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## SMOKING IN PREGNANCY IN NORTH CAROLINA: MATERNAL CHARACTERISTICS AND TRENDS 1988-1994

by

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### ABSTRACT

Smoking during pregnancy is a serious threat to the health of the mother and baby. Successful smoking cessation programs are needed to address this problem. This study describes the prevalence of smoking across different demographic subgroups of pregnant women in North Carolina and shows changing patterns over time. The validity of the self-reported smoking information on the birth certificate is assessed. A review of other data and studies suggests that, although smoking is moderately under-reported on the birth certificate, the information may reasonably be used to examine differences among subgroups and trends over time.

Women most likely to smoke during pregnancy are white, American Indian, unmarried, on Medicaid or WIC, with less than a high school education, and with three or more previous children. Smoking rates vary dramatically across different maternal groups. For Asian women, black teens, and women with a college education or greater, only about 5 percent smoke during pregnancy. On the other hand, for women with 9-11 years of education and for unmarried white and American Indian women on Medicaid with high parity, around 50 percent smoke during pregnancy. There was a substantial decline in the smoking rate from 1988-89 to 1993-94 overall and for almost all of the maternal subgroups. Among women who do smoke during pregnancy, approximately one-third reported smoking 1-9 cigarettes per day, one-third reported smoking 10-19 per day, and one-third reported smoking 20 or more per day.

The large majority of women who smoke continue to smoke throughout pregnancy, and for those who do quit the relapse rate after delivery is very high. The results of this study indicate potential target groups for smoking cessation efforts. Programs tailored to the pregnant smoker are needed to improve the cessation rate in this special population. Even a moderately effective program can pay for itself, given the ability of smoking cessation to prevent low birthweight babies.



## INTRODUCTION

Smoking during pregnancy is a serious threat to the health of the mother and the baby. Smoking during pregnancy increases the risk of placental problems and other pregnancy complications.<sup>1</sup> Smoking during and after pregnancy increases the risk of acute and chronic conditions in the mother, such as lung and cardiovascular disease.<sup>2</sup> Many studies have associated maternal smoking with infant mortality, low birthweight, and other adverse birth outcomes, such as birth defects.<sup>3</sup> One study estimated that if maternal smoking were eliminated, we could expect a 10 percent reduction in infant mortality.<sup>4</sup> Another study of a low-income population found that 31 percent of low-weight births among non-Hispanic whites and 14 percent of low-weight births among blacks were attributable to smoking.<sup>5</sup>

The negative health effects of smoking during pregnancy are well documented and most people would agree that effective smoking cessation strategies are needed. The present study seeks to describe the prevalence of smoking among different demographic subgroups of pregnant women in North Carolina and to show how these patterns have changed over time. There has been very little analysis of smoking among pregnant women using North Carolina data. This information should assist in developing and targeting smoking cessation programs within the state.

This study uses smoking data from the North Carolina birth certificates from 1988 through 1994. Though in some cases the person filling out the birth certificate may consult the maternal medical record to determine if the mother smoked during pregnancy, in many cases this information is solicited directly from the mother while she is in the hospital. Even when the information comes from the medical record, it is usually based on self-report by the mother. The issue of the validity of the smoking information on the birth certificate is very important for this study.

## VALIDITY OF SELF-REPORTED SMOKING DATA FROM THE NORTH CAROLINA BIRTH CERTIFICATE

In 1988, two questions on smoking during pregnancy were added to the North Carolina live birth and fetal death certificates, in accordance with the national model certificates. These questions ask about “Tobacco use during pregnancy” (check yes or no) and then “Average number cigarettes per day” (fill in the number). While a small number of women reporting “yes” to tobacco use may have used only smokeless tobacco, the term “smoking” during pregnancy is used throughout this report to describe the response to this question. This question reflects smoking at any time during pregnancy and thus could still be answered “yes” even if the woman quit smoking before delivery.

A 1989 study of the quality of North Carolina birth certificate data compared information on a sample of birth certificates with the corresponding maternal hospital medical records.<sup>6</sup> While the correspondence was poor for some of the birth certificate data items, the correspondence for tobacco use was fairly good. The percentage of births with tobacco use indicated in the medical record that were correctly identified by the birth certificate (sensitivity) was 86. A similar 1989 study in Tennessee found a sensitivity of 75 percent for tobacco use.<sup>7</sup> It should be noted, however, that the medical record itself may underestimate smoking prevalence, since it is often based on self-report by the mother.

