

Cigarette Smoking During Pregnancy: Independent Associations with Religious Participation

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Objective: Data from a national health survey were used to test the hypothesis of a negative association of smoking in pregnancy and three measures of religious participation and importance.

Methods: The 2002 National Survey of Family Growth included 2395 women aged 15 to 44 years with history of at least one pregnancy in the five years before interview. An association between religious participation and cigarette smoking during the last pregnancy was assessed in bivariate and multivariate analyses.

Results: The rate of smoking during the last pregnancy was 4% (95% confidence limit [CL] 2–7%) among those who attended service more than once weekly and 24% (95% CL 20–30%) among those who never attended (chi-square 68, $P < 0.0001$). In logistic regression models compared with those who never attended, those attending once a week or more were only one-fifth as likely to smoke during pregnancy among European Americans (adjusted odds ratio with 95% confidence limits of 0.22, 0.12–0.39), and Hispanics (95% CL 0.28, 0.11–0.73), and one-half as likely to smoke among African Americans (95% CL 0.53, 0.16–1.69). Significant associations were also observed for affiliation and importance of religion.

Conclusion: The frequency of attendance at religious services, affiliation, and importance were independently inversely associated with smoking during pregnancy in American women. The strength of these associations varied among ethnic groups.

Key Words: smoking, Hispanics, religion, pregnancy, African-Americans

Cigarette smoking during pregnancy remains a major public health problem in the United States. In 2004, 10.2% of birth certificates indicated the mother smoked during pregnancy.¹ Smoking in pregnancy impairs intrauterine growth, leading to low birthweight, which has been linked to multiple adverse childhood and adult outcomes including sudden infant death syndrome (SIDS).^{2–7} Furthermore, there is no safe level of smoking during pregnancy, with adverse outcomes being reported with <6 cigarettes/d.⁸ She also places herself at risk for smoking-related mortality including death from cancers of the lung and breast, and from cardiovascular disease.¹¹

Cigarette smoking in pregnancy is associated with social and cultural factors.^{6,10–14} However, to our knowledge, no population-based data have been published on maternal smoking in pregnancy and religiousness in the United States. Such information may be of value to clinicians and to public health profes-

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Key Points

- Women with active religious involvement were only one-fifth to one-half as likely to smoke during pregnancy as those with no involvement.
- The effect of religious participation was greatest in European Americans.
- Smokers who attended services weekly or more were nearly three times more likely to quit during pregnancy than those who never attended.
- Further research is needed to assess mechanisms for this association and to determine whether this information can be used to develop more effective intervention for smoking prevention and cessation in pregnancy.

sionals in targeting interventions and devising more effective smoking prevention and cessation interventions, sometimes delivered in faith-based settings.^{15,16}

Clinicians have been advised to include religious participation when taking a social history.¹⁷ However, more information is needed on how such data may be used to improve patient outcomes. Among women aged 15 to 44 independent of multiple confounders, we test the hypothesis that higher levels of three dimensions of religiousness assessed at interview (attendance at services, affiliation, and importance in daily life) are associated with a lower prevalence of smoking before and during the patient's last pregnancy, as well as a higher rate of quitting during the last pregnancy. We use data from a large, multiethnic sample of women from the sixth cycle of the National Survey of Family Growth.

Materials and Methods

The National Survey of Family Growth Cycle 6 (NSFG 6) was conducted from March 2002 to February 2003 on a US national multistage probability sample of women in the household population aged 15 to 44 years of age, yielding 7,643 interviews with a response rate of 80%. Teens, young adults (20–24 yr), and black and Hispanic persons were over-sampled. Details of the survey plan, sample design, operations, response rates, imputation of missing data, Institutional Review Board approval, and public release of data have been published, as have procedures used to obtain informed consent and to maintain confidentiality of information.^{18–20}

Demographic and health data were collected by household interview using computer-assisted personal interviews (CAPI) administered by interviewers and audio-computer-assisted self interviews (ACASI).¹⁸ Women were asked a series of questions on religion. With respect to each reported recent pregnancy since January 1997, women were asked, "How many weeks pregnant were you when you learned you were pregnant this time? If the woman knew she was pregnant and the pregnancy lasted at least 6 months, she was asked the amount smoked in the six months before she learned of the pregnancy, whether she smoked at all during the pregnancy, and if so, how much.

