

# Smoking in Pregnancy in North Carolina

## Maternal Characteristics and Trends, 1988-1994

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Smoking during pregnancy is a serious threat to the health of mother and baby. Smoking during a pregnancy increases the risk of placental and other pregnancy complications.<sup>1</sup> Smoking during and after pregnancy increases the risk of acute and chronic lung and cardiovascular disease in the mother.<sup>2</sup> In addition, many studies link maternal smoking to infant mortality, low birthweight, and other adverse birth outcomes, such as birth defects.<sup>3</sup> One study estimated that elimination of maternal smoking would reduce infant mortality by 10%.<sup>4</sup> Another study of a low-income population found that 31% of low-weight births among non-Hispanic whites and 14% of low-weight births among blacks were attributable to smoking.<sup>5</sup>

Because the negative health effects of smoking during pregnancy are so well documented, most people would agree on the need for effective smoking cessation strategies. We undertook the present study to describe the prevalence of smoking among demographic subgroups of pregnant women in North Carolina and to show how these patterns have changed over time. This information should help in developing and targeting smoking cessation programs.

### Methods

We gathered data about smoking from NC birth certificates from 1988 through 1994. In some cases, the person filling out the birth certificate may consult the maternal medical record to determine whether the mother smoked during pregnancy, but usually this information is obtained 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 validity of the smoking information on the birth certificate is very important to this study.

In 1988, two questions about smoking during pregnancy

were added to the NC 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 the "Average number cigarettes per day (fill in the number)." A small number of women reported "yes" to tobacco use may have used only smokeless tobacco, but we use the term "smoking" throughout this report to describe the response to these questions. The questions reflect smoking at any time during pregnancy and thus could still be answered "yes" even if the woman quit smoking before delivery.

In order to assess the validity of self-reported smoking information, we reviewed NC birth certificate data on smoking during pregnancy in the context of other data and studies (see Appendix, page 359). We conclude that the information on smoking derived from NC 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.

This study presents descriptive information on the prevalence of smoking during pregnancy among the population of NC residents who gave birth to live infants during the periods 1988-1989 and 1993-1994. Data are categorized according to age of mother (<18, 18-19, 20-24, 25-29, 30-34,  $\geq 35$  years old), race of mother (white, black, American Indian, other), marital status of mother (married, not married), education of mother (<9, 9-11, 12, 13-15,  $\geq 16$  years of schooling), parity (0, 1-2, or  $\geq 3$  previous living children), Medicaid participation (yes, no), and prenatal participation in the WIC (Women, Infants, and Children) program (yes, no). Educational data were examined only for women age 22 and older, who would have had time to complete 16 years of education. All data were derived from NC birth certificates, except for the information about Medicaid and WIC participation, which was derived by linking the birth certificates to these health program files.

Among those women who smoked during pregnancy, data on the number of cigarettes smoked (1-9, 10-19,  $\geq 20$  cigarettes per day) were examined to determine which groups had the highest percentage of heavy smokers.

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## Results

In 1988-1989, smoking status was recorded on 98% of all certificates; these records indicate that 21.6% of the 195,559 NC mothers giving birth to live infants smoked during pregnancy. By 1993-1994, smoking status was indicated on 99.8% of certificates, and the percentage of mothers who smoked had declined to 17.4% of the 202,391 births.

Smoking during pregnancy was reported on 19.4% of 1993-1994 fetal death certificates. Since the percentages were similar for live births and fetal deaths, and since the number of reported fetal deaths is less than 1% of the number of live births per year, we report here only data for live births.

Table 1, at right, shows the percentages of women who smoked during the two time periods, categorized by characteristics of the mother. There was a consistent decline over time in smoking during pregnancy across all maternal categories. Mothers ages 18-24 had a somewhat higher rate of smoking, but there was little variation across the other age groups. White and American Indian mothers smoked at a much higher rate than women of black or other races. Unmarried women were much more likely to smoke than married women. The prevalence of smoking increased substantially as the number of children in the family increased. During the 1993-1994 time period, women on Medicaid were 2.5 times as likely to smoke as women not on Medicaid. Mothers enrolled in WIC were also much more likely to smoke. The Medicaid and WIC groups overlap substantially and reflect a low-income population (having incomes less than 185% of the federal poverty level in the 1993-1994 period).

There were large differences in smoking by level of education. Almost half the mothers who had dropped out of high school smoked while pregnant, compared to less than 5% of women who had graduated from college. The general pattern of a decrease in smoking rates with an increase in level of education was observed across each racial group.

Certain subgroups had a very high prevalence of smoking. During 1993-1994, 51% of unmarried white and 56% of unmarried American Indian women on Medicaid who had three or more previous living children smoked during pregnancy.

