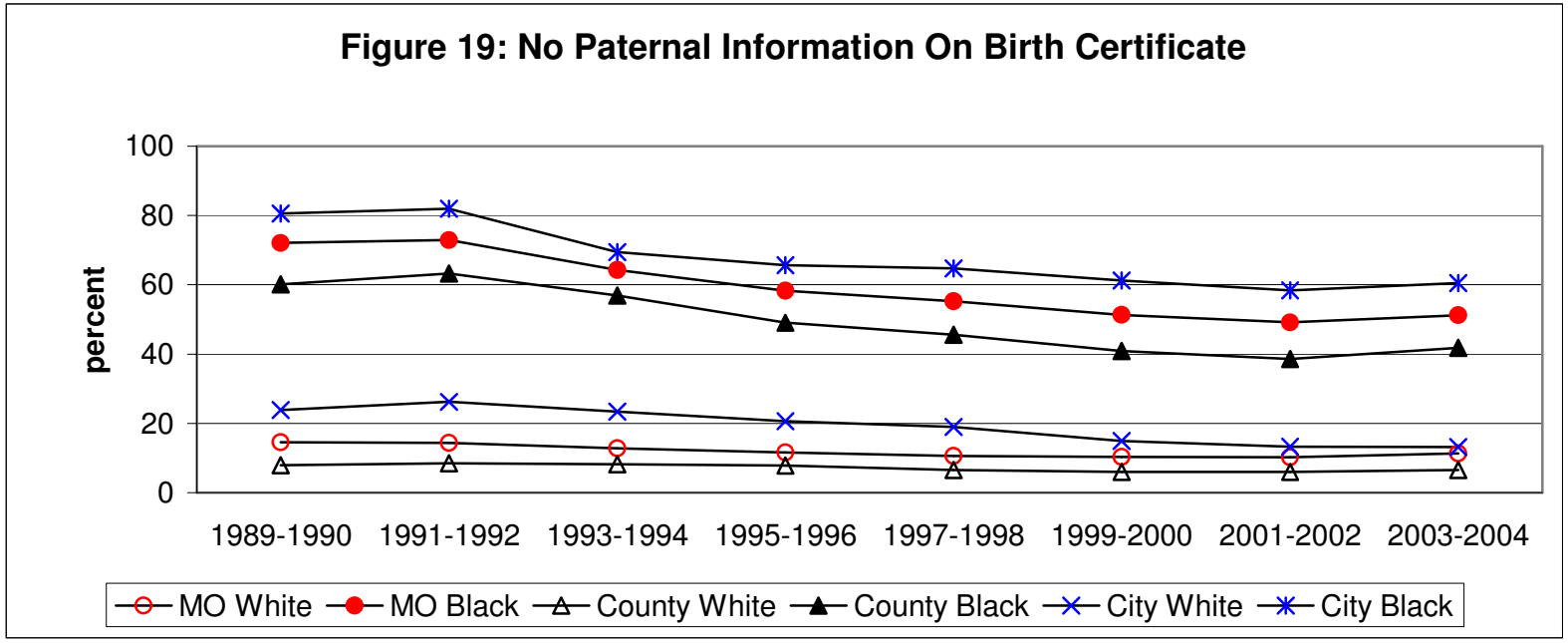


Table 20: Maternal Participation in 1 of 3 Government Assistance Programs

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	15,484	12.7	12,661	10.6	12,150	10.5	12,747	11.1	14,221	12.3	14,802	12.7	13,757	12.1	13,283	11.5
MO Black	5,002	19.3	3,883	14.6	3,609	14.8	3,275	15.1	4,011	18.4	4,367	19.7	3,955	18.4	3,396	15.7
County White	1,231	5.5	1,232	5.8	1,029	5.0	1,124	5.8	1,132	6.2	1,150	6.7	1,100	6.8	1,150	7.4
County Black	1,216	20.7	1,056	16.4	986	15.5	1,037	17.4	1,212	19.2	1,435	21.4	1,350	20.7	1,195	18.0
City White	670	11.7	457	9.3	431	10.2	365	9.8	365	10.2	439	12.7	433	12.8	362	11.0
City Black	1,916	18.2	1,369	12.8	1,333	14.2	941	12.5	1,195	16.5	1,282	18.6	1,144	17.8	914	14.2

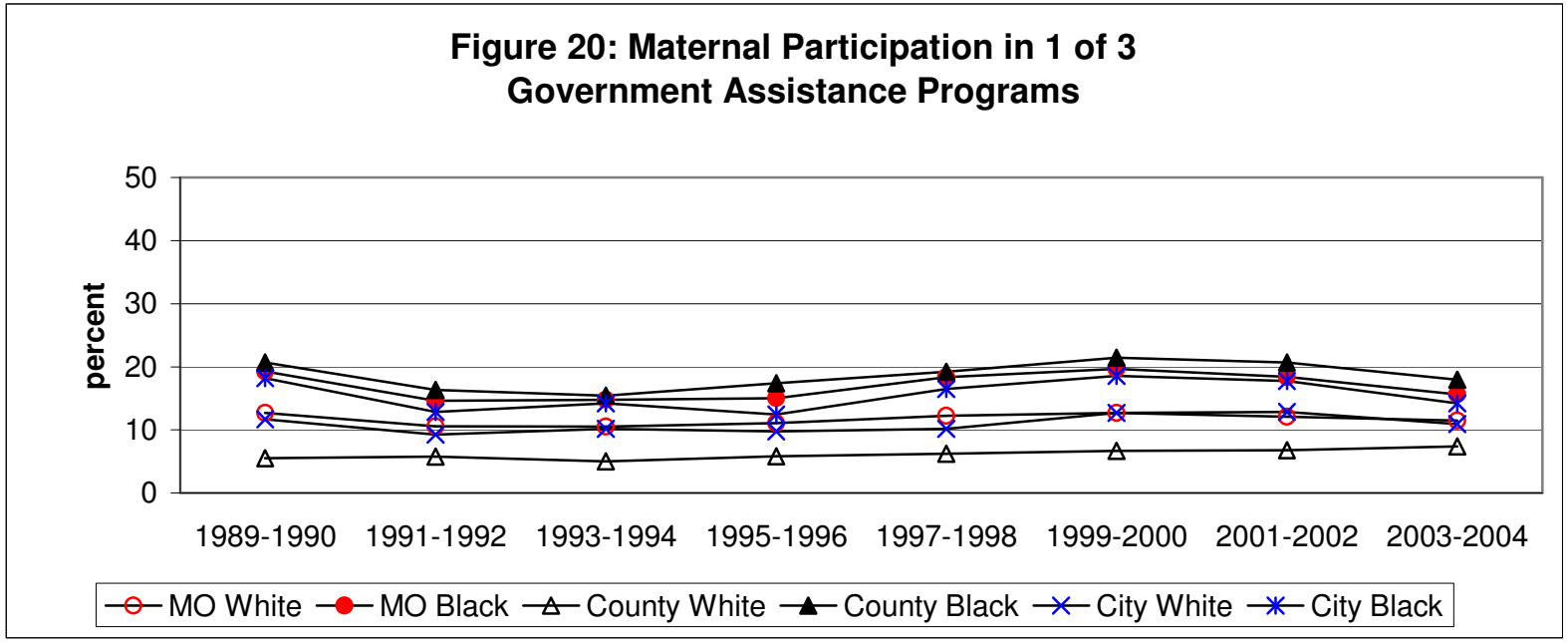


Table 21: Maternal Cigarette Use During Pregnancy

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	32,084	26.3	30,069	25.2	26,313	22.9	24,794	21.6	24,397	21.1	23,602	20.3	23,194	20.5	23,643	20.5
MO Black	5,826	22.6	5,244	19.8	4,150	17.1	2,949	13.8	3,021	13.9	2,859	13.0	2,854	13.4	3,050	14.2
County White	4,260	19.3	3,822	18.0	3,066	15.1	2,498	13.0	2,032	11.2	1,760	10.3	1,594	9.9	1,547	10.0
County Black	1,099	18.7	1,104	17.1	842	13.3	598	10.1	620	9.9	586	8.8	547	8.4	630	9.5
City White	1,930	33.7	1,629	33.1	1,122	26.6	883	23.8	793	22.2	645	18.7	655	19.5	570	17.3
City Black	2,649	25.2	2,360	22.2	1,827	19.6	1,127	15.2	1,158	16.1	1,017	14.8	1,015	15.8	1,065	16.7

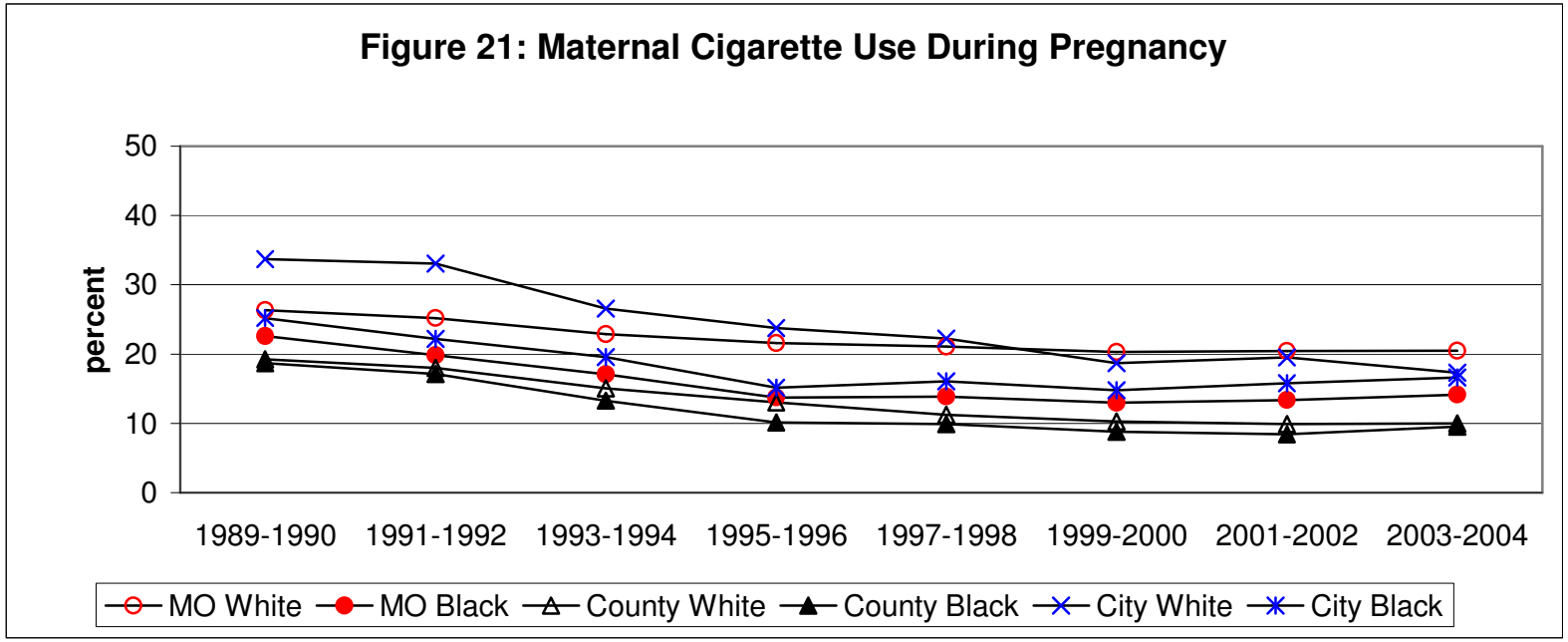


Table 22: Maternal Alcohol Use During Pregnancy

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	4,060	3.3	2,711	2.3	1,887	1.6	1,443	1.3	1,091	0.9	844	0.7	803	0.7	715	0.6
MO Black	919	3.6	975	3.7	963	4.0	639	3.0	352	1.6	236	1.1	204	1.0	152	0.7
County White	1,387	6.3	750	3.5	492	2.4	369	1.9	238	1.3	201	1.2	188	1.2	158	1.0
County Black	160	2.7	158	2.5	174	2.7	112	1.9	67	1.1	44	0.7	52	0.8	20	0.3
City White	241	4.2	174	3.5	101	2.4	60	1.6	43	1.2	36	1.0	44	1.3	42	1.3
City Black	299	2.8	381	3.6	421	4.5	269	3.6	129	1.8	65	1.0	55	0.9	44	0.7

Figure 22: Maternal Alcohol Use During Pregnancy

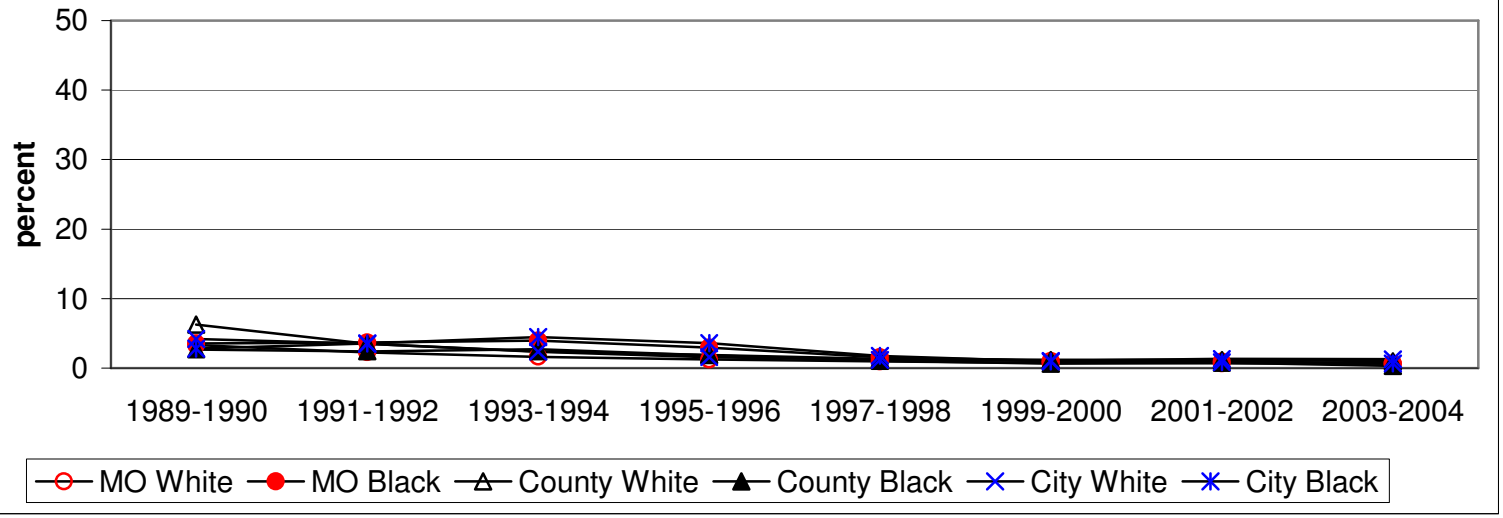


Table 23: Inadequate Prenatal Care

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	13,038	10.7	11,761	9.8	9,240	8.0	7,941	6.9	7,517	6.5	7,146	6.1	6,979	6.1	6,701	5.8
MO Black	7,438	28.7	7,174	27.0	6,128	25.1	4,330	19.9	3,860	17.6	3,339	15.1	3,076	14.3	2,846	13.1
County White	940	4.2	856	4.0	661	3.2	600	3.1	488	2.7	413	2.4	367	2.3	351	2.3
County Black	1,295	22.0	1,425	22.1	1,272	20.0	969	16.3	928	14.7	823	12.3	768	11.8	734	11.0
City White	628	11.0	447	9.1	343	8.1	297	8.0	263	7.3	212	6.1	149	4.4	145	4.4
City Black	3,533	33.6	3,510	32.9	2,927	31.2	1,836	24.3	1,535	21.3	1,237	18.0	1,114	17.3	999	15.5

