Preterm and Low Birthweight Births in North Carolina:
Incidence, Risks and Areas of Action for Prevention

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Developed for the North Carolina Child Fatality Task Force
by the Perinatal Health Committee as a resource document

WORKING DOCUMENT

Purpose

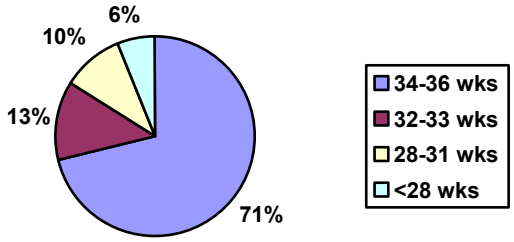
Infant deaths account for about 67% of all the child deaths in North Carolina. Premature birth is the leading cause of infant death in our state. This document describes the problem of preterm birth and low birthweight birth in North Carolina. It discusses the causes of the disease, the magnitude of the issue, and factors that may influence the incidence of the problem in our state. The report also reflects an effort on the part of the Perinatal Health Committee to develop strategies for working together to address this issue. The purpose of the report is to highlight the seriousness of premature birth and discuss promising interventions that should be explored.

Definition

Infants born after they have reached 38 weeks of gestation are considered full term. Babies born before this time are considered to be premature. Most premature babies are born between 34 and 37 weeks of gestation. These are called late preterm births. Babies born less than 33 weeks completed gestation are considered very preterm. Babies born weighing less than 2,500 grams (5 pounds, 8 ounces) are considered to be low birthweight. Babies born weighing less than 1500 grams are defined as being very low birthweight.

The chart below depicts national data and describes several categories of preterm births. For this chart, the March of Dimes distinguishes between very preterm infants (32-33 weeks) and extremely preterm infants (born 28 weeks or less). Extremely preterm infants account for the majority of the infant deaths and costs. [1]

Figure 1: Preterm Births by Gestational Age[1]



Problem

Each week in North Carolina: 2,367 babies are born, 689 babies are delivered by cesarean section, 324 babies are born preterm, 217 babies are born low birthweight, and 20 babies die before their first birthday.[1] North Carolina has higher than average rates of premature birth and low birthweight infants.[2] Preterm birth is a growing problem in North Carolina where we have experienced a 9% increase in early births over the past decade. In 2005, 16,868 babies (13.7% of all births) were born preterm. Low birthweight is also on the rise with an increase of 6% over the same ten-year period. In North Carolina in 2005, 11,308 babies (9.2% of all births) were born too small. North

Carolina lags behind the nation for its high rates of preterm birth with a grade of "F" according to the March of Dimes National Premature Birth Report Card.[3]

Not only is preterm birth the leading causes of infant death in North Carolina, it is the leading cause of infant sickness. Preterm birth accounts for greater than 70% of neonatal deaths and almost half of long-term neurological disabilities.[4] Children born preterm and/or low birthweight are at risk for respiratory distress syndrome, apnea, bleeding in the brain (intraventricular hemorrhage), patent ductus arteriosis, necrotizing enterocolitis, retinopathy of prematurity, jaundice, anemia, chronic lung disease, and infections.[1]

Later in life, these babies are at risk for school difficulties, developmental delays, cerebral palsy, visual and auditory issues, and attention deficit hyperactivity disorder. There are also concerns about increased risks for cardiovascular diseases and metabolic disorders as these children become adults due to their small size at birth and subsequent rapid growth catch up.[5]

Cost

In 2005, North Carolina Medicaid paid for prenatal and newborn care for 40% of the births in the state at a total cost of $287,774,792. The table below describes the Medicaid costs for births in North Carolina that have poor outcomes. The table does not include the costs to private insurance companies nor to families/hospitals for patients who are uninsured. The figures also do not include the costs to Emergency Medicaid, which pays only for delivery and hospitalization costs for mother and infant for an additional 9% of births in North Carolina. As such, the table only offers a portion of the cost of these health conditions to North Carolinian families and businesses. The cost per preterm or low birthweight baby is anywhere from double to 20 times higher than for healthy term newborns that average about $3,640 per birth.[6]

Table 1: Medicaid Costs in 2005 for Poor Birth Outcomes[6]

Infant Condition	Number of Infants	Average Cost	Total Cost
Late Preterm	4,546	$ 8,032	$ 36,515,326
Preterm	6,686	$19,780	$132,255,522
Very Preterm	1,332	$59,320	$ 79,013,727
Very Low Birthweight	1,217	$63,877	$ 77,738,693
Birth Defect	1,622	$34,713	$ 56,304,736
Infant Death	485	$34,713	$ 17,133,818
Neonatal Death (< 28 days of life)	263	$19,581	$ 4,360,854
At Risk Birth	3,523	$36,976	$130,268,583
Full Term	42,308	$ 3,640	$154,017,180

Table 2: Payor Source for North Carolina Births in 2005[6]

Payor Source	Number of Births	Percent of Births
Medicaid	49,381	40%
Emergency Medicaid	10,899	9%
Non Medicaid	62,760	51%
Total	**123,040**	**100%**

These figures do not account for the increased costs of treatment, therapy, and special services for these infants as they grow. They also do not consider the economic impact of a preterm birth on a family or community. The North Carolina Healthy Start Foundation developed a comprehensive list of the costs families of premature or low birthweight infants face. These include home nurse visits, follow-up assessments, early intervention visits, physical therapy, speech therapy, occupational therapy, doctor visits, opthamologist, travel to appointments, lost income (based on a

teacher's salary), hospital-grade breast pump, nebulizer, pulse oximeter, oxygen, apnea monitor, medication to prevent Respiratory Syncytial Virus, special formula, preemie diapers, preemie car seat insert and preemie clothes. These items cost about $63,092 per baby in 2003, and would likely cost more in 2009. These costs do not include any additional surgeries, prescriptions or special education costs, not to mention the emotional impact on the parents and other children in the family.[7]

The March of Dimes studied employer costs for preterm births. They found that businesses spend about $4,551 for healthy newborns in their first year of life as compared to $49,033 for infants born preterm. Nationally, preterm birth cost the nation over $26.2 billion dollars in 2008.[8] For North Carolina, this equates to $702 million in 2005.

Causes of Preterm Birth

Most preterm births are a result of spontaneous labor, either by itself or following the spontaneous premature rupture of the membranes (PROM). The causes of spontaneous preterm labor and PROM are not fully understood. The latest research suggests that many cases are triggered by the body's natural response to certain infections, including infections involving the amniotic fluid and fetal membranes. About 25% of preterm births result from the early induction of labor or cesarean delivery due to pregnancy complications or health problems in the mother or the fetus.[8] A growing number of late preterm births are due to elective inductions and cesarean deliveries. Overall, in about 40% of all cases of preterm birth, the physician cannot determine why a woman delivered preterm.

