

# Smoking Before, During, and After Pregnancy

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**Abstract:** We report the first national data on smoking before, during, and after pregnancy. Estimates are based on the 1986 Linked Telephone Survey that reinterviewed 1,550 White women 20–44 years of age who were respondents to the 1985 National Health Interview Survey. An estimated 39 percent of White women who had smoked before pregnancy quit smoking while pregnant (27 percent when they found out they were pregnant and 12 percent later during pregnancy). Women with less than 12 years of education were five times as likely to smoke and one-fourth as likely to quit as those with 16 or more years of education. Women who smoked more than one

pack of cigarettes per day before pregnancy were one-fifth as likely to quit as those smoking less. Of the women who quit, 70 percent resumed smoking within one year of delivery. Of those who relapsed, 67 percent resumed smoking within three months of delivery and 93 percent within six months. There is little evidence of educational differentials in relapse rates. The fact that relapse remains high suggests that while health of the fetus is a strong influence on women's smoking habits, women may be less aware of the effect of passive smoke on the infant. (*Am J Public Health* 1990; 80:541–544.)

## Introduction

Increased risks of fetal and infant death and low birth-weight have been linked to maternal smoking<sup>1–3</sup>; even if smoking is stopped late in pregnancy, there will be a positive effect on the infant's birth weight.<sup>4,5</sup> The effects of passive smoke on nonsmokers, and especially on young children, have also been shown to be harmful.<sup>6–9</sup>

For those women who smoke, pregnancy can be viewed as an ideal time for cessation: quitting can affect the health of their unborn child as well as their own health. It is also a time when contact with health professionals is very frequent. Thus there is substantial opportunity for health providers to have an impact on maternal and infant health through smoking cessation.

Among pregnant women, the proportion of married mothers 20 years of age and over who smoked before their pregnancy decreased between 1967 and 1980, while the proportion of those women who quit smoking after they found out they were pregnant increased.<sup>10</sup>

In this study, we report national data, the first ever available, regarding the frequency and timing of smoking relapse among women who quit smoking while pregnant.

## Methods

### Data Sources and Limitations

The National Health Interview Survey (NHIS) is a multistage stratified probability sample of the household population of the United States. In 1986, a linked telephone survey was conducted that reinterviewed respondents to the 1985 NHIS. The primary purpose of the telephone survey was to test methodology<sup>11</sup>; it included a battery of questions on smoking before, during, and after pregnancy. The target sample was selected from women responding to the NHIS during January–June 1985: nearly 2,000 women 18–44 years of age who either were pregnant at the time of the 1985 NHIS or whose most recent birth occurred during the five years preceding the NHIS. The women were interviewed using a

computer-assisted telephone interview system during March–May 1986.

### Definitions

- *Women who smoked prior to pregnancy* are those women who said that they smoked at least one cigarette per day during the 12 months before they found out they were pregnant. Women who said that they did not smoke regularly were not included as smokers prior to pregnancy.
- *Women who quit smoking while pregnant* are those who smoked prior to pregnancy and “quit early” (quit when they found out they were pregnant) or “quit later” (quit at a later time during their pregnancy). Those who quit early were not asked whether they resumed smoking prior to delivery. However, data from a large clinical trial of smoking during pregnancy show that very few women who quit early in pregnancy resume smoking before delivery.<sup>12</sup> Those who quit later continued to smoke cigarettes after they found out they were pregnant, but said that they quit for at least a week during their pregnancy and did not start smoking again before delivery; they were not questioned about when quitting occurred.
- *Women who relapse* are those who quit while pregnant and then resumed smoking within one year of the delivery.
- *Postpartum smokers* include women who relapsed within one year of delivery; women who continued smoking during the entire pregnancy and were still smoking within one year of the delivery; and women who smoked during the year after delivery even though they had not smoked in the 12 months prior to delivery.

The number of cigarettes smoked before pregnancy was dichotomized into less than 20 vs 20 or more cigarettes per day. Age of mother, education, and marital status were determined at the time of the 1985 NHIS.

### Response Rates

The response rate to the first six months (January–June) of the 1985 NHIS was 96 percent.<sup>13</sup> Of these respondents, 86 percent completed the telephone followback survey yielding a sample of 1,918 women. Non-respondents included primarily refusals and those women with changed telephone numbers who could not be tracked.<sup>11</sup> In addition to excluding nonrespondents, 28 sample women who did not respond to

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the entire battery of smoking questions were omitted from the analysis.