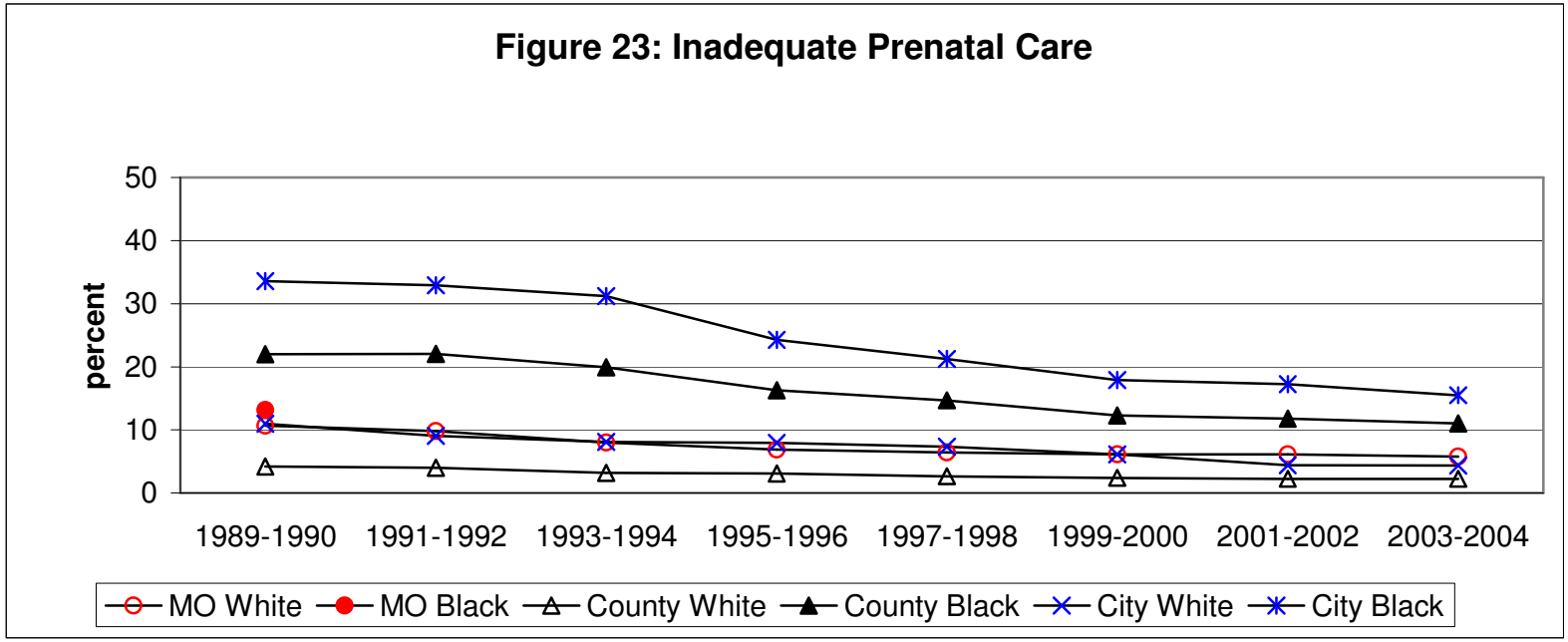


Table 24: Adequate Plus Prenatal Care

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	44,477	36.4	44,663	37.3	46,088	40.0	46,732	40.6	47,665	41.1	48,087	41.3	47,552	41.8	49,227	42.5
MO Black	8,999	34.7	9,217	34.7	9,481	38.8	9,218	42.4	9,852	44.9	9,601	43.3	9,051	42.1	9,498	43.8
County White	7,955	35.8	7,699	36.1	7,640	37.4	7,160	37.2	7,161	39.5	6,963	40.5	6,830	42.3	6,765	43.5
County Black	2,352	40.0	2,598	40.2	2,703	42.4	2,680	45.1	2,989	47.4	3,087	46.1	3,020	46.3	3,224	48.5
City White	2,170	37.9	1,989	40.3	1,750	41.3	1,615	43.3	1,623	45.3	1,437	41.6	1,425	42.3	1,380	41.7
City Black	3,593	34.2	3,480	32.7	3,253	34.7	3,170	41.9	3,451	47.8	3,055	44.3	2,729	42.3	2,804	43.6

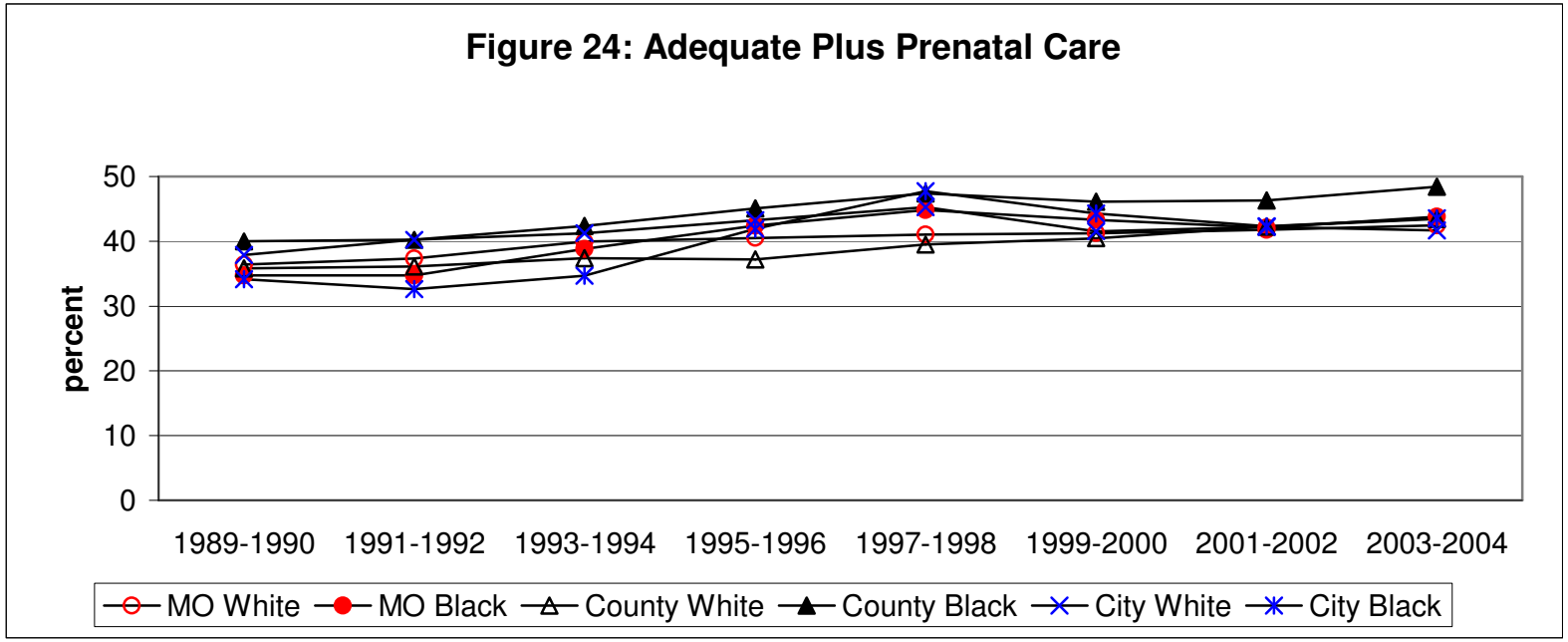


Table 25: No Prenatal Care

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	1,110	0.9	917	0.8	723	0.6	665	0.6	677	0.6	727	0.6	599	0.5	538	0.5
MO Black	1,428	5.6	1,514	5.8	1,149	4.8	746	3.6	724	3.4	566	2.7	548	2.7	438	2.1
County White	98	0.4	105	0.5	69	0.3	55	0.3	65	0.4	64	0.4	53	0.3	48	0.3
County Black	193	3.3	262	4.1	212	3.4	132	2.3	160	2.6	119	1.8	134	2.1	109	1.7
City White	84	1.5	80	1.6	51	1.2	48	1.3	45	1.3	30	0.9	24	0.7	23	0.7
City Black	775	7.4	895	8.4	657	7.1	407	5.6	334	4.7	277	4.1	234	3.8	198	3.2

Figure 25: No Prenatal Care

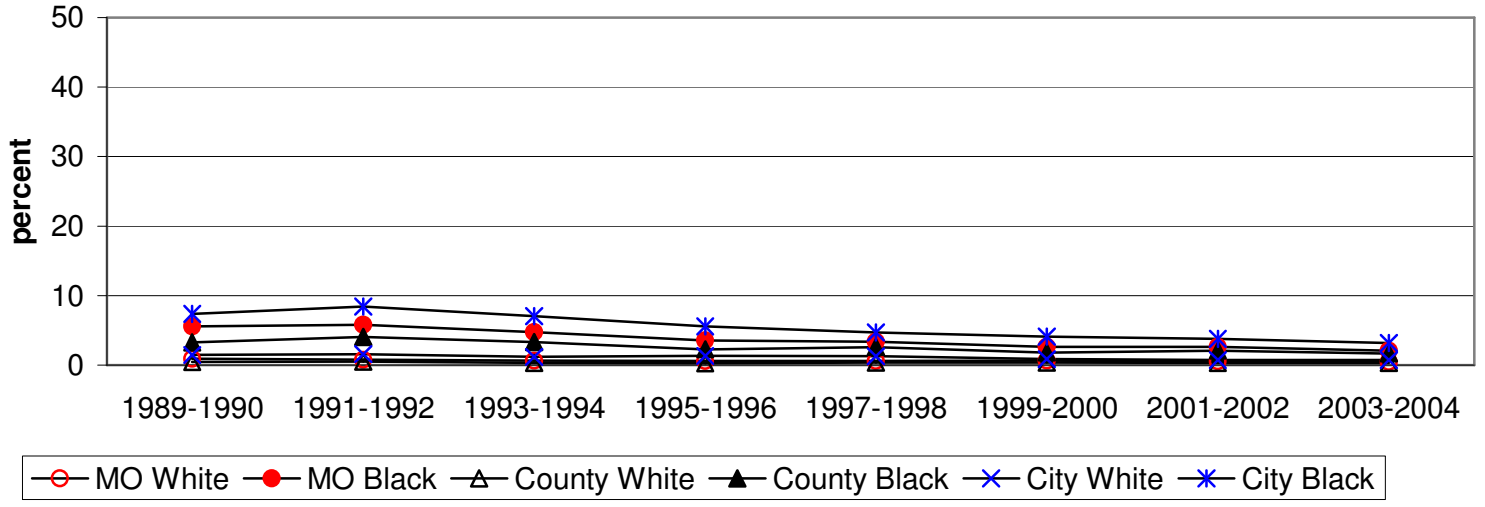


Table 26: Maternal Anemia

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	1,545	1.3	3,127	1.1	1,192	1.0	1,117	1.0	1,303	1.1	1,545	1.3	1,561	1.4	1,690	1.5
MO Black	816	3.2	799	3.0	764	3.1	757	3.5	626	2.9	742	3.4	594	2.8	579	2.7
County White	133	0.6	84	0.4	104	0.5	141	0.7	172	1.0	173	1.0	111	0.7	100	0.6
County Black	167	2.9	142	2.2	152	2.4	192	3.2	183	2.9	192	2.9	159	2.4	158	2.4
City White	64	1.1	44	0.9	25	0.6	23	0.6	27	0.8	28	0.8	26	0.8	23	0.7
City Black	238	2.3	229	2.2	281	3.0	248	3.3	196	2.7	272	4.0	183	2.8	122	1.9