Our data reveal substantial differences in the age pattern of smoking between races. In 1993-1994, American Indian mothers had consistently high rates of smoking (about 30%) over all age groups except those  $\geq 35$  years, where the rate was 20%. Mothers of "other races" (mostly Asian) had consistently low rates of smoking (about 5%) for all age groups. Table 2 shows the data by age for white and black mothers. For whites, rates of smoking were highest for teen mothers and then declined as maternal age increased. In contrast, rates of smoking were very low for black teens and increased with age thereafter. The low rate of smoking among black teens may reflect a major change in smoking behavior during the past two decades. A study in Missouri<sup>6</sup> showed that 36% of pregnant black teens smoked in 1978, but only 7% in 1990.

Of the mothers who smoked, approximately one-third reported smoking 1-9 cigarettes per day; one-third, 10-19 per

**Table 1. Percentages of North Carolina mothers who smoked during pregnancy**

	<u>1988-1989</u>	<u>1993-1994</u>
<b>Maternal age</b>		
<18	18.2%	15.2%
18-19	23.9%	19.9%
20-24	25.3%	20.3%
25-29	21.8%	16.6%
30-34	17.2%	15.0%
$\geq 35$	14.7%	14.8%
<b>Maternal race</b>		
White	23.2%	19.3%
Black	17.8%	13.0%
American Indian	35.8%	28.8%
Other	6.2%	4.0%
<b>Marital status</b>		
Married	19.2%	14.5%
Unmarried	28.2%	23.7%
<b>Previous living children</b>		
0	18.0%	14.2%
1-2	23.9%	19.0%
$\geq 3$	30.5%	28.0%
<b>Receiving Medicaid</b>		
Yes	31.1%	25.7%
No	18.1%	10.7%
<b>WIC participant</b>		
Yes	30.0%	24.2%
No	17.9%	12.8%
<b>Years of education*</b>		
<9	38.9%	27.4%
9-11	48.7%	46.5%
12	25.3%	22.3%
15-15	14.7%	12.2%
$\geq 16$	4.9%	3.2%

\*Mothers age 22 and older

**Table 2. Percentage of women who smoked during pregnancy by age and race of mother, 1993-94**

<b>Age of mother</b>	<b>White</b>	<b>Black</b>
<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%
$\geq 35$	13.4%	21.0%

day; and one-third,  $\geq 20$  per day (Table 3, next page). Data from 1988-1989 and 1993-1994 show a decrease in the percentage of

heavy smokers. In general, there was little variation in amount smoked according to maternal characteristics, but several differences should be noted. In 1993-1994, about 19% of teen smokers reported smoking  $\geq 20$  cigarettes per day. Nonwhite mothers were less likely to be heavy smokers: about 50% reported smoking 1-9 cigarettes per day, 35% 10-19, and 15%  $\geq 20$ . Nearly half of smokers ages  $\geq 22$  with  $>9$  years of education reported smoking  $\geq 20$  cigarettes per day, yet about 20% of the smokers with  $\geq 16$  years of education reported smoking  $\geq 20$  cigarettes per day.

## Discussion

Our results show a large variation in the rate of smoking according to maternal characteristics. Only about 5% of Asian women, black teens, and women with a college education smoked during pregnancy. On the other hand, around 50% of women with 9-11 years of education, or unmarried, multiparous, white and American Indian women on Medicaid smoked during pregnancy (and these percentages are likely to be underestimates due to incomplete reporting on the birth certificates). The data presented in this paper certainly indicate target groups for smoking cessation efforts. The good news is the apparent general decline in the rate of smoking during pregnancy from 1988-1989 to 1993-1994.

Self-report is generally the most practical method of collecting information about smoking. 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>1,7</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 (personal communication from Joann Halloran, Kaiser Foundation Health Plan, Charlotte NC, April 4, 1996).

Even when the best smoking cessation programs are available, and despite knowing of the increased health risks to themselves and to their developing baby, the vast majority of women continue to smoke throughout pregnancy.<sup>7</sup> For those who do quit, the relapse rate after delivery is very high.<sup>8</sup> Prager found that the prevalence of drinking alcohol is much higher than the prevalence of smoking among women of reproductive age, but women who become pregnant are much more likely to

**Table 3. Comparison of women smokers by cigarettes smoked per day during pregnancy, 1988-1989 and 1993-1994.**

	Cigarettes per day		
	1-9	10-19	$>20$
1988-1989	25.8%	38.8%	35.3%
1993-1994	30.5%	39.8%	29.7%

stop drinking than to stop smoking.<sup>9</sup> Giving up nicotine, a daily habit with strong psychological and physiological dependency, is probably more difficult than giving up light or moderate alcohol consumption. Some pregnant and postpartum women use cigarettes to limit weight gain, relieve stress, or cope with depression.<sup>7</sup> Women may also believe that if they smoke and have a smaller baby, they will have an easier birth.<sup>10</sup>