Among 7,643 interviewed women, 3,230 were nulliparous and therefore excluded. Among the 4,413 women who had ever had a pregnancy resulting in a live birth, 2,017 were excluded for no live birth since 1997, 5 for missing data on their current frequency of attendance at religious services, and 1 for missing smoking status before her last recent pregnancy. Thus 2,390 women with a completed pregnancy and live birth since 1997 formed the analysis sample.

Statistical Analysis

Detailed weighted descriptive statistics were computed. Multivariate logistic regression analysis was used to develop

models to control for the confounding of the association of smoking status with religious variables. All models controlled for age in years. All analyses were performed using the SUDAAN software package (RTI International, Research Triangle Park, NC), with techniques that incorporated sampling weights and design features of the survey.²¹

Results

Of eligible women, 24% reported smoking 6 months before their last recent pregnancy of 6 or more months duration. During that pregnancy, 48% of smokers quit and 0.5% of nonsmokers started smoking. Of those smoking during pregnancy, 45% reported smoking <6 cigarettes/d. Table 1 shows the percentage reporting smoking by sociodemographic variables. Groups more likely to report smoking before and during pregnancy included: younger women; non-Hispanic European Americans (EA), US-born; women who did not complete high

Table 1. Percentage reporting smoking 6 months before and during last recent pregnancy: NSFG 6, 2002

Variable	N	Before percentage	95% CL	During percentage	95% CL
Age					
15–24	594	33*	29–38	17*	13–20
25–34	1244	23	20–27	13	10–16
35–44	552	17	13–21	9	7–12
Ethnic group					
EA	1154	29*	26–33	16*	13–20
AA	468	20	16–25	9	6–13
HA	651	12	8–16	4	3–6
Other	117	14	9–22	8	4–14
Nativity					
US	1849	28*	25–31	15*	13–18
Other	534	6	4–9	2	1–4
Education					
<HS	470	34*	27–41	22*	17–29
≥HS	1920	22	19–24	10	9–13
Percent poverty					
<200	1282	29*	25–32	17*	14–21
≥200	1108	19	16–23	8	6–11
Marital status					
Married	1428	17*	14–20	8*	6–10
W/D/S	280	41	35–47	24	19–29
Never	628	37	32–42	21	16–26
Parity					
1	1108	28*	24–32	12	10–15
2	820	21	17–25	12	9–16
3+	462	20	15–26	14	9–19

* $n \times 2 \chi^2, P < 0.01$.

NSFG, National Survey of Family Growth; CL, confidence limit; EA, non-Hispanic European American; AA, non-Hispanic African American; HA, Hispanic American; HS, high school; W/D/S, widowed/divorced/single.

school; women with an income <200% of poverty level; women who were not married; and women with only one child.

Attendance, Smoking and Quitting During Pregnancy

Overall 12% (95% confidence limit [CL] 10–15%) reported smoking during their last pregnancy; percentages rose from the lowest level among those who attended more than once a week, to the highest level among those who never attended (chi-square 68, $P < 0.0001$) (Table 2). In logistic regression analyses, Hispanic and EA women attending once or more weekly had significantly lower odds of smoking during pregnancy compared with those who never attended (Table 3). The inverse association did not attain significance in African-American (AA) women. Tables 2 and 3 also show an independent inverse association of frequency of attendance and smoking before pregnancy.

