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Prevalence and Characteristics of Women at Risk for an Alcohol-Exposed Pregnancy (AEP) in the United States: Estimates from the National Survey of Family Growth

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Abstract

Non-pregnant women can avoid alcohol-exposed pregnancies (AEPs) by modifying drinking and/or contraceptive practices. The purpose of this study was to estimate the number and characteristics of women in the United States who are at risk of AEPs. We analyzed data from in-person interviews obtained from a national probability sample (i.e., the National Survey of Family Growth) of reproductive-aged women conducted from January 2002 to March 2003. To be at risk of AEP, a woman had to have met the following criteria in the last month: (1) was drinking; (2) had vaginal intercourse with a man; and (3) did not use contraception. During a 1-month period, nearly 2 million U.S. women were at risk of an AEP (95 % confidence interval 1,760,079–2,288,104), including more than 600,000 who were binge drinking. Thus, 3.4 %, or 1 in 30, of all non-pregnant women were at risk of an AEP. Most demographic and behavioral characteristics were not clearly associated with AEP risk. However, pregnancy intention was strongly associated with AEP risk (prevalence ratio = 12.0, $P < 0.001$) because women often continued to drink even after they stopped using contraception. Nearly 2 million U.S. women are at AEP risk and therefore at risk of having children born with fetal alcohol spectrum disorders. For pregnant women and women intending a pregnancy, there is an urgent need for wider implementation of prevention programs and policy approaches that can reduce the risk for this serious public health problem.

Keywords

Pregnancy; Alcohol-induced disorders; Fetal alcohol syndrome

Introduction

Fetal alcohol spectrum disorders (FASDs) are caused by maternal alcohol consumption during pregnancy and are a leading cause of developmental disabilities [1–3]. Each year in the United States approximately 2,000–8,000 children are born with fetal alcohol syndrome

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(FAS) [4], the most severe category of FASDs, but many thousands more are born with less severe FASDs [3]. FASDs are associated with abnormal facial features, intellectual disabilities, academic problems, poor reasoning and judgment skills, and other medical or developmental deficits [5]. FASDs are an important target for clinical and public health intervention because they can be prevented through behavioral changes [6].

The best time to target FASD prevention is prior to conception [7]. Many women, including those who are intending to become pregnant, may not be aware that they are pregnant until several weeks or months after conception. As a result, they may continue to drink during this key developmental phase of the fetus [8]. Interventions that target women who know they are pregnant may be too late because significant damage to the fetus may have already occurred [9]. In contrast, interventions that target women before they become pregnant can more effectively prevent alcohol damage to the developing fetus. Such interventions can address both drinking behavior and contraception use, and they have proven successful in preventing alcohol-exposed pregnancies (AEPs) [10, 11].

Many non-pregnant women are likely to be at risk of AEPs, which is defined as drinking and not using contraception while sexually active with a male partner. Drinking is common among women of reproductive age: 1 in 2 (51.5 %) non-pregnant women and 1 in 13 (7.6 %) pregnant women reported drinking alcohol in the past 30 days [1]. Furthermore, 1 in 8 adult women and 1 in 5 high school girls reported binge drinking in the past 30 days [12]. Similarly, contraception use is inadequate among women of reproductive age: over a 12-month period, approximately 20 % of fertile women not intending pregnancy reported not using or inconsistently using contraception when having sex with a male partner [13]. However, few data are available on the prevalence of women who practice both behaviors, i.e., drinking and not using contraception, and therefore are at risk of AEPs.

The purpose of this study was to generate the first national estimates of the number and characteristics of women in the United States who are at risk of AEPs. These estimates will help establish the magnitude of the risk for FASDs in the United States and ways that the at-risk population might be targeted for interventions.

Methods

The dataset used for this study was the 2002, Cycle 6, United States National Survey of Family Growth (NSFG). The survey was conducted from January 2002 to March 2003 by the Institute for Social Research under contract with the National Center for Health Statistics. It obtained detailed information through in-person interviews from a national probability sample of 12,571 men and women ages 15–44 years. The NSFG collects information on family life, marriage and divorce, pregnancy, contraception, and health behaviors. The response rate for women was 80 %; other detailed information regarding the survey methodology can be obtained from the Plan and Operation of Cycle 6 of the National Survey of Family Growth, Series 1, Number 42 [14]. The unweighted numbers of women who participated in the survey are shown in Fig. 1.

The NSFG survey included questions about sexual behaviors and contraception use for each of the 12 months preceding a woman's interview. The two questions about drinking, however, were not broken down by month but instead asked: "During the past 12 months, how often did you drink an alcoholic beverage?", and "During the past 12 months, how often did you drink five or more drinks within a couple of hours?" (The possible response categories for both questions were: "never", "one to two times during the year", "several times during the year", "once a month", "once a week", or "daily".) Based on these questions, we calculated AEP risk in the month preceding each interview. As part of this calculation, we decided that women had to report drinking at least once a month to have the potential to be classified as having AEP risk.