Preterm birth is a complex problem with multiple causes and interactions at play. There is a growing understanding of preterm birth as a syndrome in which various pathological disorders contribute to the initiation and progression of preterm birth. There is evidence that social and environmental factors contribute to the risk of preterm birth. However, the interactions among biological, genomic, and social factors have not been well evaluated.[4] Existing research demonstrates that preterm birth is not one disease with a single solution or cure, but rather the product of overlapping factors. There will be not be a single silver bullet or a single "cure" for this problem.[9]

Because it is a multifactorial problem, reducing the rate of preterm birth remains a challenge for many reasons. While we can begin to identify groups of women at risk for preterm birth, the science for preventing them from going into preterm labor or to stop preterm birth is inadequate. Once a woman is pregnant and presents for prenatal care, the course of her pregnancy may already have been set based on her health, her environment, and her family history.[4,10] The most effective interventions may likely need to begin before pregnancy.

There is not yet a test that can accurately predict which woman will have a preterm birth. To date, treatment has been primarily focused on slowing contractions if a woman begins labor early. This has not reduced the number of preterm births, but has delayed delivery long enough to administer steroids to the mother to help prevent respiratory distress in the infant after birth and transfer the mother and fetus to a hospital where they may receive appropriate care. These interventions have helped reduce the rates of mortality and morbidity, yet therapies and interventions for the prediction and the prevention of preterm birth are still greatly needed.[9] Improvements in the care of premature and low birthweight infants in intensive care nurseries have played the biggest role in reducing infant death from these birth outcomes rather than advances in the prevention of premature and low birthweight births.

Causes of Low Birthweight

There are two main reasons why a baby may be born with low birthweight. The first is the result of preterm birth. About 67% of low birthweight babies are premature. The earlier a baby is born, the less likely she is to have achieved a "normal" birthweight. Very low birthweight babies have the highest risk for health problems and death. Some premature babies born near term do not have low birthweight.

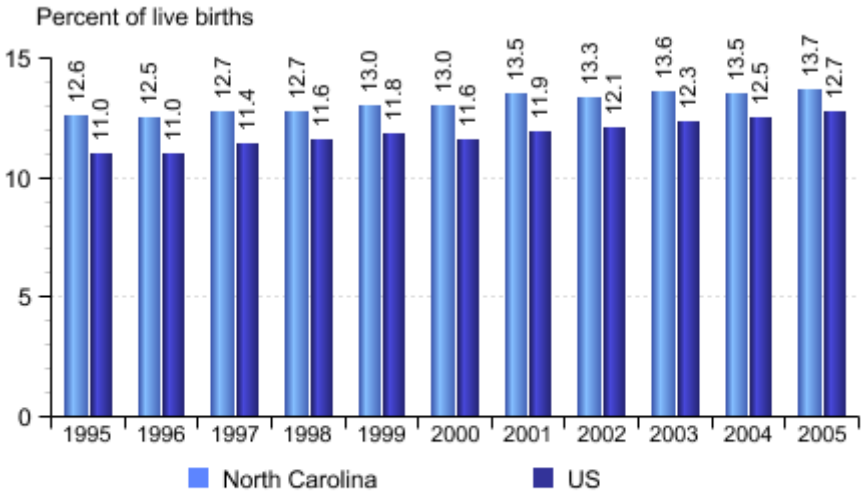
Growth restriction is the second major cause of low birthweight birth. Babies who are growth restricted, small-for-gestational age or small-for-date may be full term, but underweight. Some of these babies are healthy, even though they are small. They may be small because their parents are smaller than average. Others have low birthweight because something slowed or halted their growth

in the uterus. For example, babies with certain birth defects are more likely to be growth restricted because genetic conditions and structural abnormalities may limit normal development.[8]

Incidence

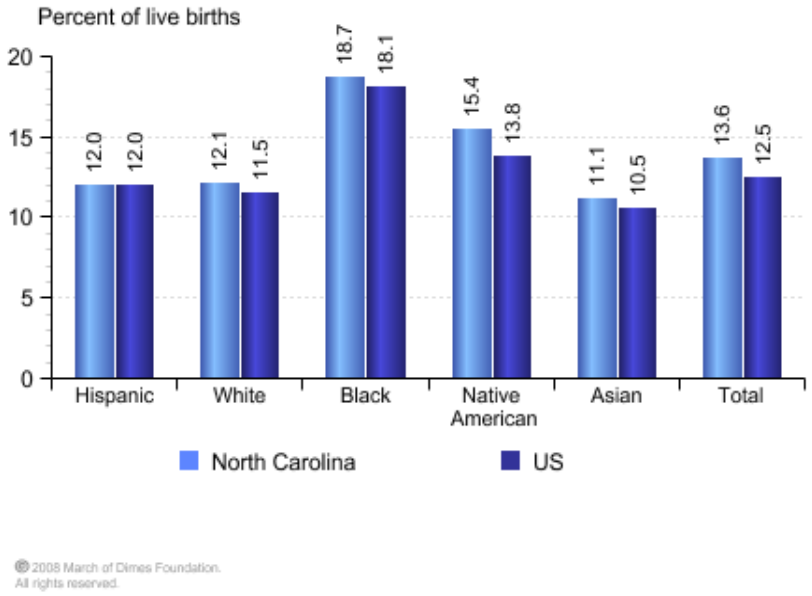
In North Carolina, one out of every seven infants is born preterm. We fall in the bottom tier of the United States for early birth, ranking 44th in the nation. While our infant mortality rates have remained fairly stagnant, preterm birth continues to increase both in North Carolina and across the nation. Most of the increase in preterm birth that has taken place over the past decade has been for infants born late preterm. Some of this increase is attributable to an increase in multiple births (due to assisted reproductive technology) and to changes in the medical management of pregnancy (increase in cesarean section and induction of labor for preterm infants)[4]. The rate of infants born very preterm has remained fairly consistent over the past 17 years. Tables located in the Appendix of this document depict this information for North Carolina. Figure 2 below compares North Carolina total preterm birth trends to those of the United States.

Figure 2: Preterm Birth Trend Data Comparing North Carolina and the United States[1]



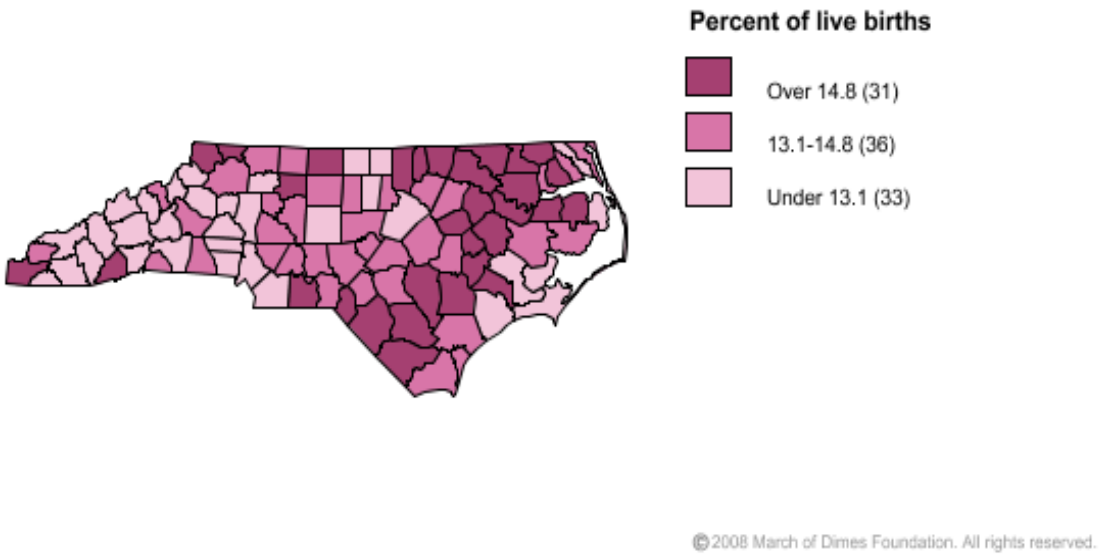
There are also major racial disparities in preterm birth and low birthweight in North Carolina and across the nation. African American babies have more than double the risk of being born very preterm or preterm compared to all other groups in North Carolina. In our state, 1 out of every 5 African American babies is born preterm. In 2007 the African American rate of very preterm birth was 4.6 compared to the White Non-Hispanic rate of 2.1. Asian mothers have the lowest rates of preterm birth followed by White mothers and Hispanic mothers. American Indians have higher rates of preterm birth than those of White and Hispanic mothers but not as high as those of African American babies. Additional charts of preterm birth and low birthweight by gestational age for different racial and ethnic groups in North Carolina are in the Appendix.