In 1990, smoking during pregnancy was reported on 21 percent of the North Carolina live birth certificates. Some studies have shown a substantial decline during the 1970’s and 1980’s in the percentage of women smoking during pregnancy,<sup>8,9</sup> but more current figures from the United States are consistent with the prevalence indicated by the North Carolina birth certificates. The 1990 National Health Interview Survey showed 18 percent of pregnant woman smoking during pregnancy.<sup>10</sup> Birth certificate data for 1989 from 43 states indicated that 20 percent of mothers reported that they had smoked during their

pregnancy.<sup>11</sup> Other survey data show that 18 percent of pregnant women reported smoking at the time of their 1989 interview.<sup>12</sup> Missouri birth certificate data for 1989, however, showed a somewhat higher rate of smoking during pregnancy of 26 percent.<sup>13</sup>

The information above shows that the smoking prevalence data from the North Carolina birth certificate is generally consistent with other self-reported data. A broader question is: how accurate are self-reported smoking data? Self-report is the most direct, practical, and widely used method. Some studies have compared self-reported smoking with objective measures such as serum cotinine levels. One study of smoking in the general population found a slightly lower level of smoking from self-report compared to cotinine measures and concluded that misclassification of cigarette smoking by self-report was low in their young adult population.<sup>14</sup> Another general population study using cotinine measures found a higher level of underestimation, with self-reported information showing a smoking prevalence 4-6 percentage points lower.<sup>15</sup> A review of 26 published reports comparing self-reported smoking with biochemical measures found that self-reports of smoking are accurate in most studies.<sup>16</sup> Kleinman concludes that, while there may be serious underreporting of smoking in the context of evaluating smoking cessation programs, self-reports in population surveys provide reasonable estimates.<sup>8</sup>

A study of pregnant women in North Carolina collected urine samples from women enrolled in prenatal care during December 1992 through January 1993 in private and public health sites across the state.<sup>17</sup> Cotinine testing indicated that 15 percent of the women had used tobacco products within the last 48 to 72 hours. This is a very conservative estimate of smoking during pregnancy since the time window for detection was short, and since women who received no prenatal care (who are at high risk for substance use in pregnancy) were not included in the sample.

Among the women who smoked during pregnancy in 1988 and 1989 in North Carolina, the

median number of cigarettes smoked per day was 11. While we currently have no data to directly validate the smoking amounts reported on the birth certificates, the high correlation of smoking amount with percentage low birthweight provides indirect evidence of the general validity of the item. A previous North Carolina study showed that for both white and black mothers there was a steady increase in the percentage of low birthweight as smoking increased from none, to 1-9 cigarettes per day, to 10 or more cigarettes per day.<sup>18</sup> Notably, the women with smoking status or amount unknown (about 2 percent of the births) had the highest percentage low birthweight. This finding supports other studies showing the high risk status of women with missing or unreported data on vital records.<sup>19</sup>

We conclude that the smoking data on North Carolina birth certificates moderately underestimates the true prevalence of smoking among pregnant women, but that the data may reasonably be used to examine differences among demographic subgroups and trends over time.

## METHODS

This study presents descriptive information on the prevalence of smoking during pregnancy for the population of North Carolina resident live births for the periods 1988-89 and 1993-94. Sub-categories examined are age of mother (<18, 18-19, 20-24, 25-29, 30-34, 35+), race of mother (white, black, American Indian, other), marital status (married, not married), education of mother (<9 years, 9-11, 12, 13-15, 16+), parity (0 previous living children, 1 or 2, 3 or more), Medicaid status (yes, no), and prenatal WIC participation (yes, no). The educational data are examined only for women age 22 and older, who would have had time to complete 16 years of education. Data on smoking prevalence by county of residence are also presented for the two time periods.