Figure 26: Maternal Anemia

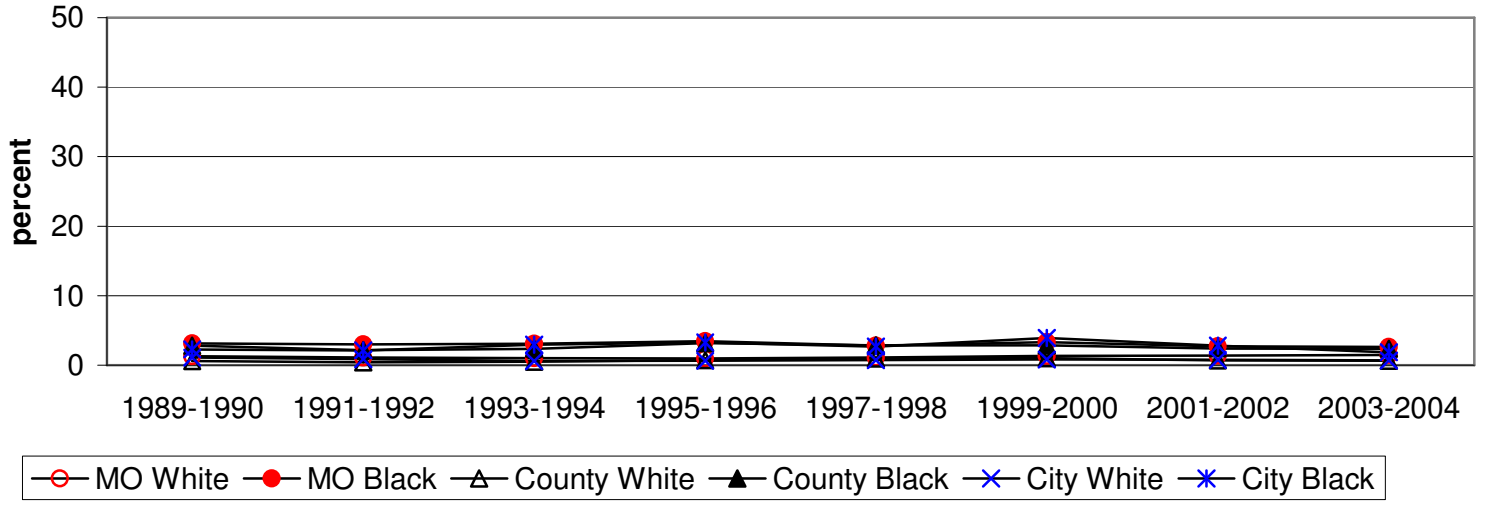


Table 27: Inadequate Gestational Weight Gain

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	27,361	23.0	24,829	21.6	23,556	21.0	22,724	20.4	21,936	19.6	20,938	18.5	20,478	18.6	19,978	17.9
MO Black	7,277	29.9	6,999	28.7	6,435	28.1	5,128	26.3	4,820	24.0	4,417	21.6	4,227	21.7	4,001	20.7
County White	4,636	21.6	3,994	20.2	3,854	19.6	3,640	19.6	3,278	18.7	2,843	17.2	2,627	16.9	2,429	16.2
County Black	1,548	27.1	1,576	26.1	1,618	26.6	1,355	24.8	1,337	22.3	1,312	20.6	1,237	20.4	1,212	19.6
City White	1,296	23.0	1,007	21.3	831	20.4	703	20.1	658	19.3	610	18.6	551	17.4	491	16.0
City Black	3,298	32.4	2,998	30.5	2,711	30.4	1,845	27.6	1,710	25.2	1,396	21.4	1,299	22.1	1,198	20.9

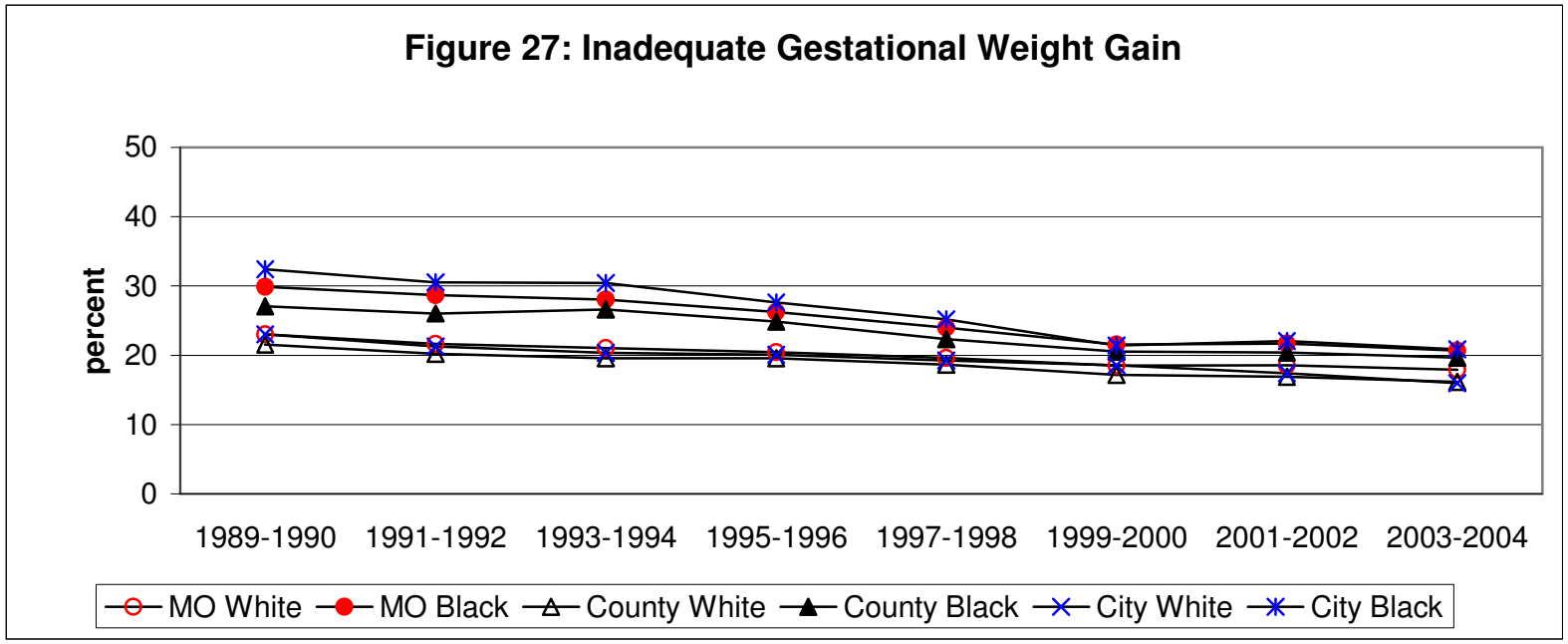


Table 28: Multiple Gestations

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	2,827	2.3	2,929	2.5	3,090	2.7	3,079	2.7	3,349	2.9	3,550	3.1	3,765	3.3	3,892	3.4
MO Black	779	3.0	788	3.0	702	2.9	681	3.1	735	3.4	803	3.6	794	3.7	814	3.8
County White	595	2.7	667	3.1	612	3.0	626	3.3	627	3.5	714	4.2	775	4.8	690	4.4
County Black	168	2.9	213	3.3	148	2.3	163	2.7	265	4.2	287	4.3	229	3.5	262	3.9
City White	155	2.7	90	1.8	121	2.9	129	3.5	129	3.6	111	3.2	113	3.4	113	3.4
City Black	311	3.0	315	3.0	280	3.0	220	2.9	230	3.2	228	3.3	222	3.4	221	3.4

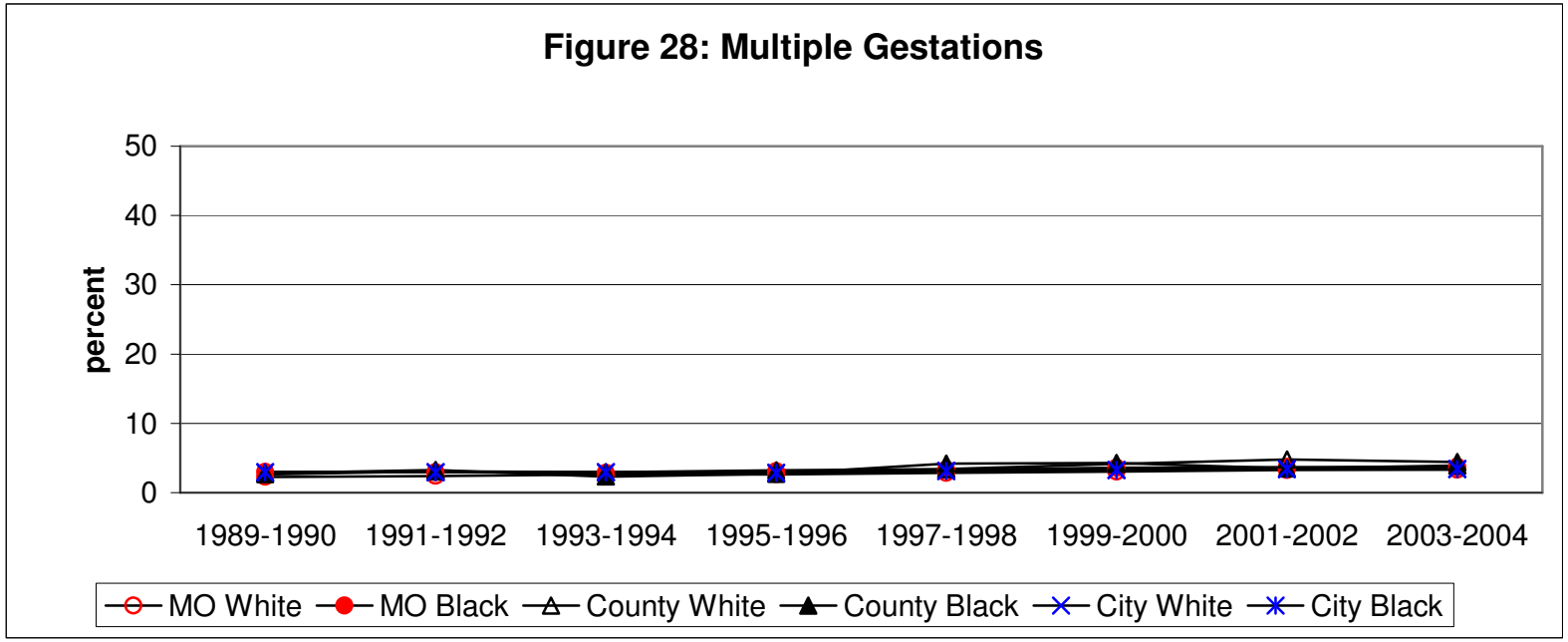


Table 29: ≥5 Prior Live Births

	1989-1990		1991-1992		1993-1994		1995-1996		1997-1998		1999-2000		2001-2002		2003-2004	
Population	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
MO White	1,340	1.1	1,387	1.2	1,319	1.2	1,475	1.3	1,537	1.3	1,671	1.4	1,716	1.5	1,768	1.5
MO Black	1,055	4.1	1,249	4.7	1,220	5.0	995	4.6	970	4.5	1,032	4.7	947	4.4	914	4.3
County White	188	0.9	196	0.9	207	1.0	194	1.0	183	1.0	217	1.3	178	1.1	169	1.1
County Black	147	2.5	178	2.8	214	3.4	169	2.9	174	2.8	220	3.3	216	3.3	219	3.3
City White	71	1.2	67	1.4	62	1.5	49	1.3	56	1.6	67	2.0	60	1.8	47	1.5
City Black	565	5.4	683	6.4	652	7.0	485	6.5	456	6.3	483	7.0	414	6.5	376	5.9

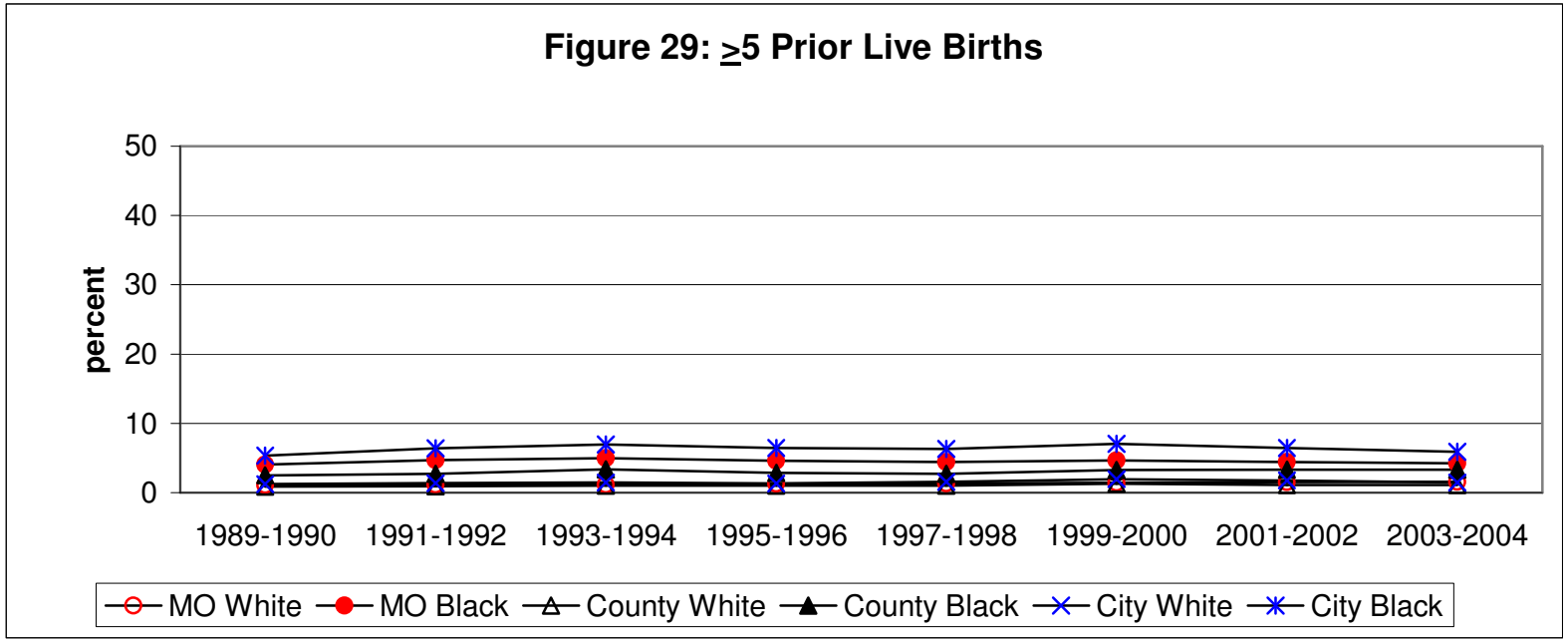


Table 30 Logistic Regression of Neonatal Mortality in St. Louis County Adjusting for Prenatal Risk Factors

Study Period: 2000-2004	**Cases (n = 365)**		**Controls (n = 61,108)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
Race / ethnicity									
white, non-hispanic	150	41	40,094	66	1.0	1.0	reference	1.0	reference
black, non-hispanic	190	52	16,312	27	3.1	***3.6***	***2.7-4.9***	***1.6***	***1.1-3.2***
other	25	7	4,702	8	1.4	NIM		NIM	
Age									
12-17 years	13	4	1,631	3	1.3	***0.3***	***0.1-0.6***	***0.2***	***0.1-0.6***
18-34 years	59	16	48,574	79	1.0	1.0	reference	1.0	reference
35-54 years	293	80	10,903	18	0.9	0.8	0.6-1.1	0.7	0.5-1.1
Education<12 years	62	18	6,235	10	1.9	***2.5***	***1.7-3.7***	***2.1***	***1.3-3.5***
No paternal information on certificate	119	33	9,286	15	2.7	***2.1***	***1.6-3.0***	1.4	0.9-2.0
Enrollment in poverty programs (Medicaid, WIC, Food Stamps)									
0 of 3 programs	212	62	40,590	67	0.7	1.4	1.0-2.0	1.1	0.7-1.8
1 of 3 programs	51	15	6,605	11	1.0	1.0	reference	1.0	reference
2 of 3 programs	54	16	7,682	13	0.9	***0.6***	***0.4-0.9***	0.6	0.4-1.1
3 of 3 programs	27	8	5,715	9	0.6	***0.3***	***0.2-0.6***	0.7	0.4-1.3
Cigarette use	34	10	5,542	9	1.1	0.9	0.6-1.3	0.8	0.5-1.4
Alcohol use	3	1	562	1	0.9	1.0	0.2-4.0	2.5	0.4-13.0
Anemia	3	1	739	1	0.7	0.3	0.1-1.0	0.2	0.1-1.2
Prenatal care*									
inadequate	21	6	2,972	6	3.8	1.0	0.5-1.8	0.8	0.4-1.6
intermediate / adequate	54	17	29,064	49	1.0	1.0	reference	1.0	reference
adequate plus	251	77	26,744	46	5.1	***2.5***	***1.9-3.4***	***1.6***	***1.1-2.3***

Table 30 Logistic Regression of Neonatal Mortality in St. Louis County Adjusting for Prenatal Risk Factors (cont.)