Figure 3: Preterm Birth by Race/Ethnicity, NC and US, 2003-2005 Average[1]



Geographically in North Carolina, Perinatal Care Regions V (Southeast) and VI (Northeast) have the highest rates of preterm birth and low birth weight in the state.[11]

Figure 4: Preterm Birth in North Carolina 2002-2005 Average[1]



Women Who Have an Increased Risk for Preterm Delivery and/or Low Birthweight

Preterm birth and/or low birthweight can affect any pregnant woman in North Carolina. Providers still are unable to predict which pregnant woman will deliver early. While providers and researchers do not know all the causes and pathways of preterm birth and low birthweight, they do know that there are some women who are at greater risk for these birth outcomes than other women.

The literature demonstrates that women with the following conditions have a **very high risk** for early birth and/or low birthweight infants.

- **Having had a prior preterm birth** is the strongest predictor of preterm birth. The risk of a mother experiencing a subsequent preterm birth ranges from 15% to 50% based on the

number and gestational age of previous deliveries. The earlier a mother's previous preterm birth was and the higher the number of early births, the greater her risk for another preterm delivery.[12] In 2005, about 5,423 pregnant women in North Carolina had experienced a previous preterm birth.[11]

- **Mothers who are African American** have a two and a half times greater risk of having a very preterm birth than any other racial/ethnic group of women in the state.[11]

- **Women with certain uterine distention or cervical abnormalities** are also at greater risk. **This group includes mothers who are pregnant with more than one baby.** For mothers carrying more than one fetus, the risk increases as the number of fetuses increases. Compared with singleton births (one baby), multiple births in North Carolina were about 5 times more likely to be born preterm. Between 1995 and 2005 the multiple birth ratio increased 33% (multiple births per total births reported). Multiple births were highest among women ages 40 and older, followed by women ages 30-39. Caucasian women were the most likely to have a multiple pregnancy followed by African American women. In 2005, North Carolinas ratio of multiple births was higher than the national average (34.6 to 33.8 respectively).[8]

Certain **medical conditions** during pregnancy also may increase the likelihood that a woman will have preterm labor or have a low birthweight baby.

- **Infections in the mother**: Certain infections, especially those that involve the uterus, may increase the risk of preterm delivery. These infections include those in the urinary tract and vagina. [8] Among women of reproductive age in North Carolina, 1234/100,000 have Chlamydia, 451/100,000 have Gonorrhea, 240/100,000 are living with HIV/AIDS, and 7/100,000 have Syphilis. Nearly every sexually transmitted disease has been associated with increased preterm birth.[14]
- **Infections in the fetus**: Certain viral and parasitic infections, including cytomegalovirus, rubella, chickenpox and toxoplasmosis can cause birth defects and low birthweight. [8]
- **Placental problems**: Placental problems can reduce flow of blood and nutrients to the fetus, limiting growth. In some cases, a baby may need to be delivered early to prevent serious complications in mother and baby. [8]
- **Birth defects**: Babies with certain birth defects are more likely to be growth restricted because genetic conditions and structural abnormalities may limit normal development. Babies with certain birth defects are also more likely to be born preterm. [8]
- **Chronic health problems in the mother**: Maternal high blood pressure, diabetes, and heart, lung and kidney problems can reduce birth weight or lead to early birth. [8]
- **Short time period between pregnancies**, particularly less than 6 months between birth and the beginning of the next pregnancy. The period of time between a woman's last delivery and her next pregnancy is called a pregnancy interval. Research has shown that women with a pregnancy interval of six months or less have double the risk of having a preterm or low birthweight infant as mothers with pregnancy intervals of 18-59 months. Excluding deliveries to first time mothers, approximately 1 out of every 10 resident births in our state (12.5%) is a short birth interval. In fifteen North Carolina counties, more than 14% of births were the result of short birth intervals.[11]
- **Being over or underweight.** Women who don't gain enough weight during pregnancy increase their risk of having a low birthweight baby. This is particularly true for women who begin a pregnancy underweight. Women who are very overweight are at increased risk for having a baby with a birth defect and preterm. [8]
- **Clotting Disorders** such as thrombophilia increase the risk of preterm birth.[8]
- **Being pregnant with a single fetus after in vitro fertilization** also increases the risk for preterm birth.[8]

- **Folate deficiency**: New studies suggest that in addition to reducing the risk of certain birth defects when taken prior to pregnancy, folic acid during pregnancy may reduce the risk for preterm birth. [8]

There are also preventive **health, lifestyle and socioeconomic factors** that can increase a woman's risk of having a preterm or low birthweight birth. These factors may be inter related and as such demonstrate the need for improved research to understand all of the various factors and interactions that lead to poor birth outcomes.

- **Smoking**: Pregnant women who smoke cigarettes are nearly twice as likely to have a low-birthweight baby as women who do not smoke. Smoking slows fetal growth and increases the risk of premature delivery and low birthweight.[8]
- **Alcohol and Illicit Drugs**: Alcohol and illicit drugs can limit fetal growth and can cause birth defects. Some drugs, such as cocaine and heroine, also may increase the risk of premature delivery. Fourteen percent of women in North Carolina reported they continued to use alcohol while pregnant, either in reduced amounts or at the same level as they did prior to pregnancy.[11] The most recent prevalence estimates of illicit drug use during pregnancy in North Carolina were collected in 1992 from a statewide random sample in private and public health sites across the state. Of the 2742 women in the sample, 7.4% had positive urine toxicology for an illegal or unprescribed drug.[13]
- **Late or no prenatal care:** Prenatal care is important to healthy pregnancies and better birth outcomes. Receiving care late or not at all is often related to maternal issues around access to care, low social support, substance use, and other factors that also might put a woman at greater risk for a poor birth outcome. [8, 11]
- **Socioeconomic factors**: Low income and lack of education are associated with increased risk of having a low birthweight baby, although the underlying reasons for this are not well understood. In North Carolina mothers who have Medicaid for Pregnant Women are at greater risk for having a premature or low birthweight infant than other mothers. [8,11]
- **Lack of social support**: Mothers who are unmarried in North Carolina have a higher risk of preterm birth and low birthweight than mothers who are married. Being unmarried is also linked to low income. [8,11]
- **Extremely high levels of stress**, **long working hours** with long periods of standing have been associated with preterm birth. [8]
- **Domestic violence**, including physical, sexual or emotional abuse, also increases the risk of preterm birth. [8]
- **Maternal age is also a factor.** We know that mothers who are younger than 18 or older than 35 have a higher risk for preterm birth and low birthweight than other groups in our state. [8]
- **Induced Abortion.** The association between induced abortion and later preterm birth is an emerging issue that requires additional study by competent experts in the field. Literature reviews yield many studies that conclude that such an association exists. There are also studies indicating that the association is inconclusive. Interestingly, there are indications that the underlying emotional perspectives on abortion in our society have affected the scientific approach taken by some authors. In recognition of the bias that may exist on both sides of this issue, an "impact factor" analysis was performed to determine the number of times that the study articles were referenced in other articles. Regrettably, the underlying bias noted above also detracted from an impact factor analysis.