As there were relatively few Black women in the sample (n = 278), this analysis is limited to White women. Further, there were only 35 White teenagers in the original sample and because teenagers are known to have different smoking habits than adults,<sup>14</sup> the analysis is limited to White women 20–44 years of age. The overall response rate for these women was 88 percent, yielding a final sample of 1,550 women.

For White women 20–44 years of age, response rates were higher for married than for unmarried women (90 vs 83 percent), and for those with at least a high school education than for those with less education (91 vs 78 percent). All percentages are weighted to reflect national estimates of women in the civilian noninstitutionalized population of the United States.

**Analysis**

The proportions and standard errors in this analysis were computed using the SESUDAAN program that takes into account the complex sample survey design of the NHIS.<sup>15</sup> Multiple logistic regression analysis was performed using the Proc Logist procedure within SAS.<sup>16</sup> Because the design effects were small (less than 1.2, based on the ratio of standard errors from SESUDAAN to simple random sample standard errors), standard errors were approximated using weighted estimates in the logistic regression procedure normalized to reflect the sample size (NORMWT option in SAS). The results of the logistic regression are presented as adjusted odds ratios with 95 percent confidence intervals calculated by taking the anti-logarithms of the regression coefficients and corresponding confidence intervals.

**Results**

One-third of White women 20–44 years of age said that they smoked cigarettes prior to pregnancy. Older women were less likely to smoke than younger women; and married women were much less likely than unmarried women to have been smokers. The prevalence of smoking decreased sharply with increasing education (Table 1).

Using multiple logistic regression to control for age and marital status, White women with less than 12 years education were five times as likely as college graduates (16 or more

years education) to have smoked prior to pregnancy. Similarly, White unmarried women (controlling for age and education) were twice as likely as married women to have smoked. Women in their 20s were about 40 percent more likely to smoke than women in their 30s and early 40s (Table 1).

Of the White women who said they smoked, 39 percent indicated that they quit while pregnant (27 percent early and 12 percent later during pregnancy) (Table 2). The Health Promotion and Disease Prevention (HPDP) supplement to the 1985 NHIS estimated that 21.2 percent of all women 18–44 years quit smoking when they learned they were pregnant.<sup>17</sup> Further analysis of the HPDP data show that among White women 20–44 years of age, 24.2 percent quit smoking early in pregnancy. This estimate is not significantly different from our estimate of 27.4 percent.

Sixty percent of college graduates quit compared with 28 percent of those with less than 12 years education. Women who were lighter smokers prior to pregnancy were much more likely to quit than were heavier smokers.

Based on the logistic regression results, the relation between quitting and education was nearly as strong as between smoking and education. The amount smoked prior to pregnancy was also strongly associated with quitting. Age and marital status had little effect on quitting (Table 2).

In all, 70 percent of White women who quit smoking while pregnant resumed smoking within one year. This may be a slight underestimate since there were eight women who quit smoking while pregnant but who had less than a year of exposure time—from delivery to interview—in which to relapse and therefore were not considered relapsers. Unlike “smoking prior to pregnancy” and “quitting,” there is little association between education and relapsing (Table 3). However, one year relapse rates are higher for those who quit later during pregnancy as opposed to those who quit when they found out they were pregnant (81 vs 66 percent).

Based on the regression results, younger women, women who were heavy smokers prior to pregnancy, and women who quit smoking later during pregnancy were more likely to relapse. However, the relatively small numbers of women who quit smoking (n = 191) result in rather wide

**TABLE 1—Prevalence of Smoking Prior to Pregnancy among White Women 20–44 Years of Age**

	Sample Size*	Percent Smoking	Standard Error	Adjusted Odds Ratios** (95% CI)
All women	1550	32.0	1.3	—
Age (years)				
20–29	832	37.5	1.7	1.38 (1.09, 1.74)
30–44	718	25.1	1.7	ref
Marital Status				
Unmarried	127	52.5	5.1	2.01 (1.37, 2.94)
Married	1423	30.1	1.5	ref
Education (years)				
Less than 12	165	54.1	4.3	4.99 (3.26, 7.65)
12	679	37.4	1.9	2.71 (1.94, 3.77)
13–15	353	26.7	2.4	1.73 (1.19, 2.52)
16 or more	352	16.1	1.9	ref

\*Sample size is number of White women 20–44 years of age. Education was missing for one woman.

\*\*Based on multiple logistic regression.