Study Period: 2000-2004	**Cases (n = 365)**		**Controls (n = 61,108)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
Inadequate weight gain**	162	53	10,307	18	5.3	***5.4***	***4.2-6.9***	1.3	1.0-1.8
Fetal risk factors									
5+ prior live births	10	3	1,029	2	1.7	0.8	0.4-1.7	0.7	0.3-1.8
Male gender	198	54	31,101	51	1.1	1.2	0.9-1.5	1.1	0.8-1.5
Multiple gestations	81	22	2,517	4	6.6	***6.7***	***4.9-9.2***	1.0	0.7-1.5
Congenital anomaly***	12	3	7	<1	296.7	***262.0***	***79.1-867.6***	***544.9***	***144.0->999.9***
Gestational age at birth									
15-28 weeks	280	77	384	1	961.4			***>999.9***	***635.3->999.9***
29-32 weeks	20	5	844	1	31.2			***30.8***	***16.1-58.8***
33-36 weeks	24	7	5,473	9	5.8			***4.1***	***2.1-7.8***
37-41 weeks	41	11	54,060	89	1.0			1.0	reference
42-47 weeks	0	0	299	<1	NC			NC	
Small-for-gestational age	65	19	4,786	8	2.6			***3.2***	***2.0-5.0***

*based on Kotelchuck index

**based on IOM guidelines

***includes anencephaly, microcephaly and renal agenesis

cOR = crude odds ratio, aOR = adjusted odds ratio, 95% CI = 95% confidence interval, GA = gestational age at birth

NC = not computed, NIM = not included in model

Table 31 Logistic Regression of Neonatal Mortality in St. Louis City Adjusting for Prenatal Risk Factors

Study Period: 2000-2004	**Cases (n = 223)**		**Controls (n = 25,908)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
Race / ethnicity									
white, non-hispanic	37	17	8,333	32	1.0	1.0	reference	1.0	reference
black, non-hispanic	181	81	15,979	62	2.6	***2.9***	***1.8-4.8***	1.6	0.9-2.9
other	5	2	1,596	6	0.7	NIM		NIM	
Age									
12-17 years	22	10	1,855	7	1.4	1.0	0.4-2.4	0.6	0.2-1.7
18-34 years	183	82	21,737	84	1.0	1.0	reference	1.0	reference
35-54 years	18	8	2,316	9	0.9	1.5	0.8-2.7	1.4	0.7-3.0
Education<12 years	85	40	7,875	31	1.5	1.1	0.8-1.6	1.2	0.7-1.9
No paternal information on certificate	153	69	10,900	42	3.0	***2.3***	***1.6-3.4***	***2.0***	***1.2-3.2***
Enrollment in poverty programs (Medicaid, WIC, Food Stamps)									
0 of 3 programs	57	27	7,172	28	0.5	1.2	0.8-1.9	1.1	0.6-2.0
1 of 3 programs	60	28	3,940	15	1.0	1.0	reference	1.0	reference
2 of 3 programs	60	28	6,729	26	0.6	***0.5***	***0.4-0.8***	0.6	0.4-1.1
3 of 3 programs	37	17	7,819	30	0.3	0.2	***0.1-0.3***	***0.2***	***0.1-0.5***
Cigarette use	58	26	4,122	16	1.9	***1.9***	***1.3-2.8***	1.1	0.7-1.9
Alcohol use	2	1	235	1	1.0	***0.5***	***0.4-0.8***	0.5	0.1-5.3
Anemia	3	1	487	2	0.7	0.7	0.2-2.1	2.3	0.6-8.7
Prenatal care*									
inadequate	53	26	3,115	13	3.8	1.4	0.9-2.3	1.5	0.8-1.9
intermediate / adequate	36	18	9,760	41	1.0	1.0	reference	1.0	reference

Table 31 Logistic Regression of Neonatal Mortality in St. Louis City Adjusting for Prenatal Risk Factors (cont.)

Study Period: 2000-2004	**Cases (n = 223)**		**Controls (n = 25,908)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
adequate plus	113	56	10,980	46	***5.1***	***1.8***	***1.2-2.6***	1.6	1.0-2.5
Inadequate weight gain**	90	51	4,719	20	***4.3***	***4.5***	***3.3-6.2***	1.1	0.8-2.7
Fetal risk factors									
5+ prior live births	11	5	1,166	5	1.1	0.5	0.2-1.1	0.4	0.1-1.0
Male gender	125	56	13,160	51	1.2	***1.5***	***1.1-2.0***	1.5	1.0-2.3
Multiple gestations	33	15	821	3	5.3	***6.3***	***3.9-10.0***	1.5	0.8-2.7
Congenital anomaly***	5	2	4	<1	148.5	***197.7***	***45.9-852.4***	NIM	
Gestational age at birth									
15-28 weeks	175	80	231	1	648.6			***512.4***	***303.3-865.6***
29-32 weeks	8	4	527	2	13.0			***7.2***	***2.6-19.4***
33-36 weeks	11	5	2,646	10	3.6			***2.6***	***1.2-5.7***
37-41 weeks	26	12	22,259	86	1.0			1.0	reference
42-47 weeks	0	0	206	1	NC			NIM	
Small-for-gestational age	29	14	2,401	10	1.5			1.9	1.0-3.4

*based on Kotelchuck index

**based on IOM guidelines

***includes anencephaly, microcephaly and renal agenesis

cOR = crude odds ratio, aOR = adjusted odds ratio, 95% CI = 95% confidence interval, GA = gestational age at birth

NC = not computed, NIM = not included in model

Table 32 Logistic Regression of Postneonatal Mortality in St. Louis County Adjusting for Prenatal Risk Factors

Study Period: 2000-2004	**Cases (n = 131)**		**Controls (n = 61,108)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
Race / ethnicity									
white, non-hispanic	47	36	40,094	66	1.0	1.0	reference	1.0	reference
black, non-hispanic	77	59	16,312	27	4.0	***2.4***	***1.5-3.9***	***2.1***	***1.3-3.4***
other	7	5	4,702	8	1.3	NIM		NIM	
Age									
12-17 years	8	6	1,631	3	2.2	2.1	0.7-7.4	2.0	0.7-6.3
18-34 years	109	83	48,574	79	1.0	1.0	reference	1.0	reference
35-54 years	14	11	10,903	18	0.6	1.3	0.6-2.5	1.3	0.6-2.5
Education<12 years	25	20	6,235	10	2.1	0.7	0.4-1.4	0.7	0.4-1.3
No paternal information on certificate	47	36	9,286	15	3.1	1.1	0.7-1.7	1.0	0.6-1.6
Enrollment in poverty programs (Medicaid, WIC, Food Stamps)									
0 of 3 programs	44	34	40,590	67	0.2	***0.4***	***0.2-0.8***	***0.4***	***0.2-0.8***
1 of 3 programs	29	22	6,605	11	1.0	1.0	reference	1.0	reference
2 of 3 programs	29	22	7,682	13	0.9	0.9	0.5-1.5	0.9	0.5-1.5
3 of 3 programs	27	21	5,715	9	1.1	0.8	0.5-1.5	0.9	0.5-1.7
Cigarette use	23	18	5,542	9	2.1	1.7	1.0-2.9	1.6	0.9-2.7
Alcohol use	0	0	562	NC	0.9	NC		NC	
Anemia	4	3	739	1	2.6	1.9	0.7-5.1	1.9	0.7-5.4
Prenatal care*									
inadequate	23	19	2,972	6	8.0	***2.4***	***1.3-4.6***	***2.3***	***1.2-4.4***
intermediate / adequate	28	23	29,064	49	1.0	1.0	reference	1.0	reference
adequate plus	73	59	26,744	46	2.8	***1.7***	***1.1-2.6***	1.3	0.8-2.1

Table 32 Logistic Regression of Post Neonatal Mortality in St. Louis County Adjusting for Prenatal Risk Factors (cont.)

Study Period: 2000-2004	**Cases (n = 131)**		**Controls (n = 61,108)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
Inadequate weight gain**	40	33	10,307	18	2.3	***1.9***	***1.3-2.9***	1.3	0.8-2.0
Fetal risk factors									
5+ prior live births	3	2	1,029	2	1.4	0.6	0.1-2.4	0.5	0.1-2.2
Male gender	85	65	31,101	51	1.8	***1.8***	***1.2-4.5***	***1.8***	***1.2-2.7***
Multiple gestations	12	9	2,517	4	2.3	***2.3***	***1.2-4.5***	0.9	0.5-1.9
Congenital anomaly***	2	2	7	<1	135.3	***215.3***	***39.5->999.9***	***225.9***	***39.7->999.9***
Gestational age at birth									
15-28 weeks	23	18	384	1	43.1			***30.1***	***16.6-54.8***
29-32 weeks	6	5	844	1	5.1			2.8	1.0-8.1
33-36 weeks	26	20	5,473	9	3.4			***2.6***	***1.6-4.4***
37-41 weeks	75	57	54,060	89	1.0			1.0	reference
42-47 weeks	1	1	299	<1	2.4			2.3	0.3-16.9
Small-for-gestational age	27	22	4,786	8	3.0			***2.4***	***1.4-3.9***

*based on Kotelchuck index

**based on IOM guidelines

***includes anencephaly, microcephaly and renal agenesis

cOR = crude odds ratio, aOR = adjusted odds ratio, 95% CI = 95% confidence interval, GA = gestational age at birth

NC = not computed, NIM = not included in model

Table 33 Logistic Regression of Post Neonatal Mortality in St. Louis City Adjusting for Prenatal Risk Factors

Study Period: 2000-2004	**Cases (n = 110)**		**Controls (n = 25,908)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
Race / ethnicity									
white, non-hispanic	12	11	8,333	32	1.0	1.0	reference	1.0	reference
black, non-hispanic	94	85	15,979	62	4.1	***2.9***	***1.4-6.2***	***2.6***	***1.2-5.4***
other	4	4	1,596	6	1.7	NIM		NIM	
Age									
12-17 years	14	13	1,855	7	1.4	1.3	0.4-4.2	1.4	0.4-4.8
18-34 years	89	81	21,737	84	1.0	1.0	reference	1.0	reference
35-54 years	7	6	2,316	9	0.7	1.2	0.5-3.2	1.4	0.5-3.7
Education<12 years	48	44	7,875	31	1.8	1.3	0.8-2.1	1.3	0.8-2.1
No paternal information on certificate	71	65	10,900	42	2.5	1.3	0.8-2.2	1.2	0.7-1.9
Enrollment in poverty programs (Medicaid, WIC, Food Stamps)									
0 of 3 programs	11	10	7,172	28	0.3	0.7	0.3-1.7	0.7	0.3-1.6
1 of 3 programs	20	19	3,940	15	1.0	1.0	reference	1.0	reference
2 of 3 programs	34	31	6,729	26	1.0	0.9	0.5-1.7	1.0	0.5-1.9
3 of 3 programs	43	40	7,819	30	1.1	1.1	0.6-2.0	1.2	0.6-2.2
Cigarette use	29	26	4,122	16	1.9	1.4	0.9-2.4	1.1	0.7-1.9
Alcohol use	1	1	235	1	1.0	1.1	0.2-8.7	1.0	0.1-8.3
Anemia	0	0	487	2	NC	NIM		NIM	
Prenatal care*									
inadequate	20	20	3,115	13	2.4	1.3	0.7-2.4	1.0	0.6-2.0
intermediate / adequate	26	27	9,760	41	1.0	1.0	reference	1.0	reference

Table 33 Logistic Regression of Post Neonatal Mortality in St. Louis City Adjusting for Prenatal Risk Factors (cont.)

Study Period: 2000-2004	**Cases (n = 110)**		**Controls (n = 25,908)**			**Model 1 Without GA & SGA**		**Model 2 With GA & SGA**	
Maternal Risk Factors	**n**	**%**	**n**	**%**	**cOR**	**aOR**	**95% CI**	**aOR**	**95% CI**
adequate plus	52	53	10,980	46	1.8	1.3	0.8-2.0	0.9	0.6-1.5
Inadequate weight gain**	28	29	4,719	20	1.6	***1.7***	***1.1-2.7***	1.0	0.6-1.7
Fetal risk factors									
5+ prior live births	8	7	1,166	5	1.7	0.9	0.4-2.2	0.9	0.4-2.1
Male gender	56	51	13,160	51	1.0	1.1	0.8-1.7	1.1	0.7-1.7
Multiple gestations	8	7	821	3	2.4	***2.6***	***1.2-5.7***	0.9	0.4-2.2
Congenital anomaly***	0	0	4	<1	NC	NIM		NIM	
Gestational age at birth									
15-28 weeks	23	21	231	1	40.3			***38.8***	***20.8-72.4***
29-32 weeks	9	8	527	2	6.9			***7.9***	***3.7-16.6***
33-36 weeks	22	20	2,646	10	3.5			***3.0***	***1.7-5.2***
37-41 weeks	55	50	22,259	86	1.0			1.0	reference
42-47 weeks	0	0	206	1	NC			NIM	
Small-for-gestational age	28	27	2,401	10	3.4			***3.5***	***2.1-5.8***

*based on Kotelchuck index

**based on IOM guidelines

***includes anencephaly, microcephaly and renal agenesis

cOR = crude odds ratio, aOR = adjusted odds ratio, 95% CI = 95% confidence interval, GA = gestational age at birth

NC = not computed, NIM = not included in model

Table 34 Summary of Birth Outcomes Surveillance Trends from 1989 to 2004.