  A search of the policy statements of major practice organizations – the American College of OB/GYN, the American Academy of Pediatrics, the March of Dimes, as well as their state counterparts – revealed no practice recommendations regarding the association of induced abortion and preterm birth.

In two published lists of risk factors for preterm birth, induced abortion is listed. The Mayo Clinic lists "multiple miscarriages or abortions" last on its list of common risk factors. In an appendix to its lengthy report on *Preterm Birth,* the Institute of Medicine lists induced abortion well down the list. In both cases no narrative could be found to explain and support the listing.

In the absence of policy statements from the practice organizations, individual clinicians make their own decisions regarding whether to inform clients of the possible association between induced abortion and later preterm birth. Given this situation, the NC Child Fatality Task Force is not in a position to make practice recommendations. However, the Task Force will continue to request that the relevant practice organizations study this emerging issue and publish practice recommendations.

There is one very relevant issue on which all parties interested in this issue agree – unintended pregnancies should be as rare as possible. This would make induced abortions rare as well. All recommendations aimed at enhancing access to comprehensive sex education, access to contraceptive services, and improved longer lasting contraceptive methods are aimed at these goals.

Pregnancy Related Trends among NC Women

Unintended Pregnancy

Based on the 2004-06 NC Pregnancy Risk Assessment Monitoring System Survey Results, 45% of mothers who recently had a baby said that they either wished they had become pregnant later or not at all. Women younger than 20 years of age, African-American women, women with less than or equal to a high school education, unmarried women, and women who received Medicaid were more likely to report an unintended pregnancy in North Carolina during this time than other women. Among young women under the age of 20, 70% reported that their pregnancies were unintended. However, five out of six unintended pregnancies in North Carolina were to women over 20 years of age. Among women with unintended pregnancies, fewer women too a multivitamin before becoming pregnant, had health insurance, were still breastfeeding and lived in households with an income of $50,000 or higher. More women with unintended pregnancies received Medicaid, WIC and smoked. In the United States in 2001, of pregnancies identified as unintended, 44% ended in live births, 45% in abortions, and 14% in miscarriages.[15]

Abortion

The abortion rate in North Carolina has remained stagnant over the past 10 years. The women most likely to seek an abortion are 20-24 years of age, unmarried, have more than 13 years education, have no living children, and have not had a previous abortion. The state abortion rate is 15.2 per 1,000 pregnancies. In 2007, the abortion rate for Caucasian women was 9.2 compared to a rate of 25.9 for African American women and 20.5 for Hispanic women. The majority of abortions occur in the first trimester (83%), with 60% taking place at 8 weeks gestational age or less.[11]

Adolescent Pregnancy

Teens are more likely to have a preterm birth than women in their 20s and 30s. Teen pregnancy rates continue to hold steady in North Carolina, with 2007 state rates nearly the same as those over the previous four years. The five-year plateau follows a 13-year decline that resulted in the state's lowest-ever rates in 2003. The state's adolescent pregnancy rate has declined by 36 percent since 1992. Nationally, based on 2003-05 birth rate averages, North Carolina ranked 36th in the nation for high rates of pregnancy among women ages 15-19. Our rate was above the national average.

The 2007 pregnancy rate for teens ages 15 through 19 was 63.0 pregnancies per 1,000 teens. The total number of North Carolina teens aged 15-19 who were pregnant in 2007 was 19,615. That number includes both married and unmarried females. Almost 30% of those pregnancies were to teens who had been pregnant at least once before. While most rates remained steady, the rate of

repeat pregnancies rose 3.2 percent from the previous year. The number of 10- to14-year-olds who were pregnant in 2007 was 404. About 23% of teen pregnancies ended in abortion.[11, 16]

Women's Health Status

The health status of women prior to pregnancy is increasingly recognized as a critical component of the health of children. Women between the ages of 18 and 44 in North Carolina have a number of health challenges that if addressed before conception would lower rates of both preterm birth and low birthweight. The North Carolina Preconception Health Strategic Plan highlights a number of health and life style issues that affect women of childbearing age in North Carolina. These health challenges include:[17]

- 11% engage in binge drinking
- 24% use tobacco
- 8% admit to using illicit drugs
- 47% do not meet minimum physical activity recommendations
- 28% are obese
- 26% are overweight
- 10% have hypertension
- 3% have diabetes
- 26% have poor mental health
- 20% have postpartum depression
- 25% are uninsured
- 31% have not visited a dental clinic in the past year
- 71% do not take folic acid at least 5 days a week
- 14% may not be rubella immune [17]

To address these issues, in 2008 North Carolina developed a comprehensive state preconception health action plan. This plan, when fully funded and implemented, has the potential to lower preterm birth and low birthweight while simultaneously improving overall women's health and saving substantial healthcare dollars.

Nationally, estimates of the number of women with disabilities ranges from 16.8 to 28.6 million, or approximately one in every five women. A large percentage of these women are in their reproductive years and they often encounter greater obstacles to receiving health care, including preconception and prenatal care, than other women. Sexuality and reproductive health issues have received inadequate attention for women with disabilities. Despite the fact that a growing number of women with disabilities are becoming pregnant, little is known about the reproductive experiences of these women. Disability is not regularly included in national or statewide surveys or surveillance tools related to pregnancy.[18]

Data from the 2007 Behavioral Risk Factor Surveillance System (BRFSS) Survey suggests that 1.8% of female respondents aged 25-34 and 5.4% of women aged 35-44 reported having a health problem that requires them to use special equipment, such as a cane, wheelchair, special bed or special telephone. In that same data set, 6.11% of the women ages 18-24 reported being limited in activities due to physical, mental emotional problems, as did 10.3% of the respondents aged 25-34 and 16.7% of women aged 35-44.[11]

Strategies

Strategies to address these complex issues can and must take several forms. Interventions can be classified as primary (directed to all women before or during pregnancy to prevent and reduce risk), secondary (aimed at eliminating or reducing risk in women with known risk factors), or tertiary (initiated after the premature labor has begun with a goal of preventing delivery or improving outcomes for preterm infants).[10] In North Carolina, we need to address our preterm birth crisis from each of these different angles. The most recently published literature from the Institute of Medicine, the Centers for Disease Control and Prevention, the March of Dimes, and the Surgeon General's Conference on Premature Birth were reviewed to find recommendations for the prevention of preterm birth and low birthweight. Due to the complexity of these conditions as well as the limited amount of

funding allocated to research and services, more studies are needed in many arenas to "prove" that specific programs reduce preterm birth and low birthweight. Until that happens, however, scientists agree that several strategies already exist that can make a difference. The strategies reflected below were put forward by leadership organizations such as the March of Dimes, Centers for Disease Control and Prevention, the American College of Obstetricians and Gynecologists, and researchers around the country who have studied these issues. While no one knows how to completely end preterm birth at this point in time, we believe that if these strategies were fully applied, North Carolina would see a marked improvement in its rates of preterm birth and low birthweight.