**TABLE 2—Smoking Cessation during Pregnancy among White Women 20–44 Years of Age**

	Sample Size*	Percent Quitting	Standard Error	Adjusted Odds Ratios** (95% CI)
All women	486	39.3	2.3	—
Age (years)				
20–29	308	38.3	2.8	1.05 (0.68, 1.61)
30–44	178	41.1	4.0	ref
Marital Status				
Unmarried	64	36.6	7.2	0.88 (0.49, 1.60)
Married	422	39.7	2.4	ref
Education (years)				
Less than 12	86	27.5	4.9	0.26 (0.12, 0.56)
12	249	37.0	3.0	0.39 (0.21, 0.75)
13–15	93	44.4	5.5	0.51 (0.25, 1.07)
16 or more	57	60.1	7.0	ref
Amount smoked before pregnancy				
<1 pack/day	204	59.0	3.6	ref
1+ packs/day	281	24.6	2.7	0.22 (0.15, 0.33)

\*Sample size is number of women who smoked prior to pregnancy. Education and amount smoked were missing for one woman.

\*\*Based on multiple logistic regression.

**TABLE 3—One-year Relapse among White Women 20–44 Years of Age Who Quit Smoking while Pregnant**

	Sample Size*	Percent Relapsing	Standard Error	Adjusted Odds Ratios** (95% CI)
All women	191	70.5	3.6	—
Age (years)				
20–29	121	74.0	4.0	1.94 (0.95, 3.94)
30–44	70	64.4	7.0	ref
Marital Status				
Unmarried	24	64.3	9.1	0.72 (0.27, 1.90)
Married	167	71.4	3.8	ref
Education (years)				
Less than 12	25	58.2	10.1	0.36 (0.10, 1.22)
12	92	75.2	5.7	1.05 (0.42, 2.66)
13–15	41	68.9	7.1	0.73 (0.25, 2.10)
16 or more	33	68.5	7.9	ref
Amount smoked before pregnancy				
<1 pack/day	121	66.6	4.5	ref
1+ packs/day	69	76.8	5.3	1.58 (0.77, 3.25)
Quit Time				
Early	131	65.9	4.6	ref
Later during pregnancy	60	81.0	5.4	2.15 (0.96, 4.82)

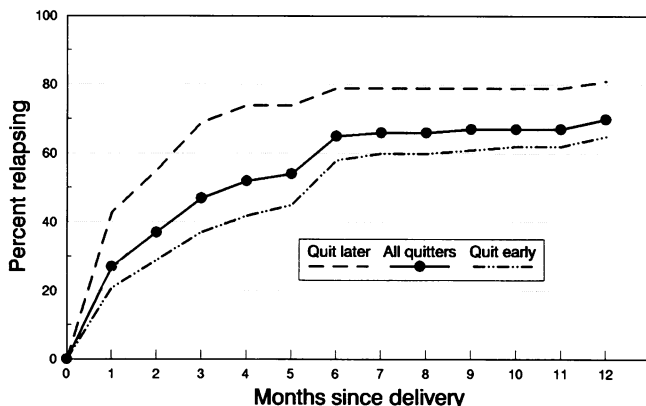
\*Sample size is number of women who quit smoking while pregnant. Amount smoked was missing for one woman.

\*\*Based on multiple logistic regression.

confidence intervals for all of these estimates (Table 3). Age of mother and time of quitting (early vs later) were the only factors for which the confidence intervals came close to excluding 1.0.

Of all White women who quit smoking while pregnant, 27 percent relapsed within a month of the delivery, and 52 percent relapsed within 4 months (Figure 1). Those women who quit later during pregnancy resumed smoking much sooner than women who quit smoking earlier in their pregnancy; 69 percent of the former group relapsed within three months of the delivery compared with 37 percent of the latter group of women.

The net effect of quitting and relapsing is the prevalence of smoking one year postpartum. The estimate includes women who relapsed within a year, those who did not quit during their pregnancy, and those who smoked postpartum but said they were not smoking before or during their pregnancy. (This latter group is small—only 2 percent of the total sample.) The great majority, 87 percent, of the women



**FIGURE 1—Relapse Rates among White Women Ages 20–44 Years Who Quit Smoking While Pregnant (data are from the 1986 Linked Telephone Survey)**

who smoked prior to pregnancy were also smokers one year after delivery. Hence, the prevalence of smoking one year after the delivery was only slightly lower than before pregnancy; 30.3 vs 32.0 percent. Postpartum smoking has similar associations with age, marital status and education as shown in Table 1 for smoking prior to pregnancy.