Among smokers of all races before pregnancy, quitting after learning of the pregnancy was reported by 71% (49–86%) of > weekly attendees, 57% (44–69%) of weekly, 59% (46–72%) of < weekly, and 44% (35–53%) of < monthly, and 37% (29–47%) of those who never attended (chi-square 11, $P = 0.03$). Logistic regression analysis of quitting during pregnancy revealed that after adjusting for age, those attending services weekly or more were nearly three times more

likely to quit than those who never attended (odds ratio [OR] = 2.71, 95% CI 1.48–4.93, $P = 0.0014$, not shown in tables). After controlling for other confounders, frequent attendees were still more than twice as likely as those who never attended to quit (OR = 2.20, 95% CL 1.11–4.35, $P = 0.025$).

Affiliation and Importance, Smoking Before Pregnancy and Quitting

Most likely to smoke were those with no affiliation (Table 2). Among women with an affiliation, those for whom religion was “very important” were least likely, and those for whom it was “not important” were most likely to smoke. Table 4 shows age-adjusted OR and 95% confidence limits for affiliation groups. EA and AA women reporting religious affiliation had reduced odds of smoking before pregnancy after controlling for age. Adjustment for multiple confounders attenuated this association and rendered it nonsignificant. In logistic regression analyses, fully-adjusted OR for those reporting religion as very important versus not important in their lives were significant (Model II, Table 5). Regression analyses also showed that among those who smoked before pregnancy, neither affiliation nor importance was significantly associated with quitting smoking before pregnancy. Inverse associations of affiliation and importance with smoking before pregnancy were also seen (Tables 2, 4, and 5).

Table 2. Percentage reporting smoking 6 months before and during last recent pregnancy by religiousness: NSFG 6, 2002

Variable	Before percentage	95% CL	During percentage	95% CL
Attendance				
>Weekly	12*	8–19	4*	2–7
Weekly	13	11–17	6	4–8
<Weekly	21	17–26	9	6–13
<Monthly	30	25–34	17	13–21
Never	38	33–44	24	20–30
Affiliation				
None	34*	27–42	20*	15–26
Catholic	16	13–20	7	5–9
Protestant	27	23–31	15	12–18
Baptist	32	28–36	18	15–22
Mainline	25	18–32	14	9–20
Other	24	18–32	12	8–19
Other	14	8–22	6	3–11
Degree of importance				
High	17*	14–20	8*	6–10
Moderate	30	25–35	15	12–19
None	40	28–53	27	16–41

*2 × n χ^2 $P < 0.001$.

NSFG, National Survey of Family Growth; CL, confidence limit.

Discussion

Despite decades of anti-smoking campaigns and declines in prevalence, smoking rates in young pregnant women remain high relative to the Healthy People 2010 national goal of $\leq 1\%$ by 2010.^{22–24} In this 2002 national sample of American women aged 15 to 44 years, three measures of religiousness were inversely associated with smoking during pregnancy. However, the strength and significance of the association with smoking of the three measures varied with race/ethnicity. Affiliation and attendance were most important for Hispanics; the importance of religion in daily life ranked highest for African Americans; and attendance and daily importance were highest for European Americans. The most consistent finding was that smoking before and during pregnancy was much less prevalent among frequent attendees of religious services than among infrequent attendees or those who never attended, independent of confounders. Furthermore, among smokers, frequent attendees were more likely to quit when they learned they were pregnant. Religious affiliation and subjective importance were associated with smoking before pregnancy, but not independently associated with quitting.

To our knowledge, this is the first reported study of religiousness and smoking during pregnancy in a total population. A better understanding of the effect of various aspects of religious involvement on smoking prevalence, incidence, and likely response to intervention may aid in

Table 3. Adjusted* odds ratios (95% CI) of smoking 6 months before and during pregnancy in attendees compared with those who never attended religious services: NSFG 6