Primary Prevention Strategies

Improve women's health in North Carolina

An area that is gaining significant interest and research is preconception health, focusing on the health of a woman before she becomes pregnant. Investing our resources and energy in preconception health is a promising opportunity to improve birth outcomes. The Centers for Disease Control and Prevention along with a panel of experts representing over 100 major organizations released national Preconception Health and Health Care Recommendations. These recommendations serve as a framework for efforts within states to improve the health of girls and women.

Building forward from the CDC Recommendations, North Carolina released a 5 year Preconception Health Strategic Plan to improve the health of women of childbearing age in our state. The Plan is based on the understanding that through a collaborative focus on women's wellness, North Carolina will improve the quality of life for women as well as the health of infants. Priority areas in the plan include a focus on pregnancy intendedness, reducing obesity and related conditions, addressing substance abuse and mental health issues, supporting collaborative research on preconception-focused topics, policy development, and increased access to care.[17]

Several major journals published over 34 articles in November/December 2008 on specific areas of practice, outreach, and populations of women as they relate to the need for and delivery of preconception health and health care. As the link between the health of women and their babies has become evident, the need for North Carolina to craft a comprehensive response to women's health grows as well.

Increase the number of pregnancies in North Carolina that are planned.

This CDC vision statement described above also puts forward the goals that all women and men of childbearing age will have high reproductive awareness, all women will have a reproductive life plan, and all pregnancies will be intended and planned. These goals are echoed in the North Carolina Preconception Health Strategic Plan, which lists pregnancy intendedness as a priority for intervention. In order to achieve this goal there are a number of steps that need to be taken. These include:

- Increase the ability of health care providers to counsel, prescribe, and refer patients for appropriate and high-quality family planning methods, particularly for women with chronic conditions.

- Decrease barriers in private and public health care systems that impede pregnancy planning and spacing.

- Support and expand the services available to low-income women through its Medicaid Family Planning Waiver.

- Educate all women and men of all ages about their reproductive health, the importance of baby spacing, and family planning methods.

- Provide outreach to men to address issues regarding male involvement and responsibility in the decision to have and care for a child.

- Offer comprehensive sexuality education in all schools in North Carolina.

Increase the number of pregnancies that are spaced between 18 and 59 months apart.

A companion strategy to preventing unplanned pregnancies, is working with families to educate and support them in their decisions around birth spacing. Pregnancy intervals of 6 to 17 months and longer than 59 months are associated with a significantly greater risk for preterm birth and low birthweight. Close birth intervals can also strain family resources and interfere with child development.[19,20] One way to address this issue is to better educate families about the risks of having their babies spaced too closely, with a special emphasis on waiting at least 6 months in between the birth of one child and the conception of another. Making sure that new mothers have access to good postpartum care after they have a baby is also important. Health care providers must talk with mothers about their future pregnancy plans and insure that they have ongoing access to contraceptive methods that will help them meet these needs. Providers should be prepared to talk about the birth intervals that are the healthiest for mother and baby. Breastfeeding also plays a role in birth spacing. This role includes family planning for mothers who are fully breastfeeding, have babies less than six months old and have not had their menses return.

Increase the number of women who stop smoking, with an intensive focus on helping mothers stop smoking during pregnancy and remain smoke free postpartum and beyond.

Tobacco use increases the risk of preterm birth and low birth weight by 25%.[10] Smoking also increases the risk of Sudden Infant Death Syndrome, lung disease, respiratory illnesses and brain development in infants. Pregnancy is a time when many mothers can be motivated to stop smoking and there are proven methods (such as the 5As method) to screen and counsel pregnant women who smoke.[10] In addition to being good for the mother, there is strong evidence that smoking cessation programs in pregnancy successfully reduce the incidence of preterm birth and low birthweight. Second hand smoke also impacts the health of infants. Smoking recidivism after delivery, however, is very high. Efforts are needed to better assist women in not only not smoking during pregnancy, but also to quit smoking before they become pregnant and to stay smoke free after their baby is born.

The North Carolina Quitline provides free individual smoking cessation counseling for pregnant women, parents, and families. The Health and Wellness Trust Funds' You Quit Two Quit project is focusing on developing quality improvement projects for health care providers serving low-income women and on provider education. The NC Healthy Start Foundation has several educational products available free of charge on this topic. The Women and Tobacco Coalition for Health has developed an award-winning guide and video for counseling patients to stop smoking.

While a number of important efforts are underway, they are under funded. Further, there is a need to encourage health care providers, parent support groups, women and families to fully engage in smoking cessation in order to maximize our efforts and realize the full potential impact of this intervention on improved maternal and infant health outcomes. Additional funding is required to put prevention tools in the hands of providers and communities. Public awareness is needed to reiterate the importance of smoking cessation both for pregnant women and new mothers as well as for the family members and friends who are around them. Access to pharmacotherapy should also be increased for postpartum mothers.

Increase the number of women who abstain from alcohol and drug use during pregnancy and beyond.

Prevention of perinatal substance exposure requires the identification of women at risk for perinatal substance exposure. Healthcare providers are uniquely positioned to address perinatal substance use through screening and brief interventions. In North Carolina, less than three-quarters of women report having received information from a prenatal care provider about how alcohol use or drug use might impact their babies.[11] Universal screening using a validated screening tool, education and appropriate follow-up with prenatal clients is optimal.[21,22] Women who receive an assessment and brief intervention for alcohol and drug use in clinical and social service settings are more likely to report abstinence or reduce their use during pregnancy.[23-25]

Women identified through screening as in need of substance abuse treatment must receive non-punitive gender-specific treatment to address their unique needs. Receiving gender-specific substance abuse treatment positively impacts women's length of stay in treatment and likelihood of remaining abstinent after treatment.[26] Women in North Carolina who are pregnant and using alcohol and drugs may access substance abuse treatment in their communities or through the NC Division of MH/D/SAS Perinatal and Maternal Substance Abuse Initiative. The initiative is composed of 21 specialized programs for substance abusing pregnant and parenting women and their children. This initiative was funded to address birth outcomes related to substance abuse during pregnancy. These programs provide comprehensive gender-specific substance abuse services, including out patient and residential services. It is imperative that North Carolina continues to support these services to increase the number of women who abstain from alcohol and drug use during pregnancy.