We need to target pregnant women for smoking cessation because quitting will benefit both mother and infant. Since there is a dose-response relationship between smoking and low birthweight, even a reduction in the amount smoked can be considered a partial success. Women may be more receptive to changing smoking behavior during pregnancy<sup>1,8</sup> because they want to do what is best for the baby or because smoking may cause nausea.<sup>10</sup>

Health education methods tailored to the pregnant smoker are more effective in changing smoking behavior than standard clinic information.<sup>11</sup> WIC clinics are a good place for smoking cessation programs, given the high rate of smoking among prenatal WIC participants (Table 1). One study showed that programs to stop prenatal smoking were well accepted by WIC clients.<sup>7</sup> Smoking policies, such as smoke-free worksites, may also help pregnant women quit smoking.<sup>12</sup>

Clark<sup>10</sup> claims that just knowing about the potential effects of smoking is usually not sufficient to make a pregnant woman quit. We must go beyond traditional health education approaches to develop new smoking cessation methods. This is especially true for women of lower socioeconomic status who need highly supportive and individual education programs that take into account the social situation of the smoker.<sup>7,10</sup> Health care providers need to keep in mind that smoking may be linked to physical abuse<sup>13</sup> or 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>14</sup> □

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## Appendix. Validity of Self-Reported Smoking Data from North Carolina Birth Certificates

A 1989 study of the quality of NC birth certificate data compared information on a sample of birth certificates with the corresponding maternal hospital medical records.<sup>15</sup> The correspondence was poor for some of the birth certificate data items, but that for tobacco use was fairly good. In 86% of cases where tobacco use was indicated in the medical record it was correctly identified by the birth certificate (sensitivity of 86%). A similar 1989 study in Tennessee found a sensitivity of 75%.<sup>16</sup> It should be noted, however, that the medical record itself may underestimate smoking prevalence, since it, too, is often based on self-report by the mother.

In 1990, smoking during pregnancy was reported on 21% of the NC live birth certificates. Some studies<sup>8,8</sup> have noted a decline in the percentage of women smoking during pregnancy during the 1970s and 1980s, but current figures from the US are consistent with the prevalence indicated by the NC birth certificates. The 1990 National Health Interview Survey showed that 18% of pregnant women smoked during pregnancy.<sup>7</sup> Birth certificate data from 43 states indicated that, in 1989, 20% of

mothers reported smoking during pregnancy.<sup>17</sup> Other survey data show that 18% of pregnant women reported smoking in 1989,<sup>18</sup> but birth certificate data from Missouri for 1989 showed a somewhat higher rate of 25%.<sup>19</sup>

The information summarized above indicates that the prevalence data from NC birth certificates is generally consistent with other self-reported data. A broader question is: how accurate are self-reported smoking data? Some studies have compared self-reported smoking with objective measures such as serum or urine cotinine levels. One study of the general population found only a slightly lower self-reported level of smoking compared to cotinine measures and concluded that misclassification of cigarette smoking by self-report was low in a young adult population.<sup>20</sup> Another general population study found a higher level of underestimation: Self-reported smoking prevalence was four to six percentage points lower than cotinine measurements.<sup>21</sup> A review of 26 published reports found that self-reports of smoking are generally accurate compared to biochemical measures.<sup>22</sup> Kleinman concluded that self-reports in population

surveys provide reasonable estimates of smoking prevalence, though there may be serious underreporting in evaluations of smoking cessation programs.<sup>8</sup>

A study of urine cotinine levels in pregnant NC women from December 1992-January 1993 indicated that 15% of the women had used tobacco within the previous 48-72 hours.<sup>23</sup> 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 (and who are at high risk for substance use in pregnancy) were not included in the sample.

Our 1988 and 1989 data indicate that the median number of cigarettes smoked per day by women who smoked during pregnancy was 11. We currently have no data to directly validate the smoking amounts reported on the birth certificates, but the high correlation of number of cigarettes smoked with percentage of low birthweight babies provides indirect evidence of general validity. A previous NC study showed a steady increase in the percentage of low birthweight for both white and black mothers as the number of cigarettes smoked per day increased from 0 to 1-9 to  $\geq 19$ .<sup>24</sup> It is noteworthy that women whose smoking status (or number of cigarettes smoked per day) was unknown (about 2% of the births) had the highest percentage low birthweight. This finding supports other studies showing the high risk status of women whose data are missing or unreported on vital records.<sup>25</sup> □