Variable	N	Model I OR	Before 95% CL	Model II OR	95% CL	Model I OR	During 95% CL	Model II OR	95% CL
Hispanic	651								
≥Weekly	232	0.51	0.25–1.06	0.62	0.28–1.39	0.21+	0.09–0.50	0.28+	0.11–0.73
≤Weekly	281	1.58	0.82–3.02	1.66	0.86–3.12	0.47*	0.25–0.86	0.47*	0.23–0.97
Never	138	1.00		1.00		1.00		1.00	
EA	1154								
≥Weekly	382	0.22+	0.14–0.35	0.30+	0.18–0.50	0.15+	0.09–0.25	0.22+	0.12–0.39
≤Weekly	506	0.54+	0.40–0.72	0.68*	0.49–0.95	0.55+	0.36–0.83	0.72	0.45–1.16
Never	266	1.00		1.00		1.00			
AA	468								
≥Weekly	175	0.27+	0.12–0.58	0.29+	0.14–0.62	0.38	0.12–1.19	0.53	0.16–1.69
≤Weekly	222	0.50*	0.26–0.96	0.46*	0.23–0.93	0.56	0.26–1.22	0.58	0.24–1.41
Never	71	1.00		1.00		1.00		1.00	

NSFG, National Survey of Family Growth; OR, odds ratio; CL, confidence limit; AA, Non-Hispanic African American; EA, Non-Hispanic European American (other race not shown).

*Model I adjusted for age; Model II adjusted for age, education <12 years, foreign born, income <200% poverty, married.

*P < 0.05; +P < 0.01.

developing more effective interventions for persons at risk for smoking during pregnancy.^{25,26}

Mechanisms

Religious affiliation, attendance at religious services, and other religious behaviors are more prevalent in the United States

than in most other industrialized nations; these behaviors have been associated with lower rates of initiation and prevalence of adolescent and young-adult smoking.^{27–29} Possible mechanisms for these associations and presumably the associations in the present study have been discussed at length elsewhere and include: direct effects of anti-smoking religious teaching (eg, Ad-

Table 4. Adjusted odds ratios (95% CI) of smoking 6 months before and during pregnancy in affiliated women compared with those of no religion: NSFG 6

Variable	N	Model I OR	95% CL before	Model II OR	95% CL	Model I OR	95% CI during	Model II OR	95% CL
Hispanic	651								
None	67	1.00		1.00		1.00		1.00	
Catholic	443	0.59	0.24–1.42	0.64	0.28–1.43	0.48*	0.25–0.92	0.35*	0.15–0.83
Protestant	136	1.21	0.44–3.31	1.14	0.46–2.81	0.64*	0.41–0.99	0.60	0.26–1.38
Other	5	—	—	—	—	—	—	—	—
EA	1154								
None	158	1.00		1.00		1.00		1.00	
Catholic	262	0.55*	0.32–0.93	0.70	0.40–1.25	0.48*	0.25–0.92	0.64	0.32–1.30
Protestant	669	0.57	0.37–0.86+	0.77	0.48–1.23	0.64*	0.41–0.99	0.91	0.55–1.50
Other	65	0.36+	0.18–0.73	0.51	0.24–1.09	0.27*	0.10–0.73	0.41	0.14–1.19
AA	468								
None	67	1.00		1.00		1.00		1.00	
Catholic	39	0.22*	0.06–0.84	0.31	0.08–1.18	—	—	—	—
Protestant	344	0.84	0.38–1.82	0.82	0.36–1.87	0.90	0.37–2.18	0.94	0.33–2.62
Other	18	—	—	—	—	—	—	—	—

NSFG, National Survey of Family Growth; OR, odds ratio; CL, confidence limit; AA, Non-Hispanic African-American; EA, Non-Hispanic European American (other race not shown).

*Model I adjusted for age; Model II adjusted for age, education <12 years, foreign born, income <200% poverty, married.

*P < 0.05; +P < 0.01.