Outcome	Trends
Fetal Death	White-decreasing/stable Black-fluctuating to '95-'96 -increasing since '95-'96
Infant Mortality	White-City -decreasing to '93-'94 (lowest in 16yrs) -jumped '95-'96 (highest in 16 yrs) -declining since '95-'96 -County and State -declining to '95-'96 -increasing since '99-'00 Black (all areas) -lowest in '93-'94 -increasing from '93-'94 to '01-'02 -decreased '01-'02 to '03-'04 (equal to '89-'90 rate)
Neonatal Infant Mortality	White-decreasing/stable to '93-'94 - jumped '95-96 - stable to '99-'00 - declining since '99-'00 Black-lowest '93-'94 -increasing to '99-'00 -decreasing to last 2 (state and county) or 3 (city) data points
Post neonatal Infant Mortality	White-City -Fluctuated (low numbers), no clear trend -County and State -decreasing to '99-00 -stable '99-'00 to '03-'04 Black- City -Fluctuated, no clear trend -County -Fluctuated to '95-'96 -stable since '95-'96 -State -Declining to '95-'96 -Stable since '95-'96
Low Birth Weight (<2500 gm)	All-increasing
Moderately LBW (1500-2499 gm)	White-increasing Black-decreasing/stable
Very LBW (<1500 gm)	All-increasing

Outcome	Trends
Preterm Birth (<37 wks)	All-increasing
Moderately preterm (32-36 wks)	All-increasing steadily except City Black -City black -increased to '97-'98 (highest) -dropped '99-'00 -increased from '99-'00 to '03-'04 (almost back to '93-'94 level)
Very preterm (<32 wks)	White-increasing Black-decreasing/stable
Small for Gestational Age	All-decreasing

Table 35 Risk Factors as Predictors of Neonatal and Post Neonatal Infant Mortality and Risk Factor Trends

	Mortality[1,2] Predicted by Risk Factor[3]		Trend over Time
Risk Factor	1995-1999	2000-2004	1989-2004
Mother <18 years		NN County	-declining over last decade -leveling off since 2000
Mother >35 years			-increased to 1989-1990 -stable since 1990
Education<12 years	PN City	NN County	-declining since 1991-1992
No Father Information	NN City	NN City	-peaked in 1991-1992
	NN County	NN County	-declined since; until 2001-2002
	PN County	PN County	-increased 2003-2004 in all groups except city-White
Mother in only 1 of 3 Poverty Programs	NN City	NN City NN County	-increasing for white since 1994 -White: 2003-2004 highest in 16 years -Black: peaked 1999-2000, declining since
Maternal Cigarette Use		NN City	-White: declining -Black: declined to mid-90's, leveled off, increasing since 1999-2000
Maternal Alcohol Use		NN City	-declining in all
Inadequate PNC[4]	PN City	PN County	-declining in all, decline has slowed since 1999-2000
Adequate plus PNC[4]	NN County PN City PN County	NN City NN County PN County	-increasing for all
Maternal Anemia	PN County		-no clear trends, fluctuates
Inadequate gestational weight gain	NN City NN County	NN City NN County PN City PN County	-declining in all -decline is slowing among Black
Multiple Gestations	NN City NN County PN County	NN City NN County PN City PN County	-gradually increasing in white -gradually increasing in black since 1997-1998
≥5 Prior Live Births	PN County		-fluctuates, 2003-2004 highest in the 16 years examined for all groups examined

[1] NN=Neonatal infant mortality, [2]PN=Post neonatal infant mortality, [3]Logistic regression, adjusted for mother's age, education, father information missing, number of poverty programs, cigarette use, adequacy of prenatal care, maternal anemia, inadequate prenatal weight gain, multiple gestations and > 5 prior births. [4]PNC=Prenatal care.

Geographic Mapping of Events

Methods

We proposed to use GIS software to map the coordinates for the residential addresses of all infant deaths within neighborhood boundaries in St. Louis City and municipalities in St. Louis County during 2001-2004 and then to update these when the 2005 birth/death linked file became available. Mapping infant deaths and risk factors for infant death allows identification of possible clustering of risk factors and infant deaths and identification of the areas with the highest risk per 1,000 live births. Because of HIPAA concerns and the change in administration at the Missouri Department of Health and Senior Services, we were unable to obtain additional data to create the neighborhood boundaries for our proposed study population. As an alternative they provided the corresponding census tract and zip code designation for residence at time of the birth or death. In addition, they have required an additional human subject's review before they will provide the most current data (2005). Consequently, the current report is based on linked birth certificate and death certificate data from the 2001-2004 birth cohort. We will update these analyses when the state provides us with the 2005 data.

Area-specific infant mortality rates as well as rates for birth outcomes known to be risk factors for infant death for St. Louis City and St. Louis County have been computed for the period 2001-2004. Combining years is necessary to calculate reliable mortality rates when there are a small number of events. Even so, zip code and census tract level rates can be unstable if based on too few events. Consequently, rates were not included if they were based on fewer than 100 births in the zip code or census tract during the 4-year period.

For each birth outcome, 5 categories were created based on the Healthy People 2010 objective for that outcome. These were (from lowest risk to highest):
1) meets the 2010 objective, 2) no more than 1.5 times the objective, 3) no more than 2 times the objective, 4) no more than 2 ½ times the objective and 5) more than 2 ½ times the objective. For example, for infant mortality the 2010 objective is an infant mortality rate of less than 7.2 deaths per 1000 births. So we created categories of: less than 7.2 per 1000, 7.2 to <10.8, 10.8<14.4, 14.4 to <18 and 18 or above.

Excluding rates based on fewer than 100 births improved the stability of the rates but readers are further cautioned to use the GIS maps to look for patterns and areas of relatively greater or lesser risk rather than for reliable individual zip code rates. Any of the individual geographic area rates calculated on fewer than 1000 births or fewer than 10 events (as some are) must still be viewed with caution. Because of this and to identify the specific areas with the highest overall risks we also ranked each of the zip codes in each of the two areas (St. Louis City and St. Louis County) on infant mortality and then also ranked the zip codes on each of the 7 risk factors. From this we identified the zip codes that have the highest relative rankings in the most categories of risk.

RESULTS

The aggregate data used to calculate area-specific rates are included in Appendix 1.

Infant Deaths

Figure 1 displays the degree to which each zip code in St. Louis City and St. Louis County meets the 2010 objective for infant mortality (7.2 deaths of live born infants in the first year of life per 1000 live births). In St. Louis County 65% of the 43 zip codes included met the 2010 objective (there were no data for two zip codes and two zipcodes with fewer than 100 births were excluded). Of those not meeting the Healthy People 2010 objective all were in the northeastern sector of the county with one exception. Zip code 63127 (Sappington/Sunset Hills) stands out in sharp contrast in southeastern St. Louis County. This zip code reports a rate of 22.1 per 1000 (more than 2 ½ times the 2010 objective). This area stands out because it is surrounded by zip codes meeting the objective. However, the rate is based on only 136 births and 3 deaths suggesting it may be an artifact of few events. However, as we will show later in this report this zip code seems to be an exception for other more common risk factors as well. Two other zip codes in the county show rates in the highest category: 63121 (which includes multiple municipalities including Normandy, Northwoods, Bellerive and others) and 63120 (Pinelawn) with 22.9 and 19.6 infant deaths per 1000 live births respectively. Interestingly there were no county zip codes in the next lower risk category (14.4 to 18 deaths per 1000 live births), the rest of the zip codes report rates no more than either 1½ or 2 times the objective.

In St. Louis City, only 2 (12.5%) of the 16 zip codes met the 2010 objective for infant mortality (2 zip codes were excluded for having <100 live births). Zip codes in the highest three categories covered most of north St. Louis City and part of the central corridor (63110). Two of these, 63120 (which straddles the city/county line and includes the Goodfellow neighborhood) and 63113 fall in the highest risk category with infant mortality rates of 19.6 and 19.1 per 1000 respectively.

Fetal Deaths

Fetal death rates are calculated by dividing the number of fetal deaths reported (deaths prior to birth after 20 weeks gestation) divided by the number of live births plus the number of reported fetal deaths. Fetal deaths are not reported as reliably as births or infant deaths (CDC, 1994) but nonetheless only 39.5% (17/43) of county zip codes and 6.3% (1/16) of city meet the 2010 objective of less than 4.1 fetal deaths per 1000 live births and fetal death (see Figure 2). In addition, 18.6% (8/43) of zip codes in the county and 68.8% (11/16) in the city report rates higher than 2½ times the Health People 2010 target of 4.1 fetal deaths per 1000 births and fetal deaths.

Not only are we much farther from meeting the 2010 objective for fetal deaths in both the city and the county than for infant mortality but the geographic patterns of fetal loss are quite different from those for infant mortality. In St. Louis City and County, zip codes not meeting the objective are distributed throughout the regions. Areas with the highest risk,

while primarily in the northern areas for both city and county, are also found in southern areas where infant mortality statistics were closer to the objective.

Neonatal Death

Neonatal deaths are those infant deaths occurring in the first month of life and usually reflect deaths as a consequence of problems occurring in pregnancy or at birth as well as deaths related to congenital anomalies (CDC, 1994). Prevention of neonatal deaths should focus on prenatal health and prenatal care. The geographic distribution of rates for neonatal deaths are quite similar to those for fetal deaths except that rates that are relatively higher (compared to the 2010 objective) are more predominate. They are also more concentrated in the northeastern part of the county and more spread throughout the city than were the highest fetal death rates. Only 41.9% (18/43) of county zip codes and 12.5% (2/16) of city met the 2010 objective of less than 2.9 per 1000 live births and 23.3% of county zip codes and 62.5% of city zip codes were in the highest category (> 7.25 neonatal deaths per 1000 live births). Included in the highest ranked county zip codes was 63127 (Sappington), again standing out amongst zip codes which met the 2010 objective. In the city, the two zip codes meeting the objective are on the southwestern edge of the city (63109 and 63139).

Post Neonatal Death

Post neonatal deaths occur after one month of life but before the first birthday and are more influenced by postpartum environmental circumstances than neonatal deaths. However, they can continue to reflect congenital defects and preterm births where infants have survived longer than a month. Prevention of post neonatal death should include support for the family of the new infant and receipt of medical care for the newborn.

As observed with fetal and neonatal deaths, a much higher percentage of both city and county zip codes show rates of post neonatal death which are considerably above the 2010 objective than was observed for infant mortality. For post neonatal mortality only 41.9% (18/43) of county zip codes met the 2010 objective and 18.8% (3/16) city zip codes met the objective. The distribution of the highest risk zip codes in the county remain largely in the northeast but with a greater concentration along the eastern border than was observed for neonatal mortality. In the county there are also more at risk zip codes in the southeastern part of the county than observed for fetal or neonatal deaths or for infant mortality as a whole. In the city 62.5% (10/16) were in the highest risk category compared to 27.9% (12/43) in the county.

Preterm Birth

Preterm births are births occurring at less than 37 completed weeks of gestation. We classified gestational age using the clinical estimate of gestational age as reported on the birth certificate. Figure 5 shows that none of the zip codes in either county reach the highest risk category (2 ½ times the objective). However, only one of the zip codes (6.3%) in the city (63109) and 11 in the county (25.6%) achieved the 2010 objective.

The highest risk zip codes in the city are in the northern sector although they dip into the near south side as well (zip codes 63104, 63110 and 63118). In the county, the highest risk areas are similar to those reflected in the plots of post neonatal deaths although the relative severity compared to the 2010 objective is less.

Moderate preterm birth and very preterm birth carry differing risks for the infant and are hypothesized to have different etiologies so it is valuable to look for differences in the distribution of their occurrence. Moderate preterm births include elective inductions and cesarean sections where there was a modest miscalculation in dating the pregnancy in addition to those occurring spontaneously. Very preterm births are more likely to reflect intrinsic and extrinsic factors that shorten the duration of the pregnancy.

Figures 6 and 7 show the geographic distribution of these two subcomponents of preterm birth. We defined moderate preterm birth as deliveries between 32 and 36 completed weeks of gestation. Figure 6 shows that no zip code hits the highest risk category (more than 2 ½ times the objective) for moderate preterm birth. In both the city and the county only 1 zip code (63120 which encompasses the city and county) falls into the 2nd highest risk category, 2 ½ times the objective. The lowest category of risk, 64-96 per 1000 live births (1/2 times the 2010 objective) was reported by zip codes that distribute throughout the St. Louis County and in the city, throughout south St. Louis. These are more affluent areas of the city and county.

This risk, while not high is important because the number of infants affected is high and the risk is preventable. Prevention can take the form of cautioning physicians about the risks of elective deliveries which may end up a few weeks preterm (Kramer et al., 2000). Because of the sheer number of deliveries affected what is a modest risk contributes to infant mortality in a meaningful way.]

Figure 7 shows the distribution of very preterm births or births under 32 completed weeks. These infants can be quite compromised and suffer considerable morbidity and mortality. Etiologies can include medical complications and may include prenatal stress (Rich-Edwards & Grizzard, 2005). As might be expected the geographic distribution of rates resemble the pattern seen for fetal deaths and neonatal deaths. Nearly half (48.8% or 21/42) of county zip codes met the 2010 objective (less than 11 very preterm deliveries per 1000 live births) but only one (6.3%) of city zip codes met this criteria. Conversely, in the city 50% (8/16) of zip codes were in the highest risk category (>27.5 very preterm births per 1000 live births) while only 4 (9.3%) zip codes were in this category in the county. The county zip codes included 63127 (Sappington), 63133 (Pagedale, Wellston and others), and 63121 (includes multiple municipalities including Normandy, Northwoods, Bellerive and others).

Low Birth Weight

Low birth weight births, defined as births of babies weighing less than 2500 grams, consist of both preterm births and births of infants whose growth was compromised,

whether preterm or full term. Figure 8 displays the distribution of this indicator of maternal child health. The distribution of this characteristic shows a more marked north/south division in the county than was seen for other characteristics with only a few zip codes in the southern half of the county showing any risk and representing only in the lowest risk category (1/2 times the 2010 objective or 50-75 low birth weight births per 1000 live births). These few zip codes do however, include 63127 (Sappington). In North County, no zip codes achieve the objective and all 3 risk levels, short of the highest, are represented. In St. Louis County 41.9% (18/43) of zip codes met the 2010 criteria while only 1 (6.3%) of city zip codes did. The highest risk in the city is largely on the north side but risk in the 2nd and 3rd highest categories reaches into the central corridor (63110 and 63104) and into the south side (63118 and 63111) as well.