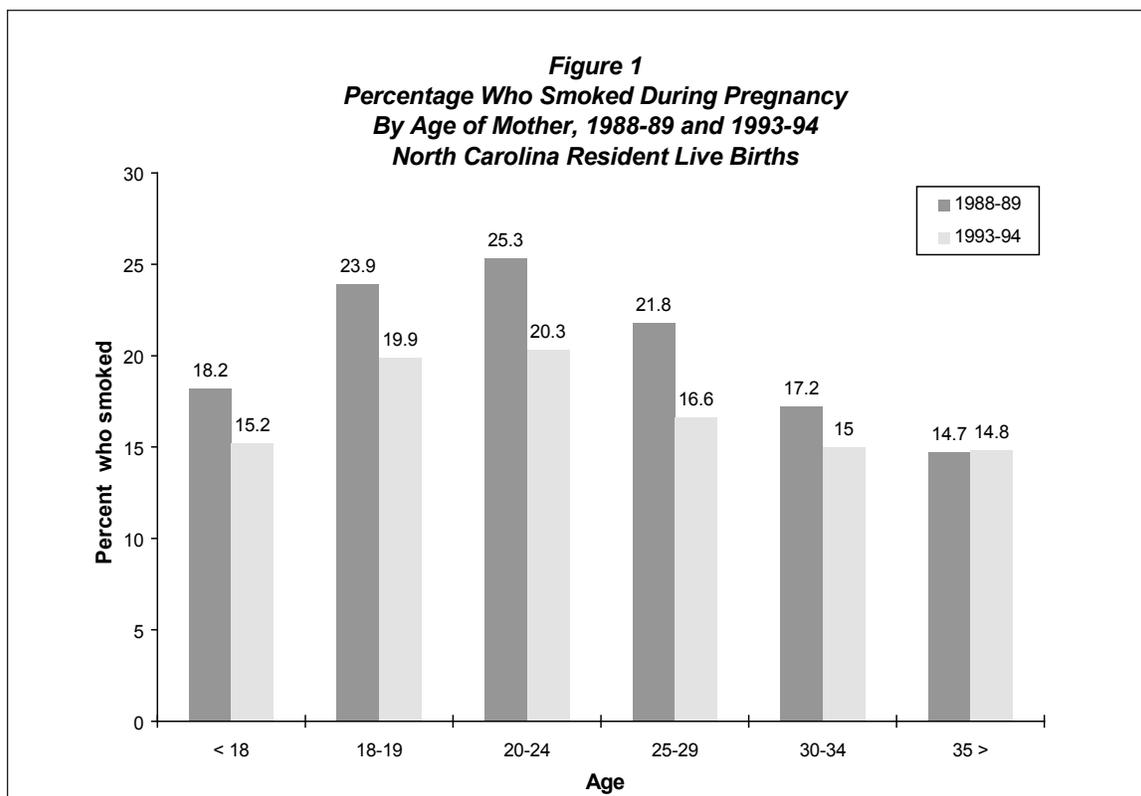
Among those women who smoked during pregnancy, data on the amount smoked are examined to determine which groups had the highest percent-

age of heavy smokers. The categories used are 1-9 cigarettes per day, 10-19, and 20+.

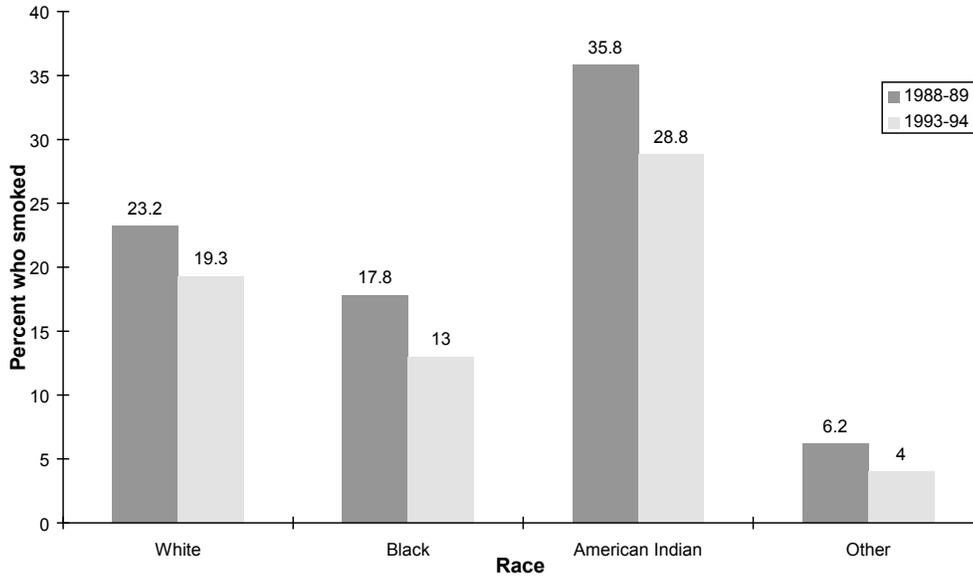
## RESULTS

In 1988-89 smoking during pregnancy was reported on 21.6 percent of the 195,559 North Carolina resident live birth certificates that had smoking status indicated. By 1993-94 this percentage had declined to 17.4 percent of the 202,391 birth certificates that had smoking status indicated. (In 1988-89 and 1993-94, the percentages of the total birth records that had missing information on smoking status were 2.0 and 0.2, respectively.) Smoking during pregnancy was reported on 19.4 percent of 1993-94 fetal death records. Since these percentages are similar, and since the number of reported fetal deaths per year is less than one percent of the number of live births, the data in this report are for live births only.