North Carolina must also increase the ability of health care professionals to screen women who are pregnant for alcohol and drug use, and counsel and refer patients to treatment as indicated. Barriers to appropriate interventions in public and private health care settings must be evaluated and addressed in order to ensure access to care for women in need. The general public should be educated on the risks of substance use during pregnancy and available resources for assistance with alcohol and drug abuse.

Secondary Prevention Strategies

Reduce the risk of recurring preterm birth with 17 Alpha Hydroxyprogesterone Caproate (17P)

The use of 17 Alpha Hydroxyprogesterone Caproate (17P), a progesterone supplementation, has been demonstrated to show a reduction in recurring preterm birth by 33% for women who have had a previous singleton spontaneous preterm birth.[27] While the benefit of progesterone at present has been proven to work for only a segment of the women at risk for preterm birth, the savings of treating this group of mothers has been estimated at more than $2 billion per year in the United States alone. The use of 17P is listed in many scientific articles as one of the key tools available at present to provide secondary prevention for preterm birth. In fact, 17P as a treatment holds promise for future research because of its mechanism of action and its potential impact on other populations of at risk women.[10] North Carolina should continue to support the 17P program to provide medication for uninsured mothers, education for health care providers and patients, program monitoring, and quality improvement initiatives in clinical application.

Increase access to interconception health care (care between pregnancies) for mothers who experienced high risk pregnancies and/or had poor birth outcomes.

Having a prior preterm birth is the strongest predictors of having a preterm birth. This is in part because many of the factors contributing to preterm birth, such as chronic illnesses or poor health status, continue after delivery and may continue long after pregnancy. Women who have had a high-risk pregnancy should be provided interconceptional care that includes, at a minimum: treatment of chronic illnesses (such as diabetes, hypertension, or substance abuse), infections, asthma, obesity, depression, genetic counseling, family planning counseling, and counseling for diet and lifestyle factors.

The state can reduce the number of high-risk births by improving the interconceptional care of the mother. Dunlop et. al. conducted a study to determine whether providing interconceptional care to women who had a prior preterm birth would improve subsequent birth outcomes. Study participants were provided medical, dental, and supportive services for two years following their initial delivery. Dunlop found that the women who did not receive the interconceptional care (control group) had 3.5 times as many adverse pregnancy outcomes and 2.6 times as many repeat pregnancies as the women who were offered comprehensive services. [28]

Currently, low-income mothers lose their access to Medicaid at 60 days after delivery. This may leave them unable to access needed services to cope with health concerns that could impact their health as well as future pregnancies. The Centers for Disease Control and Prevention along with 35 national partner organizations and over 100 experts from around the country set forth a vision for improving preconception health and health care which will improve women's health and the health of

their infants. This vision includes the goal that women with previous adverse pregnancy outcomes will have access to interconception care aimed at reducing their risks.

The North Carolina General Assembly should direct the Division of Medical Assistance (DMA) to seek a Medicaid 1115 waiver to provide coverage to low-income women who have given birth to an infant weighing less than 1500 grams, born less than 34 weeks gestation, born with a congenital anomaly, stillborn, and/or who has died in the neonatal period (first 28 days of life). These women should receive care until their next pregnancy or two years postpartum, whichever comes first. As part of this directive: a) DMA should develop a benefit package to improve interconceptional care in order to decrease poor birth outcomes in subsequent pregnancies; and b) DMA should explore whether the cost savings from improved health outcomes will offset the cost of providing Medicaid coverage to this targeted population. North Carolina's current 1115 Family Planning Waiver only allows for coverage of family planning services, not comprehensive care for at-risk women. North Carolina's waiver provides family planning services to women and men with incomes up to 185% federal poverty guidelines. Under the terms of the federal waiver, the state can only cover family planning services and very limited treatment of sexually transmitted diseases.

As we move forward, it is important to consider expanding care to mothers who had high risk conditions such as hypertension, gestational diabetes during pregnancy but were fortunate to not have an infant requiring intensive care nursery services. These women are at risk for having these conditions reoccur in a future pregnancy which then may result in an adverse birth outcome. Further, with pregnancy now considered a stress test for life, women who were high risk during pregnancy due to medical, mental health or behavioral risk factors have "flagged" themselves and deserve additional services to ameliorate the impact on future pregnancies and their long-term health.

Tertiary Prevention Strategies

Hospitals and Health Care Professionals in North Carolina should voluntarily assess cesarean sections and inductions of labor prior to 38 weeks gestation to ensure consistency with professional guidelines.

While the bulk of mortality and morbidity from preterm birth and low birthweight occurs to infants born very preterm, infants born late preterm birth in North Carolina are also at risk for health problems both during the newborn period and childhood. Compared with births at 39 weeks of gestation, the rates of adverse respiratory outcomes, mechanical ventilation, newborn sepsis, hypoglycemia, admission to the neonatal ICU, and hospitalization for 5 days or more were increased by a factor of 1.8 to 4.2 for births at 37 weeks and 1.3 to 2.1 for births at 38 weeks. While elective repeat cesarean delivery before 39 weeks of gestation is common, it is associated with respiratory and other adverse neonatal outcomes.[29] In light of the increasing number of late preterm births in our state along with the increased cost and consequence for these births, it is important that we employ all appropriate methods to insure that as many infants as possible are safely carried to full term.

Insure that infants who are preterm, low birthweight and/or have birth defects are born in a hospital prepared to care for them.

Regionalization of perinatal care has been in place in North Carolina for over three decades. This organization of a system of care insures that high-risk mothers and infants receive care from a team of specialists and have access to a neonatal intensive care unit prepared to handle their medical needs. Studies show that mortality among very low birthweight babies is lowest for deliveries that occurred in hospitals with neonatal intensive care nurseries with a high level of care and a high volume of such patients.[30] With an increase in both the number of neonatal intensive care units in community hospitals and the complexity of the cases treated in these units, it is important that attention is paid to insure that babies are born in facilities that are equipped to care for them.

Insure that health care professionals and institutions are correctly and fully implementing all known science and options in the care and treatment of mothers in preterm labor and infants born preterm or low birthweight.

While the science is not complete, there are best practices available in the management of women in preterm labor, during childbirth, and for infants born preterm and low birth weight. For example, the appropriate use of tocolytic drugs and antenatal steroids with mothers in preterm labor are effective tools in helping to reduce the morbidity of a preterm birth.[14] The importance of human milk for the secondary prevention of mortality in the premature infant is another. Efforts such as the North Carolina Perinatal Quality Care Collaborative and the State Perinatal Outreach Coordination Program which build initiatives in hospitals, health departments, and clinics across the state to insure consistent and optimal care for high-risk newborns and mothers are important in tertiary prevention of the negative effects of preterm birth and low birthweight.

Key Elements for Action

Community Involvement and Health Equity

Experts agree that community involvement and support are critical as part of efforts to address preterm birth and low birthweight, especially in addressing health disparities. Communities, given sufficient support, have the ability to provide leadership in efforts to improve birth outcomes. Program efforts must extend beyond the healthcare system to efforts that involve working with community leaders, inclusive of civic and faith organizations, along with family participation in designing program efforts. These entities have already been instrumental in providing education and support in communities all across North Carolina. These groups can also advocate for and provide feedback about programs that work. The North Carolina Baby Love Plus Program is an example of this effort in action.