Within low birth weight births, infants below 1500 grams experience the greatest morbidity and mortality. Figure 9 shows how this characteristic distributes. Not surprisingly, the pattern of risk resembles that of very preterm infants (Figure 7) as well as fetal deaths (Figure 2) and neonatal deaths (Figure 3). In St. Louis County, 37.2% of zip codes met the 2010 objective of less than 9 very low birth weight births per 1000 live births. In the city, only 1 zip code (63116) or 6.3% met the objective. The highest risk areas were on the north side in both the city and the county with a number of zip codes in the highest risk category (more than 2 ½ times the 2010 objective) in both areas. In the county, zip code 63127 (Sappington) was again an exception as the only zip code in south county that in the highest risk category; other south county zip codes were at least 2 risk categories lower. In the city, the higher risk areas again included all of the northern zip codes, some in the central corridor (63110 and 63104) and the eastern edge of the south side (63118 and 63111).

Identification of High Risk Zip Codes

As described in the methods section above, to summarize overall risk and increase the confidence that we have identified the highest risk zip codes without distortion of rates because of small numbers, we compared the risk rankings across different birth outcomes for the zip codes with the highest risk of infant mortality. Table 1 displays these results for St. Louis City and Table 2 for St. Louis County. While zip codes that rank highly for risk in multiple categories are less likely to have been unduly influenced by a few events in a given category, this method is not perfect since the different outcomes are not independent of one another.

Table 36 suggests 5 zip codes with particularly high risk in the city. Each of these is ranked in the top 4 for at least 3 parameters:

63120 Goodfellow
63113 Kingsway East, Jeff-Vander-Lou
63107 Hyde Park, Fairgrounds, College Hill
63110 Shaw Neighborhood, Forest Park Southeast, McReetown
63115 Greater Ville, Penrose

Note: Zip code boundaries and neighborhood boundaries do not coincide, the above neighborhoods are listed only as rough suggestions of the areas represented by a zip code, many neighborhoods are in several zip codes.

Table 37 suggests 5 zip codes with particularly high risk for the county as well;

63121 includes multiple municipalities including Normandy, Northwoods, Bellerive and others
63127 Sappington/Sunset Hills
63120 Pinelawn
63137 Bellefontaine Neighbors, Riverview
63133 Pagedale, Wellston

Note: Zip code boundaries and county municipality boundaries do not necessarily coincide and a zip code may contain a number of municipalities, the above municipalities are listed only as rough suggestions of the areas represented by a zip code.

Zip code 63127 was identified as a high risk area for several parameters: infant mortality, neonatal deaths, post-neonatal deaths, very preterm births and very low birth weight births. Since this zip code stands out as inconsistent with other observed patterns, demographic and health information describing residents was examined but no particular explanation for these findings could be identified. The area (Sappington/Sunset hills) is a relatively affluent, largely Caucasian area with only a modest influx of immigrants in recent years, according to the information reviewed (City-data.com, Accessed August 30, 2007: http://www.city-data.com/zips/63127.html). As mentioned earlier all rates for this zip code were based on a denominator of only 136 births so the resulting rates could have been high because they were based on small numbers, however, this seems less likely since similarly high rates were obtained for different measures: for example for both neonatal and post-neonatal deaths.

Table 36 St. Louis City Zip Code Rankings for Birth Outcomes Among the Ten Zip Codes with the Highest Infant Mortality Rate (2001-2004).

Zipcode	Infant Mortality	Fetal Death	Neonatal Death	Postn'l Death	Low Birth Weight	Very Low Birth Wt	Preterm Birth	Very Preterm Birth	**No. of Rankings In the top 4**
63120	1		2	2	3	9	2	10	**5**
63113	2	6	1	4	2	6	5	6	**4**
63107	3	5	4	7	1	2	1	2	**6**
63110	4	4	3	8	6	8	7	4	**4**
63115	5		7	3	5	3	3	5	**3**
63106	6	10	5	5	8	4	4	7	**2**
63108	7	2	8	1	9	10	6		**2**
63112	8	8	9	6	4		8	8	**1**
63147	9	9		9	10		9		**0**
63118	10		10			7		9	**0**

Note: Excluded zip codes with fewer than 100 births (63101 and 63102).

Table 37 St. Louis County Zip Code Rankings for Birth Outcomes Among the Ten Zip Codes with the Highest Infant Mortality Rates (2001-2004).

Zipcode	Infant Mortality	Fetal Death	Neonatal Death	Postn'l Death	Low Birth Weight	Very Low Birth Wt	Preterm Birth	Very Preterm Birth	**No. of Rankings In the Top 4**
63121	1	2	1	4	4	1	2	1	**8**
63127	2		2	3		2		4	**5**
63120	3		4	2	2	4	1	8	**6**
63137	4	1	9	1	8	3	9	2	**5**
63134	5	6	7	6			6		**0**
63133	6	8	5	9	3	9	3	3	**3**
63138	7	9		8	7		7		**0**
63136	8	3		5	5	7	4	5	**2**
63034	9		3		6		8		**1**
63033	10	4	6			10		9	**1**

Note: Excluded zip codes with fewer than 100 births (63069 & 63140) and two zip codes with no data (63049 & 64045).

Summary of Progress Toward The Healthy People 2010 Objectives

Table 38 summarizes progress toward the Healthy People 2010 objectives in St. Louis City and St. Louis County by reporting the percent of zip codes in each county which have either met the respective objective or were far from achieving the objective and had rates that were more than 2 ½ times higher than the objective. In the City of St. Louis, for

all parameters except one, only 1 or 2 zip codes (6-13%) had met the 2010 objectives for the birth outcomes examined. These two zip codes were 63109 and 63116 in south city.

In St. Louis County about 40-50% of the zip codes had met the 2010 objective (37-49%) for each birth outcome. The one exception was infant mortality where 67% of the zip codes in St. Louis County met the objective.

The percent of zip codes with rates at least 2 ½ times higher than the respective 2010 objective indicates the areas with the greatest challenges. In St. Louis City, from 12 to 69% of zip codes have rates more than 2 ½ times the objective with the exception of preterm birth. For example, over 68% of city zip codes have a fetal death rate 2 ½ times the 2010 objective of less than 4.1 fetal deaths per 1000 live births and fetal deaths. In St. Louis County very few zip codes reach this high threshold for infant mortality, preterm birth or low birth weight births. However, for fetal death, neonatal death, post neonatal death and very low birth weight birth from 18 to 28% of zip codes have rates 2 ½ times the 2010 objective. Clearly much work remains to be done.

Table 38 Summary of Progress Toward Healthy People 2010 Objectives (2001-2004).

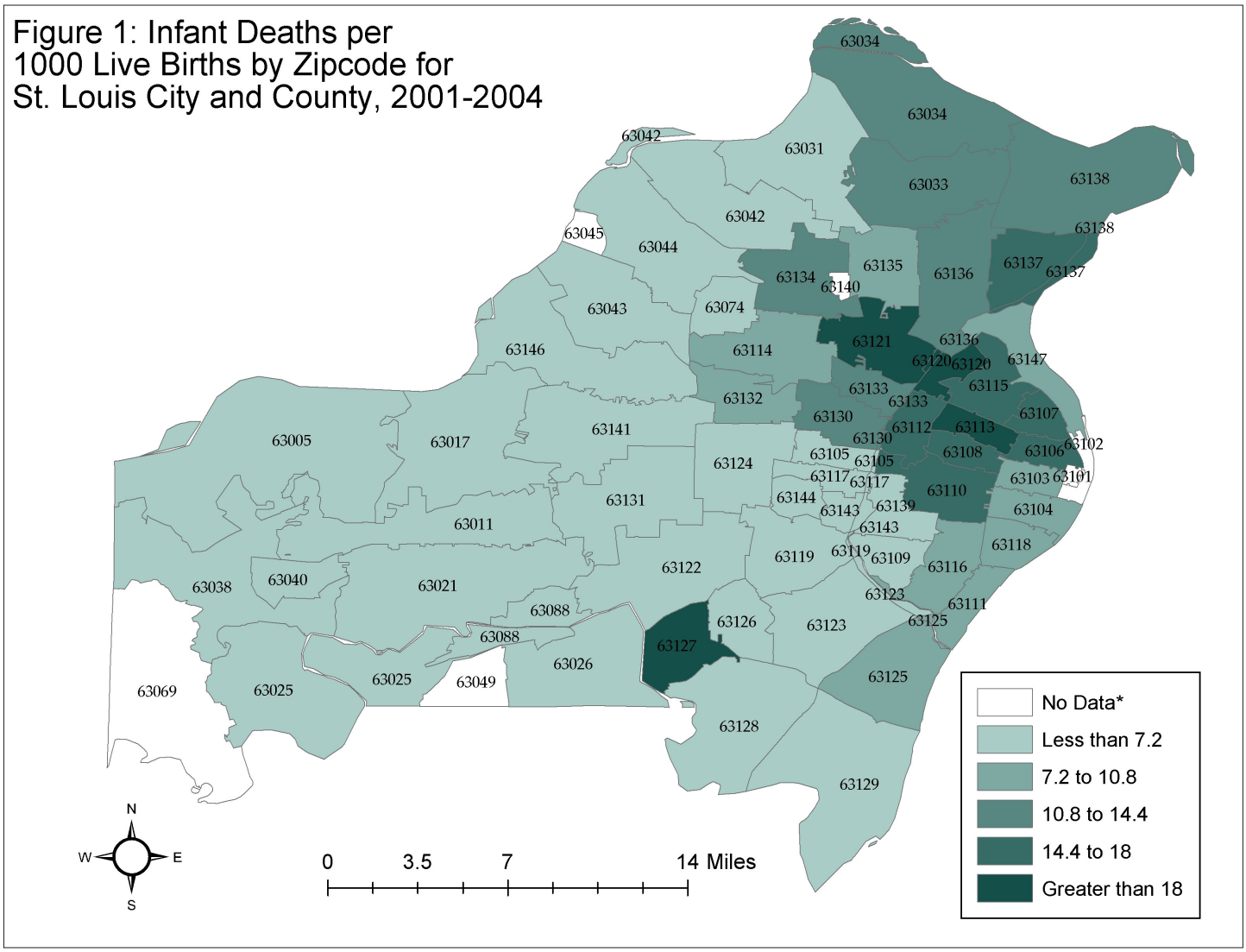
	Zip Codes Meeting the 2010 Objective		Zip Codes with Rates More Than 2 ½ Times The 2010 Objective	
	St. Louis City %	St. Louis County %	St. Louis City %	St. Louis County %
Infant Mortality	2.5	67.4	12.5	7.0
Fetal Death	6.3	39.5	68.6	18.6
Neonatal Death	12.5	41.9	12.5	27.9
Post Neonatal Death	18.8	41.9	18.8	18.6
Preterm Birth	6.3	27.9	0	0
Very Preterm	6.3	48.8	50.0	9.3
Low Birth Weight	6.3	44.2	18.3	2.3
Very Low Birth Weight	6.3	37.2	62.5	20.9

Note: Excludes zip codes with < 100 births.

Summary and Conclusions

Clearly the city of St. Louis remains at much higher risk overall than St. Louis County but St. Louis County has areas that need intervention and monitoring. We have identified a set of five zip codes in the city and county, respectively, which were found to have high rates of poor birth outcomes across the parameters examined suggesting they should be a high priority for intervention.

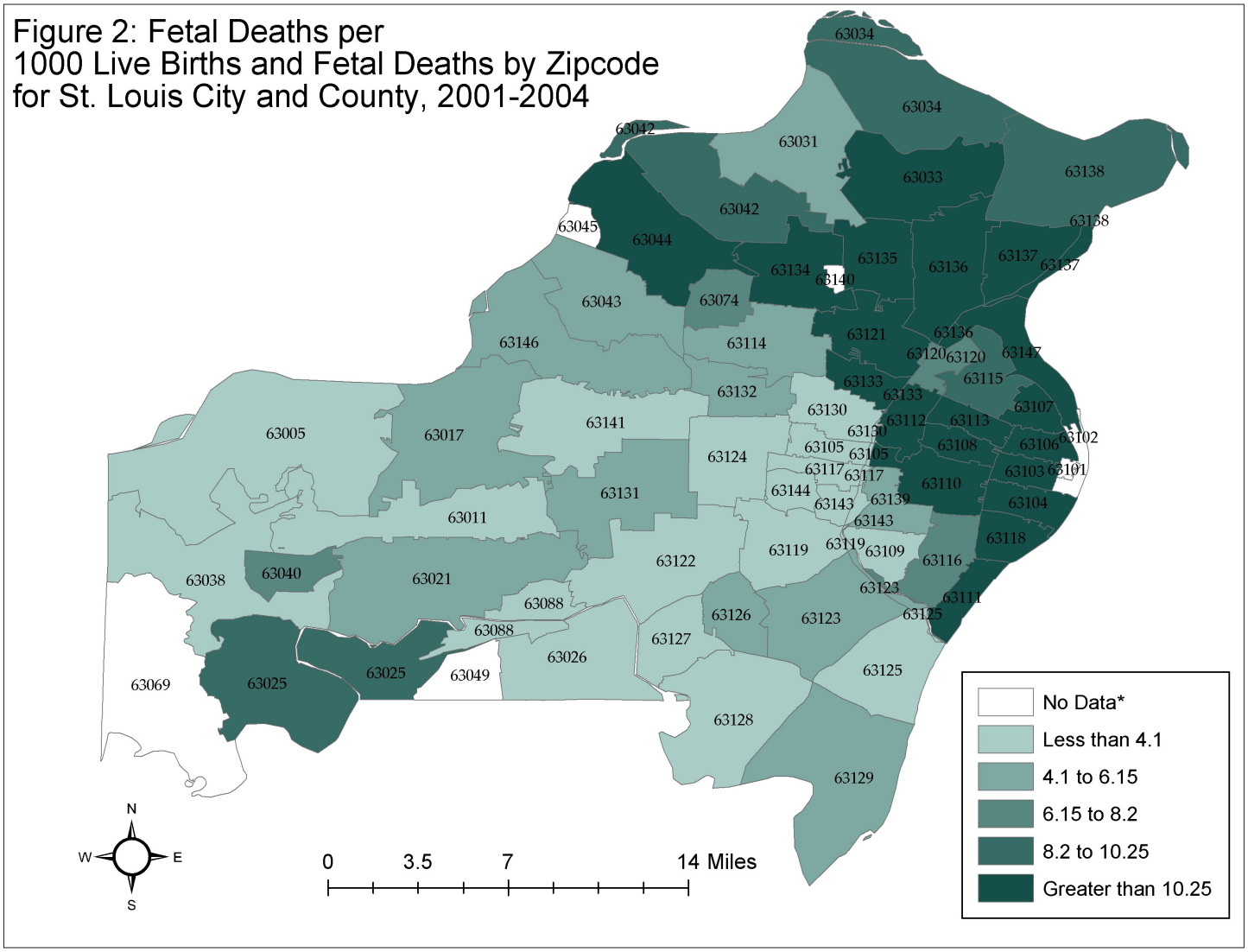
These results suggest priority areas for intervention and suggest that there is still much work to be done to move St. Louis City and St. Louis County closer to the 2010 objectives for birth outcomes and infant mortality.