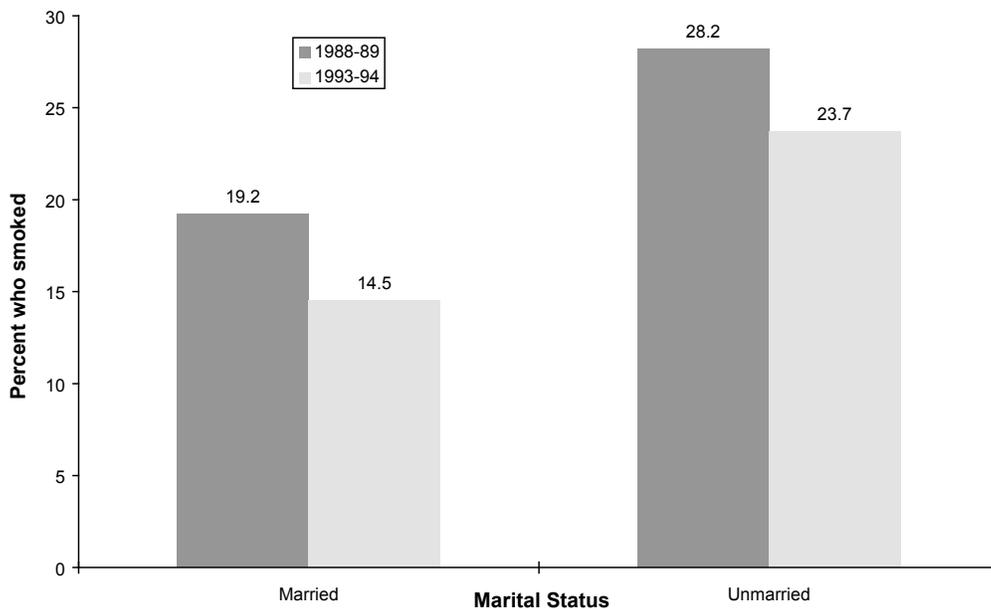
Figures 1 through 7 show the percentages of women who smoked for both time periods by various characteristics of the mother. There has been a consistent decline over time in smoking during pregnancy across all maternal categories. Mothers of ages 18-24 have a somewhat higher rate of smoking, and there is little variation across the other age groups. White and American Indian mothers smoke at a much higher rate than women who are black or other races. Unmarried women are much more likely to smoke than married women. Smoking increases substantially as the number of children in the family increases. Women on Medicaid are 2.5 times as likely to smoke as women not on Medicaid, during the 1993-94 time period. WIC mothers are also much more likely to smoke. The Medicaid and WIC groups overlap substantially and reflect a low-income population, generally less than 185 percent of the federal poverty level in the 1993-94 period. There are large differences in smoking by level of education (among mothers age



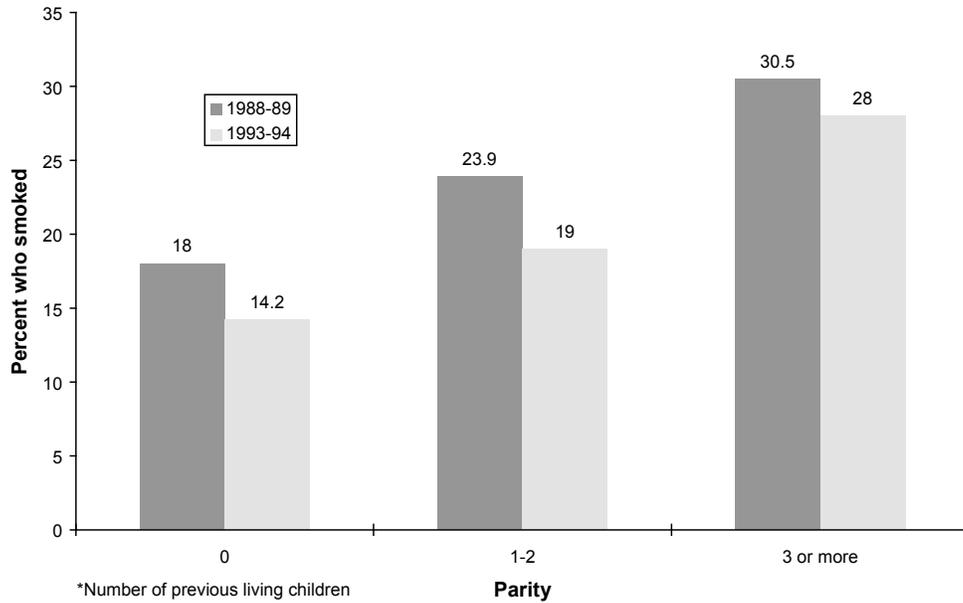
**Figure 2**  
**Percentage Who Smoked During Pregnancy**  
**By Race of Mother, 1988-89 and 1993-94**  
**North Carolina Resident Live Births**