#### Prenatal Care and Smoking

Nearly all (99 percent) of the women said that they received prenatal care during their pregnancy. Those who smoked prior to pregnancy were less likely to begin prenatal care in the first trimester than those who did not smoke during this period (90 percent vs 95 percent). Those smokers who quit while pregnant were more likely to have begun care in the first trimester than those who did not quit, 94 vs 88 percent.

Regardless of whether a woman went to a clinic or to a private physician for prenatal care, about three-fourths of the smokers prior to pregnancy said that a doctor had advised them to quit or cut down on smoking during their pregnancy (57 percent who quit smoking and 83 percent who did not quit).

In response to a question about different methods used to quit or help cut down on smoking, about 95 percent of the women who quit smoking stated that they quit entirely on their own, without a formal program or counseling. While some of the women also said that they stopped with the help of friends and that they switched to low tar and nicotine cigarettes to help themselves quit, clearly the vast majority, regardless of whether they quit early or later during pregnancy, attributed their behavior to their own initiatives.

#### Discussion

The potential effect of recall bias on the results of this study should be considered. Because of the survey design, a woman may have been asked to recall her smoking habits that occurred five or six years earlier. About 22 percent of the women in the sample delivered in 1980–81, 56 percent from 1982–84, and 22 percent in 1985–86. There was a decrease in the proportion of White women smokers between 1980 and 1985–86, similar to the decline observed in the NHIS data collected during those years.<sup>18</sup> Moreover, smoking history recall over a 10-year period was found to be quite reliable.<sup>19</sup> Thus, recall bias in the current study should not have a major effect on the conclusions.

Nearly all women in this sample received prenatal care and most smokers reported that they had been advised by a doctor to quit smoking. Those who did not quit were, in fact, more likely than quitters to report such advice (83 vs 57 percent); this apparent paradox probably reflects their longer opportunity to be given this advice on repeated prenatal visits. We cannot distinguish the role that counseling during prenatal care might have played in encouraging women to quit; it is possible that women who quit early did so in response to counseling that occurred at their first prenatal visit when they were told they were pregnant. Several previous studies have documented that the advice of a doctor or nurse can be very important in encouraging smokers to quit.<sup>20</sup> A variety of materials are available to health providers who want to provide smoking cessation help to their smoking patients.<sup>21</sup>

We found strong educational differentials in smoking prevalence and in quitting. This reinforces the conclusions of a recent study of smoking prevalence in the general population.<sup>22</sup> Between 1974 and 1985 smoking declined five

times faster among college graduates compared with those with less than a high school education.

Pregnant women appear to quit smoking at a greater rate than the general population. Based on data from the 1986 Adult Use of Tobacco Survey, an estimated 28 percent of persons 17 years of age and over who had smoked in the preceding 12 months quit smoking for at least one week during the year.<sup>1</sup> The proportion of White women who quit for at least a week while pregnant is higher—39 percent.

Relapse rates among women who quit smoking during pregnancy appear to be somewhat less than among quitters in the total population. In general, about 80 percent of smokers who quit resume smoking within a year. This is similar to the relapse rates for other drug dependencies.<sup>23</sup> In our study, 81 percent of White women who quit late in pregnancy also resumed within a year, but only 66 percent of those who quit early resumed smoking again within a year. Thus for some women, pregnancy appears to be an event that could be more likely to result in longer-term abstinence than smoking cessation for other reasons.

It is also noteworthy that women who quit smoking while pregnant resume smoking after delivery at a similar pace to quitters in the general population. In both instances, there is a precipitous rise in the proportion who resume smoking by three months followed by a relatively smaller increase by six months. The likelihood of resuming after six months is less than during the preceding months.<sup>23</sup> The underlying difference between these two groups, however, is that these pregnant women were abstinent during their pregnancy before they resumed smoking again.

However, the fact that relapse rates are high suggests that while the fetus's health is a strong influence on women's smoking habits, women may be less aware of the effect of passive smoke on the infant. Children of parents who smoked are more likely to have a variety of health problems such as respiratory illnesses than children of parents who do not smoke.<sup>6-9</sup> Education about the deleterious effects of infant and childhood exposure to passive smoke should be an essential part of comprehensive prenatal and postpartum care. Intervention programs for pregnant smokers should focus on assisting them to quit permanently.

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