* Zip codes were excluded if there was no data reported or if there were fewer than 100 live births in the period. In the city two zip codes were excluded for <100 births (63101 and 63102) in the county four zip codes were excluded two for <100 births and two for no reported data.

Note: The categories of rates were determined based on the 2010 objective for this birth outcome. 1) less than the 2010 objective, 2) less than 1½ times the objective, 3) less than 2 times the objective, 4) less than 2 ½ times the objective and 5) greater than 2 ½ times the objective.

Figure 2: Fetal Deaths per 1000 Live Births and Fetal Deaths by Zipcode for St. Louis City and County, 2001-2004



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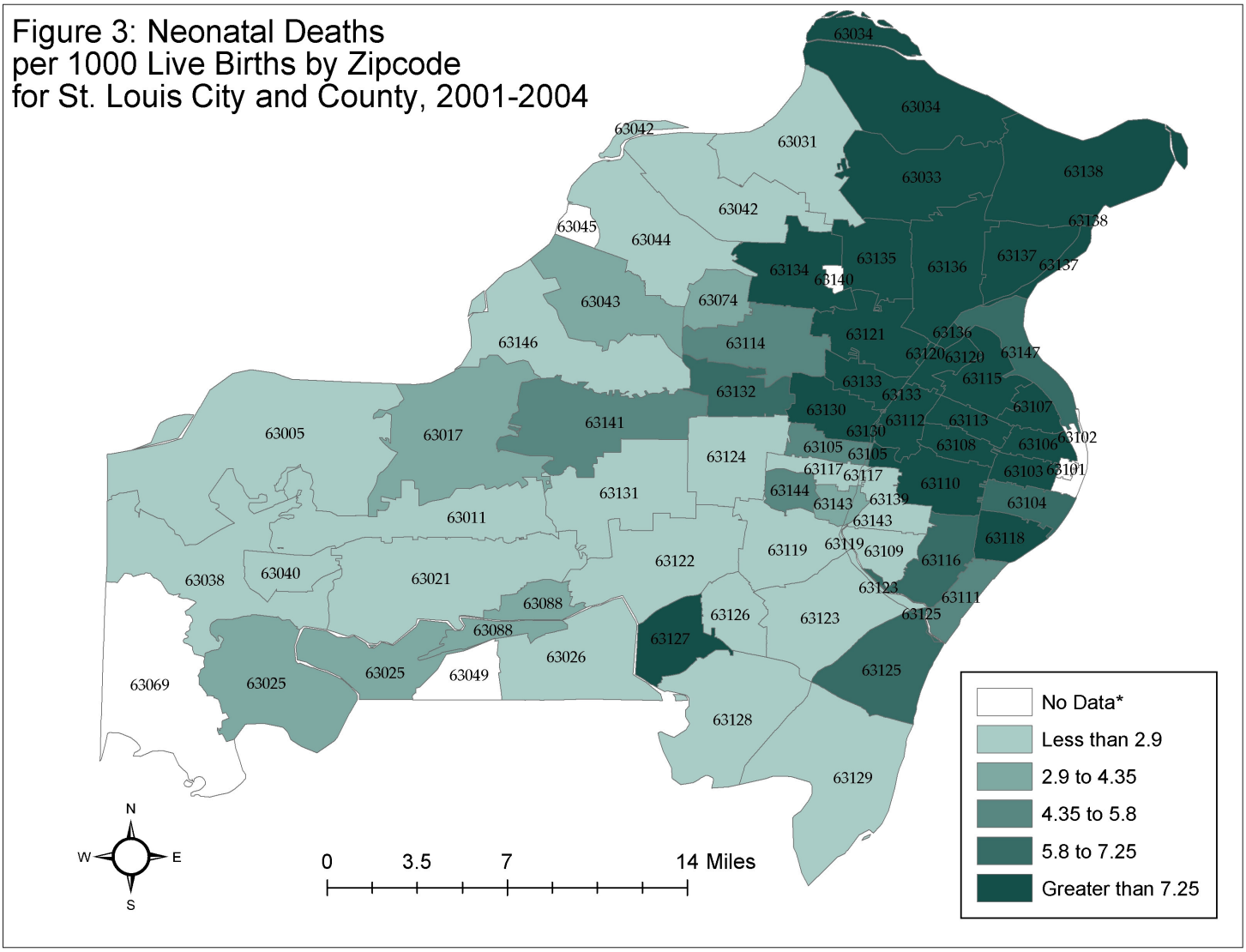

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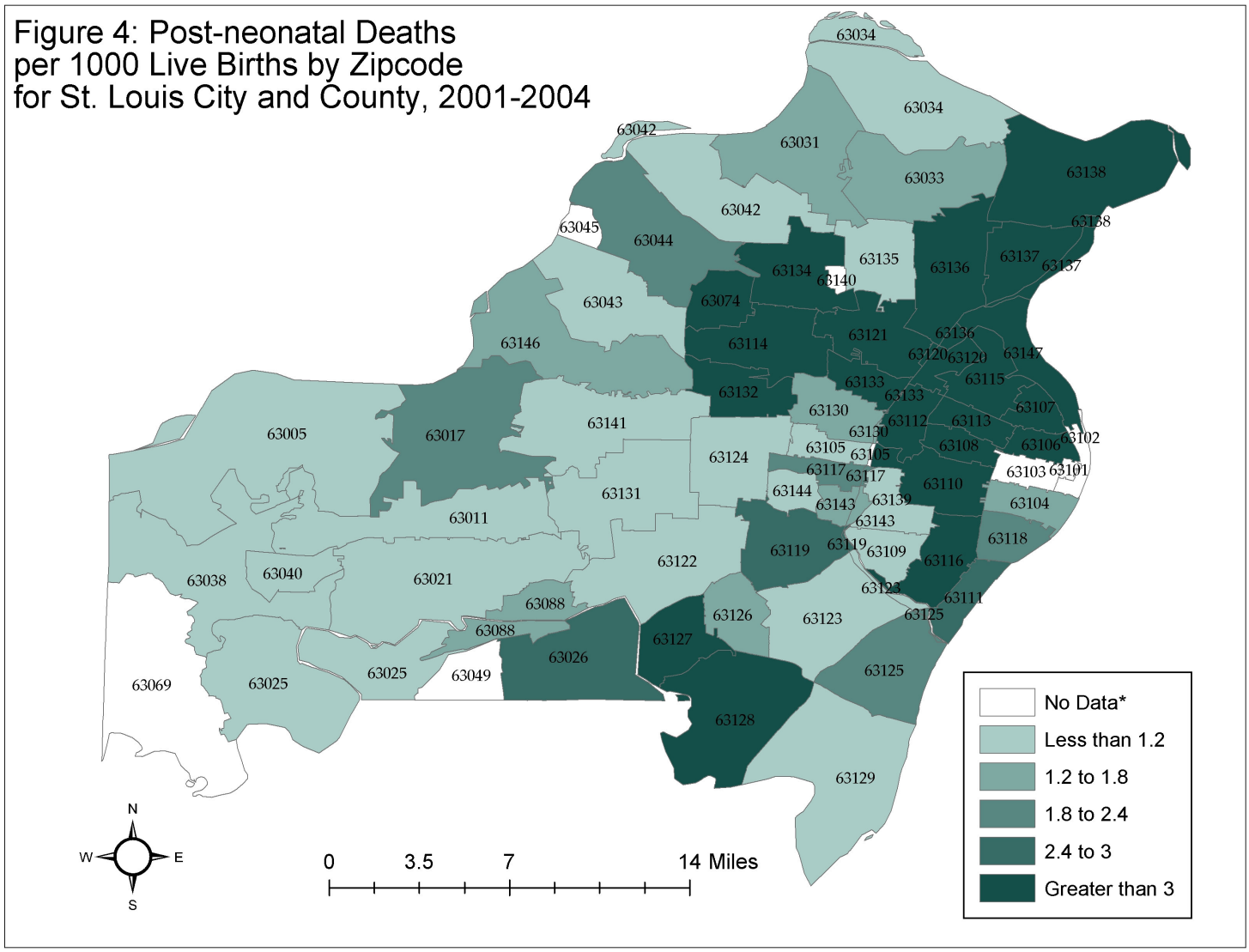

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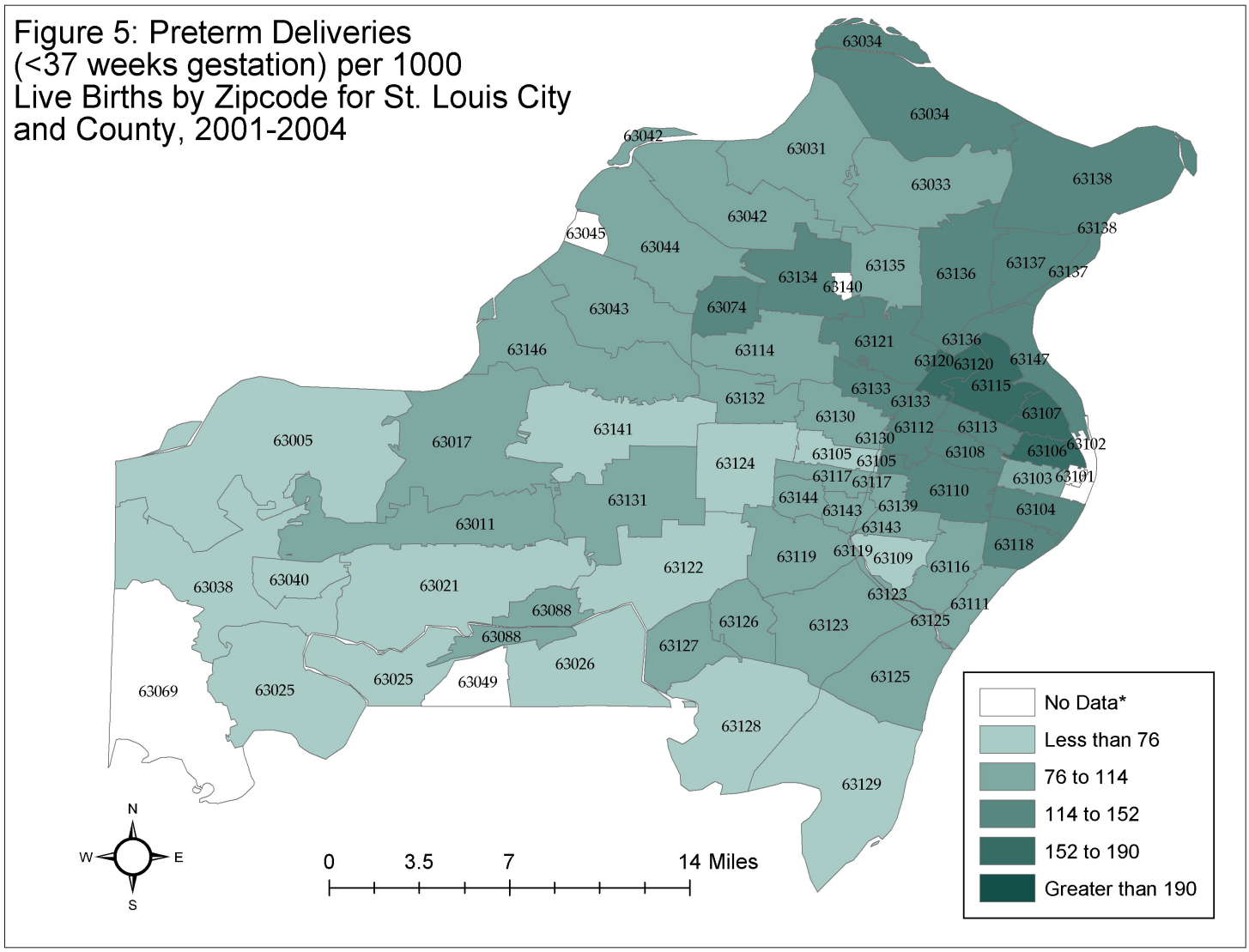