Women who reported drinking less frequently than once a month could not be classified as having AEP risk. We defined AEP risk in two general ways. In the first, a woman had to have met the following criteria during the month preceding the interview: (1) was drinking; (2) had vaginal intercourse with a man; and (3) did not use a method of contraception (e.g., IUD, oral contraceptives, withdrawal, rhythm, etc.). In the second definition, we added the criterion that (4) the woman was not known to be sterile or to have a sterile partner. Thus, the women included in the second definition were a subset of the women included in the first definition (Fig. 1). The first definition captured a more general population, whereas the second definition captured a population that might be eligible for a preconception care intervention, since all women in it were at risk of an AEP unless they changed their drinking or contraception practices. Within each of these general definitions of AEP risk, we also looked at three specific definitions of drinking during the last month: any use, binge drinking (five or more drinks within a couple of hours), and daily drinking.

We also stratified AEP risk by pregnancy intention. Intention to become pregnant was defined by a question directed only to women who were not using contraception: "Is the reason you are not using a method of birth control now because you, yourself, want to become pregnant as soon as possible?". If a woman answered "Yes", she was classified as intending to get pregnant; if she answered "No" or "Inapplicable" or was not asked the questions because she had previously indicated only having protected sex in the last month, she was classified as not intending to become pregnant.

Because the data were obtained by using a complex multistage probability cluster sample design, we used weighted data to calculate AEP risk and associated confidence intervals. Any estimates with a relative standard error of more than 30 % or with a denominator of fewer than 50 were not reported (consistent with Healthy People 2010 criteria for data suppression) [15]. We applied a Wald Chi square test to identify univariate correlates of AEP risk. We also computed predictive marginals with a multivariate logistic regression model that adjusted for demographic and behavioral variables, using SAS (release 9.2; SAS Institute, Cary, NC) and SUDAAN statistical software (release 9.0; Research Triangle Institute, Research Triangle Park, NC) to account for the complex sampling design. We used Satterthwaite adjusted Chi squared tests [16] and pairwise comparison tests to identify multivariate correlates of AEP risk. Associations having P values <0.05 were considered to be statistically significant.

Results

The estimated number and percentage of women at AEP risk in the United States are shown in Table 1. We found that during 2002–2003, nearly 2 million women were at risk of an AEP in the month preceding their interviews [95 % confidence interval (CI) 1,760,079–2,288,104], including more than 600,000 who were involved in binge drinking. Thus, 3.4 %, or approximately 1 in 30, of all non-pregnant women were at risk of an AEP. This proportion was even higher—6.6 %—among women who were not sterile and whose partner was not known to be sterile (Table 1).

Pregnancy intention was a strong correlate of AEP risk. Among all non-pregnant women, AEP risk (any alcohol use) was 33.7 % (95 % CI 27.1–40.2 %) for those intending to get pregnant compared to 2.3 % (95 % CI 1.8–2.7 %) for those not intending to get pregnant. Similarly, among non-pregnant women who were not sterile and whose partner was not known to be sterile, AEP risk was 36.7 % (95 % CI 29.4–44.0 %) for those intending to get pregnant compared to 4.2 % (95 % CI 3.3–5.1 %) for those not intending to get pregnant.

We also compared drinking prevalences (any alcohol use) among all non-pregnant women according to their pregnancy intention. Because all women intending pregnancy were having unprotected vaginal sex with a male, their drinking prevalence was the same as their AEP risk: 33.7 % (95 % CI 27.1–40.2 %). Among women not intending pregnancy, drinking prevalences were 37.7 % (95 % CI 32.1–43.7 %) among those having unprotected vaginal sex with a male, 41.7 % (95 % CI 39.1–44.4 %) among those having protected vaginal sex with a male, and 28.4 % (95 % CI 26.1–30.9 %) among those not having vaginal sex with a male.

Table 2 shows AEP risk factors (any alcohol use) among non-pregnant women. In univariate analysis, the following factors were significantly associated with higher AEP risk: age (no clear pattern), non-Hispanic race/ethnicity, being married, cohabiting, or divorced/separated/widowed, more education, higher household income, younger age at first intercourse, number of live births (no clear pattern), intending to become pregnant, being a current smoker, and using marijuana in the last 12 months. In the multivariate analysis, AEP risk was significantly associated with education (no clear pattern), household income (no clear pattern), poorer health, younger age at first intercourse, number of live births (no clear pattern), intending to become pregnant, being a current smoker, and using marijuana in the last 12 months. Pregnancy intention was by far the factor most strongly associated with risk of AEP (prevalence ratio = 12.02), while all other factors had prevalence ratios less than 2.6. Similar results were found among non-pregnant women who were not sterile and whose partner was not known to be sterile (data not shown).