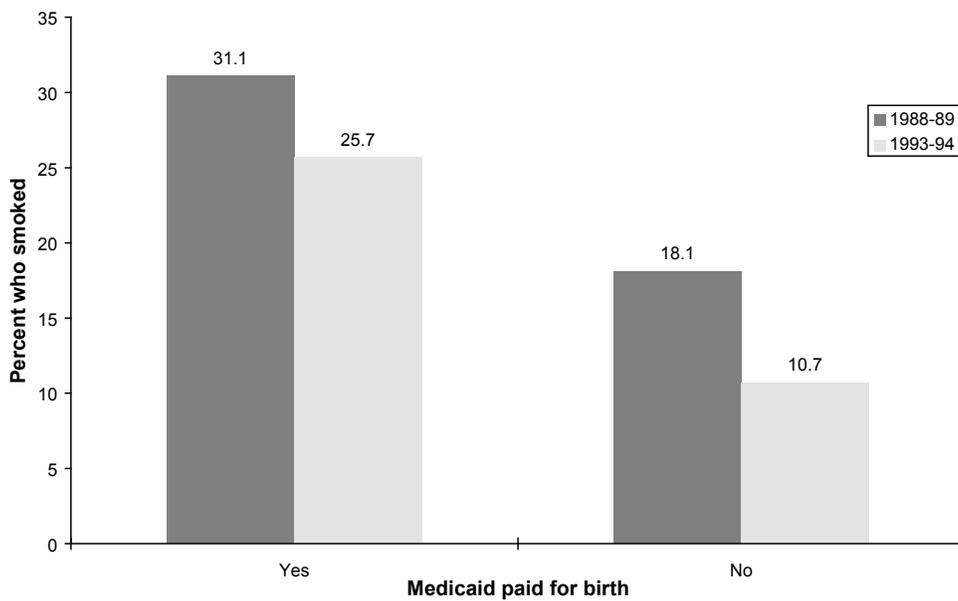
**Figure 3**  
**Percentage Who Smoked During Pregnancy**  
**By Marital Status, 1988-89 and 1993-94**  
**North Carolina Resident Live Births**



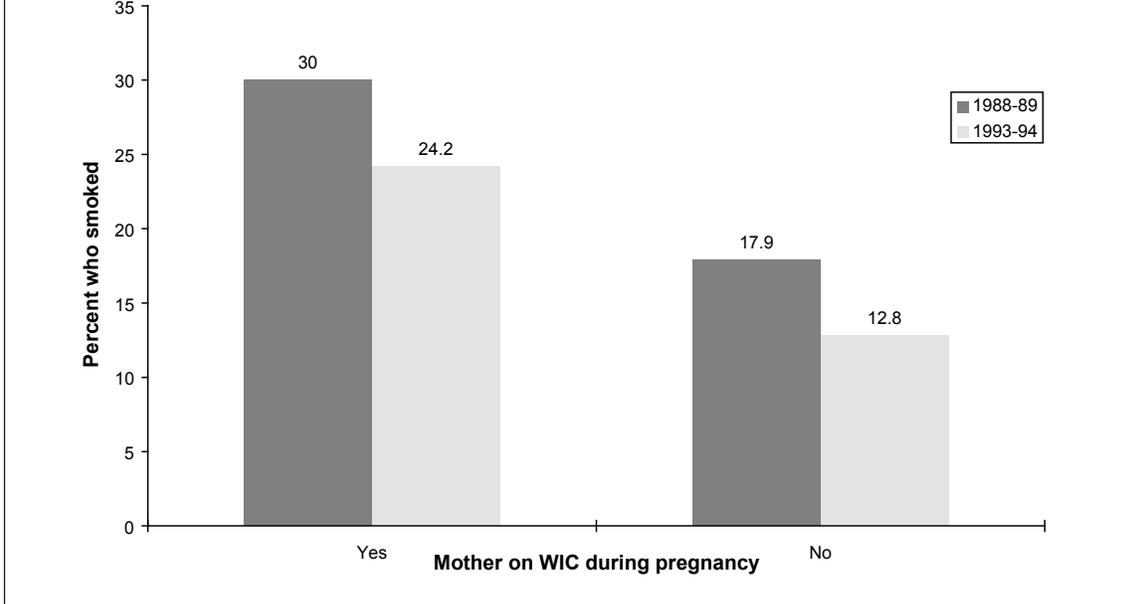
**Figure 4**  
**Percentage Who Smoked During Pregnancy**  
**By Parity\*, 1988-89 and 1993-94**  
**North Carolina Resident Live Births**