In light of the greater than two-fold disparities in preterm birth and low birthweight for African American mothers and babies in North Carolina, it is also imperative that prevention strategies in North Carolina have a special focus on this population. This includes focusing on counties and cities in the state where this disparity is particularly pronounced. Additional outreach, education, and partnership building will be needed to better understand the root of these disparities and to employ strategies to address them.

Data

In order to target resources, monitor trends, and demonstrate program progress/success, it is very important that comprehensive core data be available about pregnancy, birth outcomes, and women's health in North Carolina. Funding for the Pregnancy Risk Assessment and Monitoring System (PRAMS) survey need to continue to be allocated to allow us to continue to access this key data to understand the risk indicators and situations of pregnant and new mothers in North Carolina. North Carolina is in the process of moving to an electronic birth certificate system. Birth certificate data is very important in our ability to monitor and track birth outcomes. It is imperative that the roll out of the new certificate is smooth and that there is minimal disruption to the data. We also need to increase the amount of information collected about the health needs and birth outcomes of women with disabilities. Finally, we need to look for ways to learn more from women themselves about their experiences, ability to access services, and their perceptions about their health and that of their babies.

Impact of Policy and Environment on Birth Outcomes and Health

Every day in North Carolina decisions are made in arenas such as transportation, education, zoning, business, law enforcement, the courts, health care, and the environment that impact women of reproductive age and their babies. The connection between a decision made by city planners and the birth of a sick baby may not always be obvious, but the relationship is there. To address the root causes of the conditions that lead to preterm birth, time and expertise should be applied to begin to understand these connections.

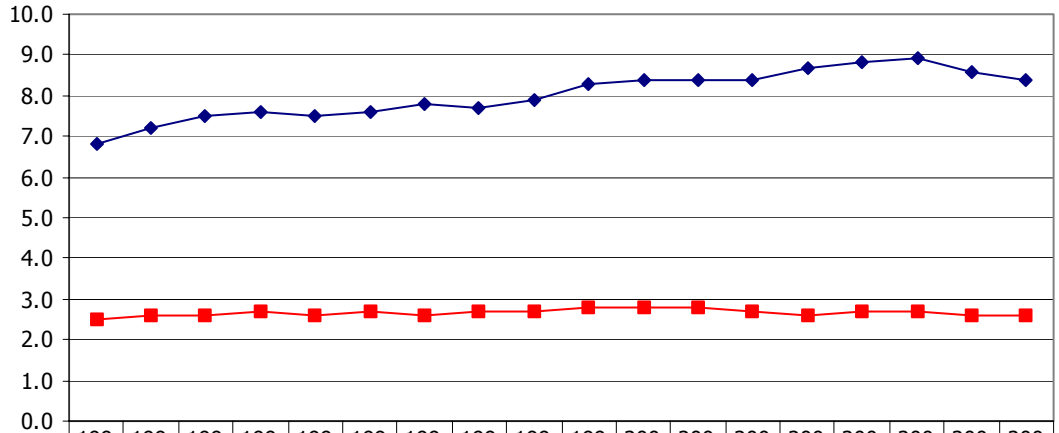
Summary

While the problem of preterm birth and low birthweight is complex, there are many ways in which North Carolina can continue to work together to meet these challenges. The strategies proposed in this working document build on existing work in North Carolina. Programs such as Baby Love Maternity Care Coordination, Perinatal Outreach Coordination, the NC Healthy Start Foundation, Nurse Family Partnerships, the Safe Sleep Campaign, the NC Folic Acid Campaign, High-Risk Pregnancy clinics, Adolescent Pregnancy Prevention programs, and the Family Planning Waiver are examples of programs that have helped North Carolina improve its birth outcomes over time. These and many other programs supported through the Division of Public Health are essential.

To more fully address the issue of preterm and low birthweight birth, we must have the political will to not only preserve what we have in place for mothers and infants, but to implement programs and practices that will improve our state's birth outcomes. Successfully reducing preterm birth and low birthweight will save both money and lives in our state. We owe this effort to ourselves, our children, and to the residents of this state.

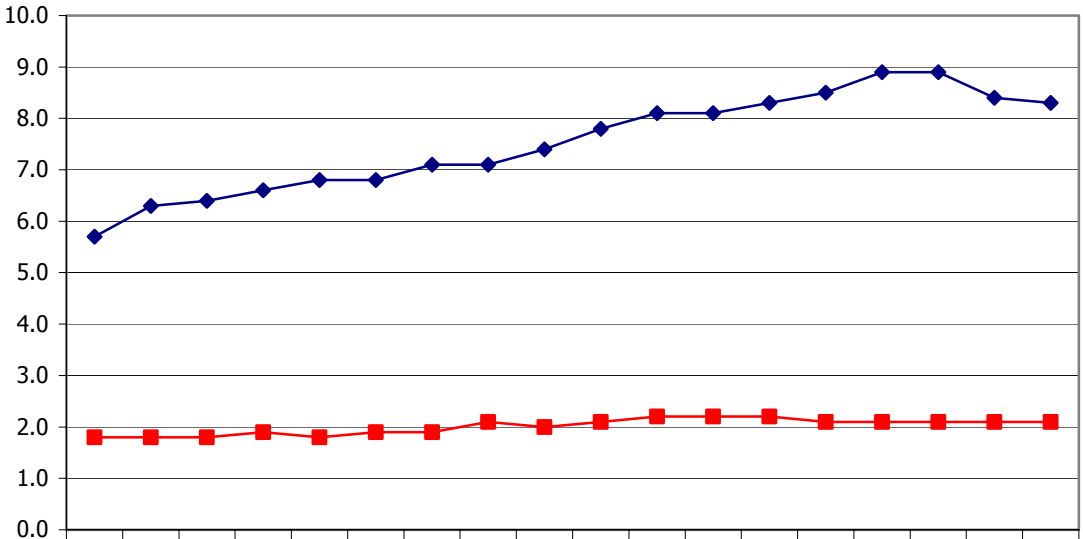
Appendix

1990-2007 NC Resident Births:
Percentage Preterm by Clinical Estimate of Gestation: TOTAL