Table 5. Adjusted odds ratios (95% CI) of smoking 6 months before and during pregnancy in persons for whom religion was important in daily life compared with those for whom it was not important by ethnicity: NSFG 6

Importance	N	Model I OR	95% CL before	Model I OR	95% CL	Model II OR	95% CL during	Model II OR	95% CL
Hispanic	586								
Very	366	0.57	0.32–1.01	0.66	0.38–1.17	1.04	0.38–2.86	1.31	0.47–3.61
Not very	220	1.00		1.00		1.00		1.00	
EA	996								
Very	530	0.31+	0.15–0.62	0.40+	0.20–0.79	0.25+	0.10–0.58	0.29*	0.11–0.76
Somewhat	401	0.58	0.29–1.13	0.68	0.34–1.38	0.47	0.22–1.00	0.52	0.21–1.25
Not	65	1.00		1.00		1.00		1.00	
AA	468								
Very	175	0.27+	0.12–0.58	0.29+	0.14–0.62	0.23	0.04–1.35	0.77	0.08–7.82
Somewhat	222	0.50*	0.26–0.96	0.46*	0.23–0.93	0.29	0.04–2.15	1.11	0.09–14.29
Not	71	1.00		1.00		1.00		1.00	

NSFG, National Survey of Family Growth; OR, odds ratio; CL, confidence limit; AA, Non-Hispanic African American; EA, Non-Hispanic European American (other race not shown).

*Model I adjusted for age; Model II adjusted for age, education <12 years, foreign born, income <200% poverty, married.

*P < 0.05; +P < 0.01.

ventists, Latter Day Saints), norms of the religious community, and social support and psychological resources (eg, self esteem, self-efficacy and optimism).^{30–33} Furthermore, studies reporting an inverse association of social support and smoking in pregnancy seem consistent with Bandura's social learning theory.^{34–40} Social factors have been shown to be of importance in cessation and relapse across a range of drugs including tobacco, alcohol and opioids.⁴¹

Strengths and Limitations

Strengths of this study include the use of female interviewers to minimize bias, interviewing over a third of Hispanic respondents in Spanish, and using CAPI and ACASI interviewing which resulted in low frequencies of imputed values due to missing data (eg, only 7.6% for poverty index, about half that seen in earlier NSFG cycles). The sample of women with live births excluded women whose pregnancy was terminated by spontaneous or induced abortion between three and six months, who may have had a high prevalence of smoking, possibly biasing OR toward the null. A further strength is the battery of questions on several dimensions of religion, rarely found in health surveys. A "social desirability effect," such as systematic over-reporting of religious attendance, should if anything bias results toward the null.⁴² Adequate reliability has been documented for self-reported smoking.^{43,44} Further study of Catholic versus Protestant mothers would be of interest, since in a report of data from young adults surveyed in 1987/1988 the prevalence of smoking was similar in Catholics and most Protestants.²⁹ As with all

observational studies, causal inference is not possible. The representativeness of the sample and the use of sample weights provides generalizability of the results to US household population of the same ages. However, results may not be applicable to countries where the religious profile differs markedly from the United States, eg, Japan.

Future Research

Future longitudinal studies should focus on determining temporal sequence and mechanisms of the relationship of religiousness and smoking in pregnancy. For example, a prospective follow-up study of a cohort of women of reproductive age could assess multiple dimensions of religion and spirituality as well as of measures of social integration and networks and smoking at baseline. This information could then be related to subsequent smoking and other health behaviors before and during pregnancy. Associations of baseline religion with smoking could be compared with those of nonreligious forms of social integration and support. A multiethnic cohort would allow exploration of the apparent ethnic variation reported here.

Further research is also needed to determine whether this information can be used to develop more effective interventions for smoking prevention and cessation in pregnancy. Clinicians have been advised to include religious participation when taking a social history.¹⁷ Research to detect possible "unintended consequences" of health professionals asking about religious practices and then making individual assumptions or recommendations would be desirable in assessing clinic-based interventions.

Conclusion

Women with active religious involvement were only one-fifth to one-half as likely to smoke during pregnancy as those with no involvement. The effect of religious participation was greatest in European Americans. Smokers who attended services weekly or more were nearly three times more likely to quit during pregnancy than those who never attended.

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