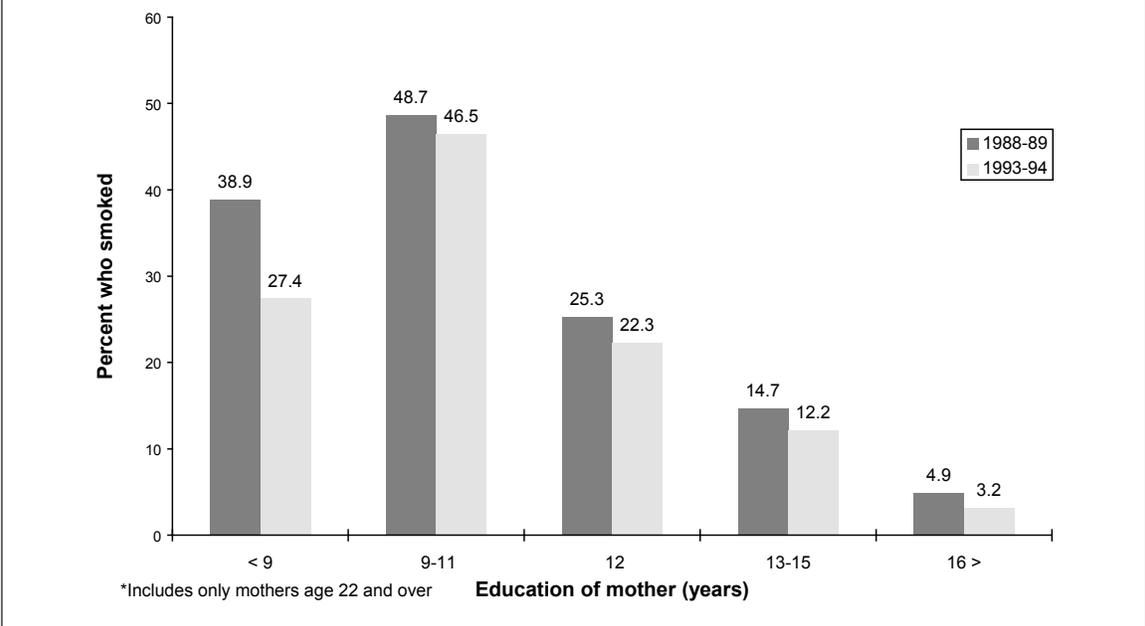
**Figure 5**  
**Percentage Who Smoked During Pregnancy**  
**By Medicaid Status, 1988-89 and 1993-94**  
**North Carolina Resident Live Births**



**Figure 6**  
**Percentage Who Smoked During Pregnancy**  
**By Mother on WIC During Pregnancy, 1988-89 and 1993-94**  
**North Carolina Resident Live Births**



**Figure 7**  
**Percentage Who Smoked During Pregnancy**  
**By Years of Education of Mother\*, 1988-89 and 1993-94**  
**North Carolina Resident Live Births**



22 and over). Almost half of mothers who dropped out of high school smoke while pregnant, compared to less than 5 percent of women who graduated from college. This general pattern of decreasing smoking rates with increasing level of education was observed for each racial group.

Certain subgroups have very high smoking rates. During 1993-94, among unmarried women on Medicaid who have three or more previous living children, 51 percent of white mothers and 56 percent of American Indian mothers smoked during pregnancy.

Further analysis of the data revealed a substantial difference in the age pattern of smoking between race groups. In 1993-94, American Indian mothers had a consistently high rate of smoking (about 30%) for all age groups, except age 35 and over where the rate was 20 percent. Mothers of “other” races (mostly Asian) had a consistently low rate of smoking for all age groups of about 5 percent. Table 1 shows the data by age for white and black mothers. For whites, teen mothers have the highest rate of smoking and then the smoking rates decline as age of mother increases. For blacks, teens have a very low rate of smoking and then the smoking rates increase with age. The low rate of smoking among black teens may reflect a major change over the past two decades. One study<sup>9</sup> showed that 36 percent of pregnant black teens in Missouri smoked in 1978, while by 1990 this percentage had declined to 7.

The Appendix presents smoking rates by county of residence for 1988-89 and 1993-94 live births. Smoking rates declined in every county except Clay, Granville, Haywood, Hyde, Richmond, Rockingham, Stokes, Surry, Transylvania, and Yadkin. In 1993-94 the smoking rates varied from a low of 9.5 percent in Wake county to a high of 34.6 percent in Stokes county. In almost every county, the number of women smoking during pregnancy (the numerator of the percentage) in the two-year time periods is sufficiently large to produce statistically stable estimates.