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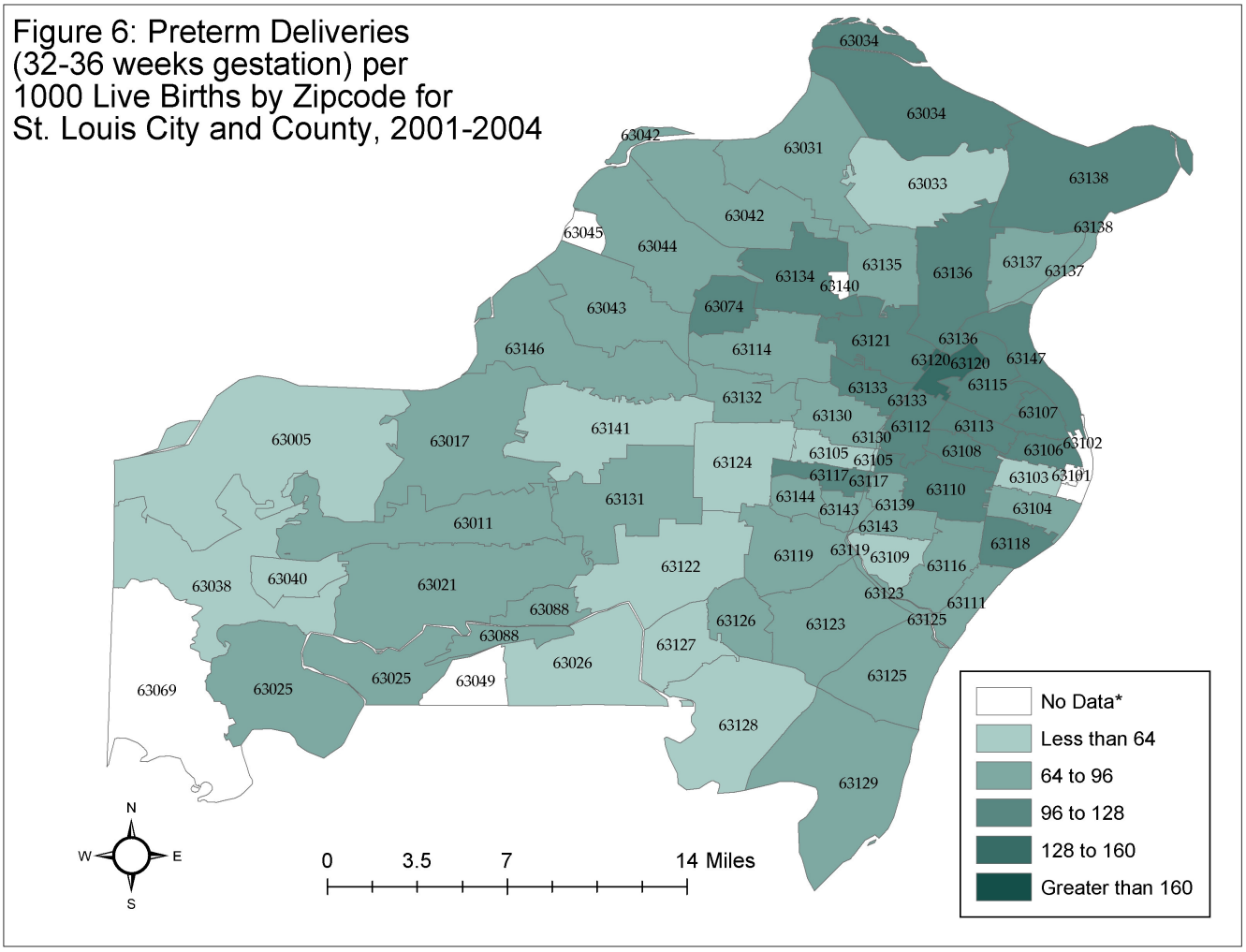

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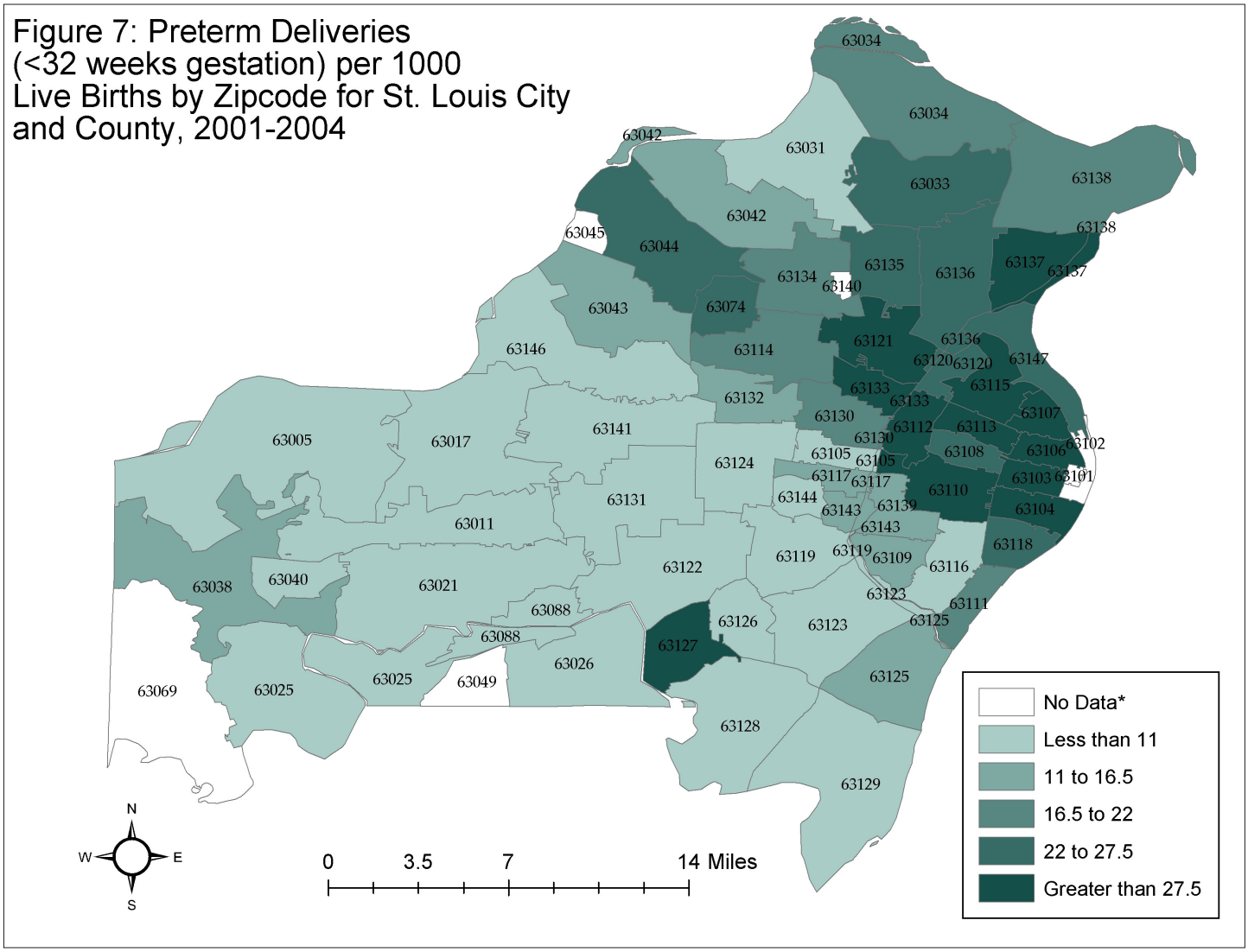
Note: The categories of rates were determined based on the 2010 objective for this birth outcome. 1) less than the 2010 objective, 2) less than 1½ times the objective, 3) less than 2 times the objective, 4) less than 2 ½ times the objective and 5) greater than 2 ½ times the objective.

Figure 7: Preterm Deliveries (<32 weeks gestation) per 1000 Live Births by Zipcode for St. Louis City and County, 2001-2004



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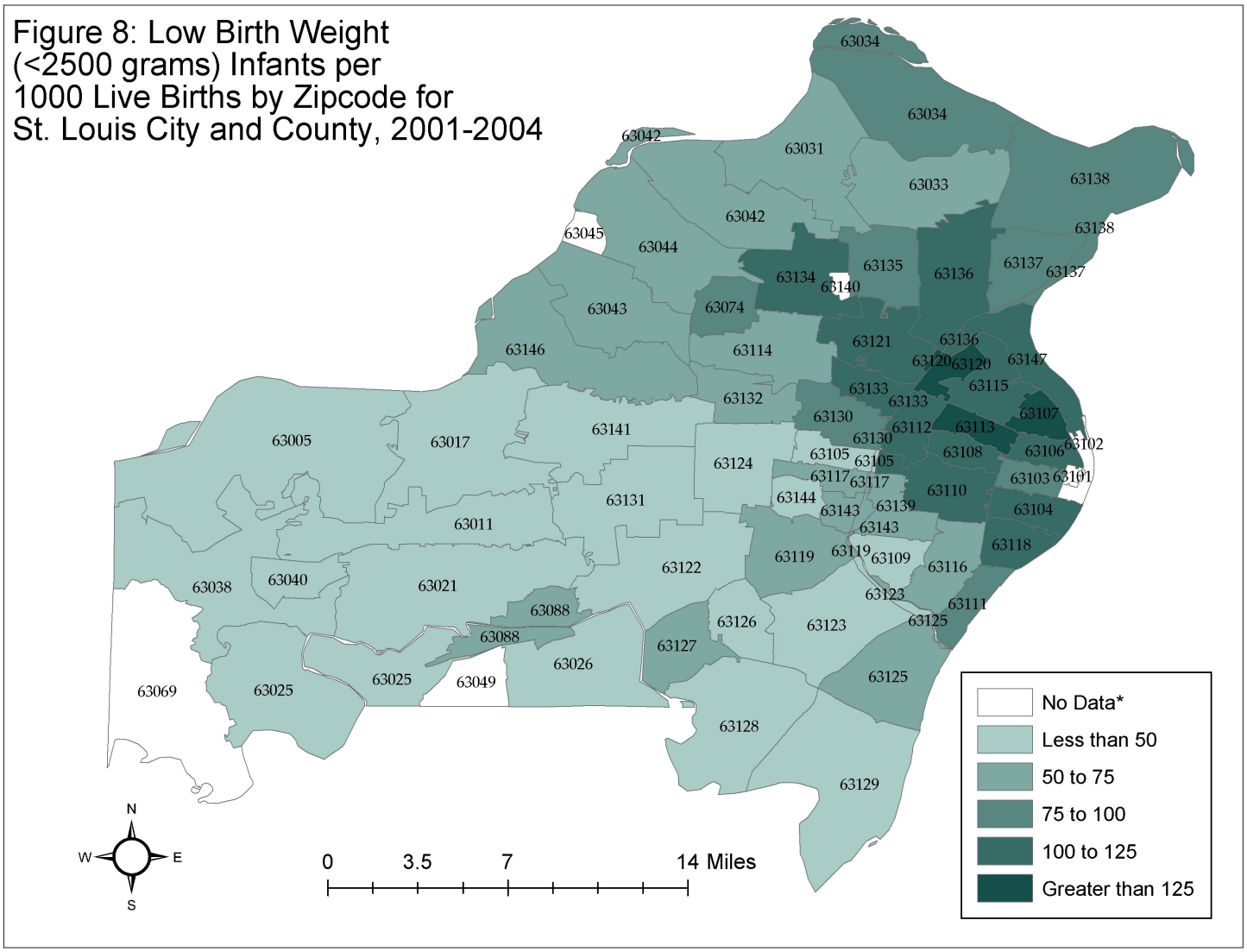

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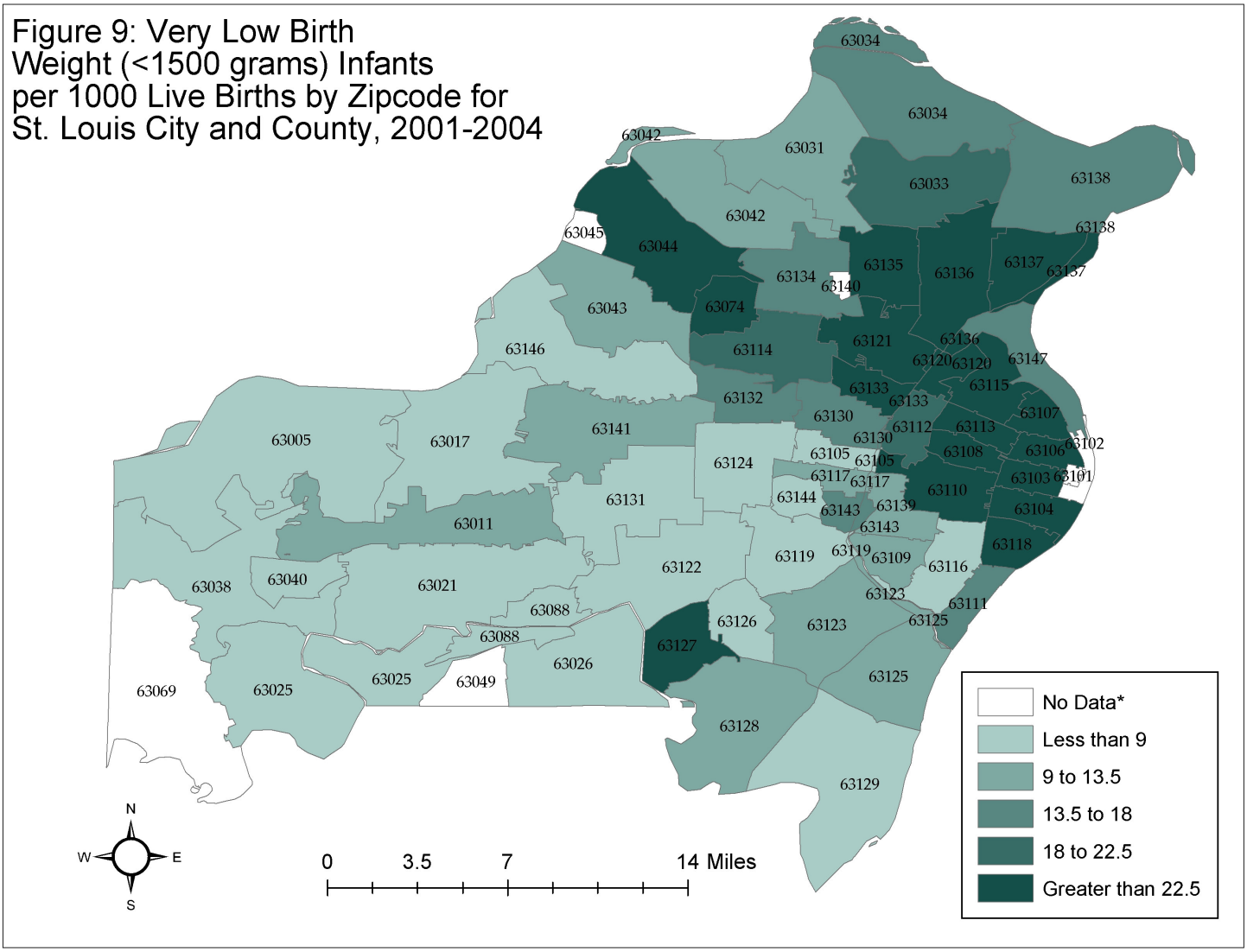
Note: The categories of rates were determined based on the 2010 objective for this birth outcome. 1) less than the 2010 objective, 2) less than 1½ times the objective, 3) less than 2 times the objective, 4) less than 2 ½ times the objective and 5) greater than 2 ½ times the objective.

Figure 9: Very Low Birth Weight (<1500 grams) Infants per 1000 Live Births by Zipcode for St. Louis City and County, 2001-2004



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Note: The categories of rates were determined based on the 2010 objective for this birth outcome. 1) less than the 2010 objective, 2) less than 1½ times the objective, 3) less than 2 times the objective, 4) less than 2 ½ times the objective and 5) greater than 2 ½ times the objective.

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APPENDICES