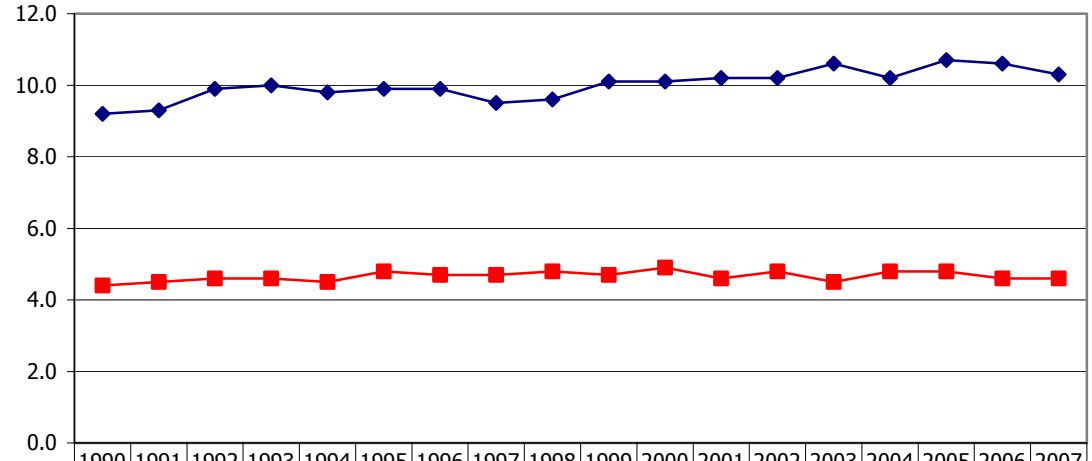
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Very Preterm: <=32 Weeks	2.5	2.6	2.6	2.7	2.6	2.7	2.6	2.7	2.7	2.8	2.8	2.8	2.7	2.6	2.7	2.7	2.6	2.6
Late Preterm: 33-36 Weeks	6.8	7.2	7.5	7.6	7.5	7.6	7.8	7.7	7.9	8.3	8.4	8.4	8.4	8.7	8.8	8.9	8.6	8.4

1990-2007 NC Resident Births to
White, Non-Hispanic Mothers:
Percentage Preterm by Clinical Estimate of Gestation



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Very Preterm: <=32 Weeks	1.8	1.8	1.8	1.9	1.8	1.9	1.9	2.1	2.0	2.1	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1
Late Preterm: 33-36 Weeks	5.7	6.3	6.4	6.6	6.8	6.8	7.1	7.1	7.4	7.8	8.1	8.1	8.3	8.5	8.9	8.9	8.4	8.3

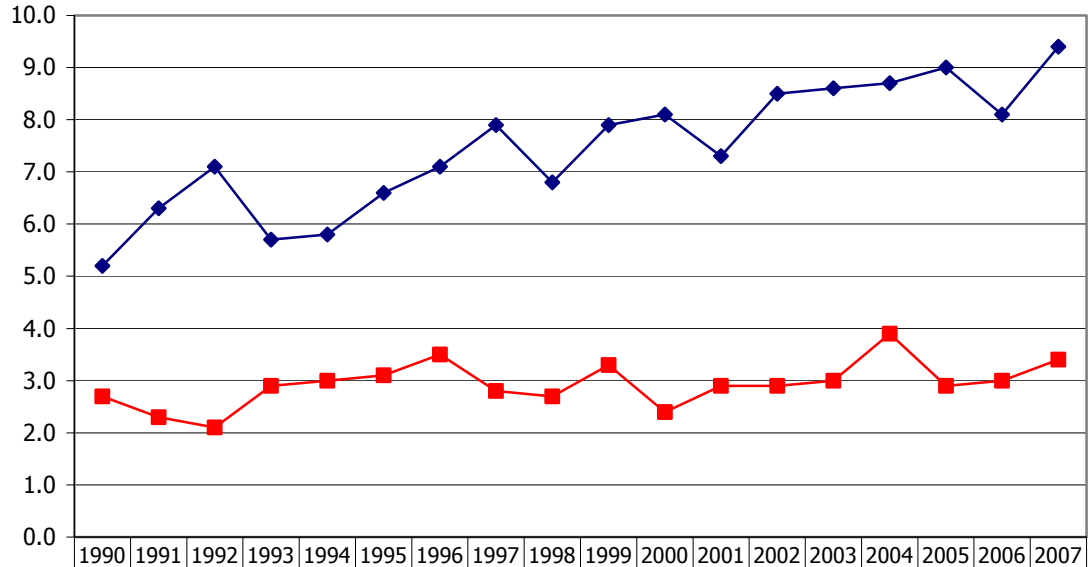
1990-2007 NC Resident Births to
African-American, Non-Hispanic Mothers:
Percentage Preterm by Clinical Estimate of Gestation



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Very Preterm: <=32 Weeks	4.4	4.5	4.6	4.6	4.5	4.8	4.7	4.7	4.8	4.7	4.9	4.6	4.8	4.5	4.8	4.8	4.6	4.6
Late Preterm: 33-36 Weeks	9.2	9.3	9.9	10.0	9.8	9.9	9.9	9.5	9.6	10.1	10.1	10.2	10.2	10.6	10.2	10.7	10.6	10.3

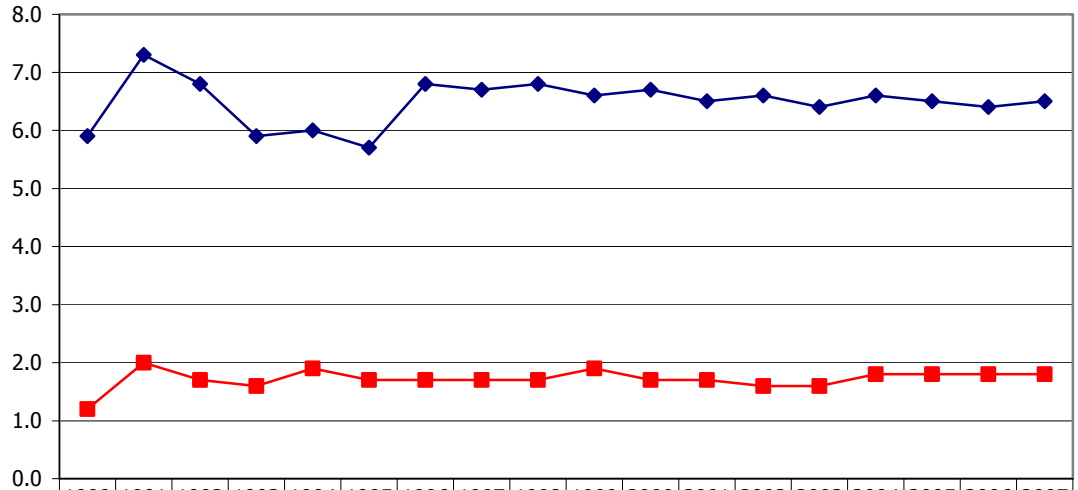
1990-2007 NC Resident Births to

Percentage Preterm by Clinical Estimate of Gestation



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Very Preterm: <=32 Weeks	2.7	2.3	2.1	2.9	3.0	3.1	3.5	2.8	2.7	3.3	2.4	2.9	2.9	3.0	3.9	2.9	3.0	3.4
Late Preterm: 33-36 Weeks	5.2	6.3	7.1	5.7	5.8	6.6	7.1	7.9	6.8	7.9	8.1	7.3	8.5	8.6	8.7	9.0	8.1	9.4

1990-2007 NC Resident Births to
Hispanic Mothers:
Percentage Preterm by Clinical Estimate of Gestation



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Very Preterm: <=32 Weeks	1.2	2.0	1.7	1.6	1.9	1.7	1.7	1.7	1.7	1.9	1.7	1.7	1.6	1.6	1.8	1.8	1.8	1.8
Late Preterm: 33-36 Weeks	5.9	7.3	6.8	5.9	6.0	5.7	6.8	6.7	6.8	6.6	6.7	6.5	6.6	6.4	6.6	6.5	6.4	6.5

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