**Table 1**  
**Percentage Who Smoked During Pregnancy**  
**by Age by Race of Mother**  
**North Carolina Resident White and Black Live**  
**Births, 1993-94**

Age of Mother	Percentage Who Smoked	
	White	Black
<18	27.0	4.2
18-19	29.0	6.7
20-24	25.1	11.0
25-29	16.7	16.8
30-34	13.7	21.0
35+	13.4	21.0

Among mothers who did smoke, approximately one-third reported smoking 1-9 cigarettes per day, one-third reported smoking 10-19 per day, and one-third reported smoking 20 or more per day. The exact percentages for 1988-89 and 1993-94 are shown in Table 2. These data indicate that the percentage of heavy smokers has decreased. In general, there was little variation across maternal characteristics, though several differences should be noted. Among teen smokers in 1993-94, about 19 percent reported smoking 20 or more cigarettes per day. Black smokers and smokers of “other” races were less likely to be heavy smokers: about 50 percent reported smoking 1-9 cigarettes per day, 35 percent 10-19, and 15 percent 20 or more. Nearly half of smokers age 22 and over with less than 9 years of education reported smoking 20 or more cigarettes per day, while about 20 percent of the smokers with 16 or more years of education reported smoking 20 or more per day.

**Table 2**  
**Percentage by Number of Cigarettes Smoked**  
**Per Day Among Women Who Smoked**  
**During Pregnancy**  
**North Carolina Resident Live Births**  
**1988-89 and 1993-94**

	Cigarettes per Day – %		
	1-9	10-19	20 or more
1988-89	25.8	38.8	35.3
1993-94	30.5	39.8	29.7

## DISCUSSION

The results show a large variation in the rate of smoking by different maternal characteristics. For Asian women, black teens, and women with a college education or greater, only about 5 percent smoke during pregnancy. On the other hand, for women with 9-11 years of education and for unmarried white and American Indian women on Medicaid with high parity, around 50 percent smoke during pregnancy. These percentages are likely to be underestimates due to incomplete reporting on the birth certificates, and so the actual percentages are probably higher. The data presented in this paper do indicate potential target groups for smoking cessation efforts. The good news is that there has been an apparent general decline in the rate of smoking during pregnancy from 1988-89 to 1993-94.

Self-report is the most practical method of collecting information on smoking in most situations. Rates of disclosure among self-reported smokers can be improved by using multiple choice questions that allow respondents to choose partially favorable answers, such as "I smoke now, but I have cut down since I found out I was pregnant."<sup>1,10</sup> In one prenatal clinic in North Carolina, changing the questions on smoking during pregnancy from a yes/no to a less-direct format markedly increased the disclosure of smoking by pregnant women.<sup>20</sup>

Most evidence shows that, even with the best smoking cessation programs, the vast majority of women continue to smoke throughout pregnancy despite their knowledge of the increased health risks to themselves and to the developing fetus.<sup>10</sup> And for those who do quit during pregnancy, the relapse rate after delivery is very high.<sup>8</sup> Prager<sup>21</sup> found that the prevalence of drinking is much higher than the prevalence of smoking among women of reproductive age, but that women who become pregnant are much more likely to stop drinking than to stop smoking. It is likely that giving up nicotine, which is a daily habit with strong psychological and

physiological dependency, is more difficult than giving up light or moderate alcohol consumption. Some pregnant and postpartum women may use cigarettes to limit weight gain, relieve stress, or cope with depression.<sup>10</sup> Women may also believe that if they smoke and have a smaller baby, they will have an easier birth.<sup>22</sup>

Targeting pregnant women for smoking cessation is needed since quitting will benefit both the mother and infant. Also, because of the dose-response relationship between smoking and low birthweight, for some women a reduction in the amount smoked can be considered a success. Women may be more receptive to behavioral change during pregnancy<sup>1,8</sup> due to an initial increased desire to do what is best for the baby or because smoking may cause nausea.<sup>22</sup>

Health education methods tailored to the pregnant smoker are more effective in changing smoking behavior than standard clinic information.<sup>23</sup> WIC clinics present a good setting for smoking cessation programs, given the high rate of smoking among prenatal WIC participants (Figure 6). One study showed that programs to stop prenatal smoking were well accepted by WIC clients.<sup>10</sup> Smoking policies, such as smoke-free worksites, may also be effective in helping pregnant women quit smoking.<sup>24</sup>

Clark<sup>22</sup> maintains that knowledge of the potential effects of smoking is usually not sufficient to influence a pregnant woman to quit, and that we therefore need to go beyond traditional health education approaches to develop new smoking cessation methods. Especially among women of lower socioeconomic status, highly supportive and individual education programs are needed, taking into account the social situation of the smoker.<sup>10,22</sup> Smoking may be interrelated with physical abuse<sup>25</sup> and other aspects of the home environment. Even a moderately effective program can pay for itself, given the ability of smoking cessation to prevent low birthweight babies.<sup>26</sup>

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## APPENDIX

**Percentage of Live Births  
Where the Birth Certificate Indicated that the Mother Smoked  
During Pregnancy by County of Residence  
North Carolina, 1988-89 and 1993-94**

	Percentage who Smoked			Percentage who Smoked	
	1988-89	1993-94		1988-89	1993-94
All N.C. Residents	21.6	17.4			
Alamance	22.7	19.9	Franklin	19.1	16.0
Alexander	23.1	19.3	Gaston	27.2	22.5
Alleghany	26.3	25.8	Gates	24.1	15.9
Anson	18.2	16.6	Graham	23.9	21.4
Ashe	22.4	19.8	Granville	18.4	22.1
Avery	25.0	22.1	Greene	19.8	12.6
Beaufort	19.6	18.9	Guilford	22.6	15.7
Bertie	14.2	10.4	Halifax	23.1	17.1
Bladen	17.5	14.2	Harnett	24.6	21.8
Brunswick	30.1	25.8	Haywood	29.8	29.9
Buncombe	28.2	22.8	Henderson	26.6	23.2
Burke	28.3	22.3	Hertford	17.9	12.7
Cabarrus	20.0	15.5	Hoke	23.9	16.3
Caldwell	29.2	24.1	Hyde	16.8	18.6
Camden	16.5	16.3	Iredell	25.1	20.5
Carteret	25.7	18.6	Jackson	24.2	20.3
Caswell	25.4	20.2	Johnston	22.7	16.5
Catawba	19.4	19.1	Jones	26.0	14.3
Chatham	19.8	14.0	Lee	23.9	21.0
Cherokee	26.1	22.6	Lenoir	26.3	18.6
Chowan	17.3	16.2	Lincoln	24.3	23.8
Clay	20.4	22.6	McDowell	27.0	25.4
Cleveland	25.1	19.6	Macon	24.6	23.2
Columbus	26.8	19.9	Madison	30.0	29.5
Craven	17.1	14.3	Martin	17.0	15.7
Cumberland	21.2	14.9	Mecklenburg	15.8	11.5
Currituck	28.7	24.6	Mitchell	25.1	22.8
Dare	21.0	20.7	Montgomery	24.3	14.8
Davidson	28.8	26.1	Moore	21.3	16.9
Davie	25.5	22.8	Nash	18.5	14.8
Duplin	22.6	16.6	New Hanover	22.8	17.4
Durham	15.7	11.7	Northampton	19.4	14.2
Edgecombe	20.4	16.3	Onslow	20.1	15.6
Forsyth	22.8	20.3	Orange	15.3	12.6
			Pamlico	26.5	25.0
			Pasquotank	19.0	15.1

**APPENDIX (continued)**

**Percentage of Live Births  
Where the Birth Certificate Indicated that the Mother Smoked  
During Pregnancy by County of Residence  
North Carolina, 1988-89 and 1993-94**

	<b>Percentage who Smoked</b>			<b>Percentage who Smoked</b>	
	<b>1988-89</b>	<b>1993-94</b>		<b>1988-89</b>	<b>1993-94</b>
Pender	22.9	19.3	Surry	19.2	24.7
Perquimans	21.9	19.2	Swain	27.8	25.3
Person	21.9	19.5	Transylvania	25.8	26.6
Pitt	19.8	12.8	Tyrrell	28.6	21.3
Polk	21.8	19.6	Union	17.6	15.1
Randolph	26.7	23.7	Vance	18.5	16.1
Richmond	18.8	20.8	Wake	15.0	9.5
Robeson	31.0	25.1	Warren	17.9	17.4
Rockingham	24.0	24.3	Washington	17.7	13.1
Rowan	23.6	22.8	Watauga	17.8	16.0
Rutherford	24.7	18.4	Wayne	23.1	17.8
Sampson	22.1	17.4	Wilkes	26.3	23.7
Scotland	27.2	22.4	Wilson	13.4	11.6
Stanly	21.2	17.6	Yadkin	25.5	25.8
Stokes	28.3	34.6	Yancey	27.2	25.9

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