Discussion

We found that in the United States during any given 1-month time period, nearly 2 million non-pregnant women are at risk of an AEP. Approximately 600,000 of these women are not only drinking, but practicing binge drinking.

These findings indicate that many women could benefit from interventions that attempt to reduce risk of AEP by modifying drinking behaviors and contraceptive practices. A 2011 committee opinion from the American College of Obstetricians and Gynecologists (ACOG) advised that providers should give pregnant women and women at risk of pregnancy, "… compelling and clear advice to avoid alcohol use and provide assistance for achieving abstinence, or provide effective contraception to women who require help." [17].

Evidence-based interventions that are effective in reducing AEP risk are currently available. The U.S. Preventive Services Task Force, "… recommends screening and behavioral counseling interventions to reduce alcohol misuse by adults, including pregnant women, in primary care settings" [18]. Furthermore, interventions that use motivational interviewing have been shown in randomized, controlled trials to lower risk of AEPs among women in high-risk settings [10]. Policy interventions also can have an important impact. AEP risk could be reduced by enforcing the minimum legal drinking age, reducing alcohol outlet density, raising the price of alcohol, and other evidence-based approaches [12, 18]. Wider implementation of these various interventions would reduce the number of AEPs and therefore reduce serious outcomes such as FASDs.

Women who intend to become pregnant have a higher risk of AEP because they stop using contraception but continue drinking. Other studies have found that even though women may intend to become pregnant, their likelihood of drinking does not appear to decrease until they know they are pregnant [19]. Thus, there is a strong need for specific targeted interventions to change drinking behaviors among women intending to become pregnant [7]. For these women, messages about the dangers of alcohol consumption before pregnancy recognition could supplement and strengthen other pre-conception health efforts.

In addition to pregnancy intention, several other demographic and behavioral variables were associated with AEP risk in our analyses. However, absolute differences across variable categories were small, at most 3–4 %. These small differences suggest that interventions probably should not target subgroups with particular demographic characteristics or behavioral practices, except for the previously described need to target women intending to become pregnant.

This is the first U.S. study we are aware of to generate national estimates of AEP risk. Although many studies have looked at drinking behaviors or contraceptive practices separately [1, 20, 21], few have addressed combined risk [22] and none has done so in a nationally representative study. One previous study looked at drinking behaviors among women who were not using contraception, but did not estimate the proportion of the population at AEP risk [19]. Other studies examined AEP risk among special populations, such as women who are incarcerated or who are attending sexually transmitted disease clinics [10]. Our data will provide a baseline estimate to examine trends in AEP risk over time using more recent data.

Our study had several strengths. We had a nationally representative sample with a relatively high response rate and few missing or inconsistent data. Furthermore, we had a detailed and comprehensive contraceptive and sexual behavior history. However, we faced several

limitations that could have led to biased estimates. To begin with, we based our AEP risk estimates on reports of drinking, sex, and contraception that occurred in the same month, but not necessarily at the same time in the month. Thus, if all the drinking in the month occurred before any of the unprotected sex in the month, then the fetus would have no risk from alcohol exposure. However, such a scenario seems unlikely among women who report drinking every month of the year. Also, we included all contraceptive methods in our definition of contraception, including those that are somewhat less effective (e.g., withdrawal, rhythm), and we did not know whether contraceptive methods were used correctly (e.g., condoms). This limitation could cause an underestimation of AEP risk.

In addition, the alcohol measures in our study created important limitations. First, the recall period for alcohol consumption was long (12 months) and therefore more susceptible to recall bias. Second, among adults, alcohol consumption generally and excessive drinking in particular are underreported in surveys because of recall bias, social desirability bias, and lack of understanding of what constitutes one drink [23]. Thus, we may have underestimated AEP risk as a result, although this underestimation may be partially offset because drinking questions were part of the audio computer-assisted self-interviewing (ACASI), a method that can reduce social desirability bias. Third, at the time of the survey, binge drinking for women was still defined as 5 or more drinks on an occasion, whereas that definition has since been revised to 4 or more drinks. Thus, our estimates of AEP risk associated with binge drinking would be even higher if it would have been possible to use the revised definition for women. Last, the lack of monthly drinking data led us to count in our AEP estimates only those women who drank every month. This conservative approach ensured that their drinking occurred during the 1-month period in question. However, it meant that we underestimated AEP risk, since some women who drank one to two times or several times during the year would have been drinking during the relevant 1-month time period but were excluded from the calculations. Taken together, these various biases suggest that the true prevalence of AEP risk may be considerably higher than what we are reporting.

In conclusion, nearly 2 million U.S. women of reproductive age are at AEP risk and therefore at risk of having children born with FASDs. Women who are intending a pregnancy have especially high risk since they often continue to drink until they find out they are pregnant, thus exposing the developing fetus to alcohol for several weeks or even months. There is an urgent need for raised awareness about AEP risk, wider implementation of prevention programs and campaigns, and increased use of policies that reduce risk for this serious public health problem.

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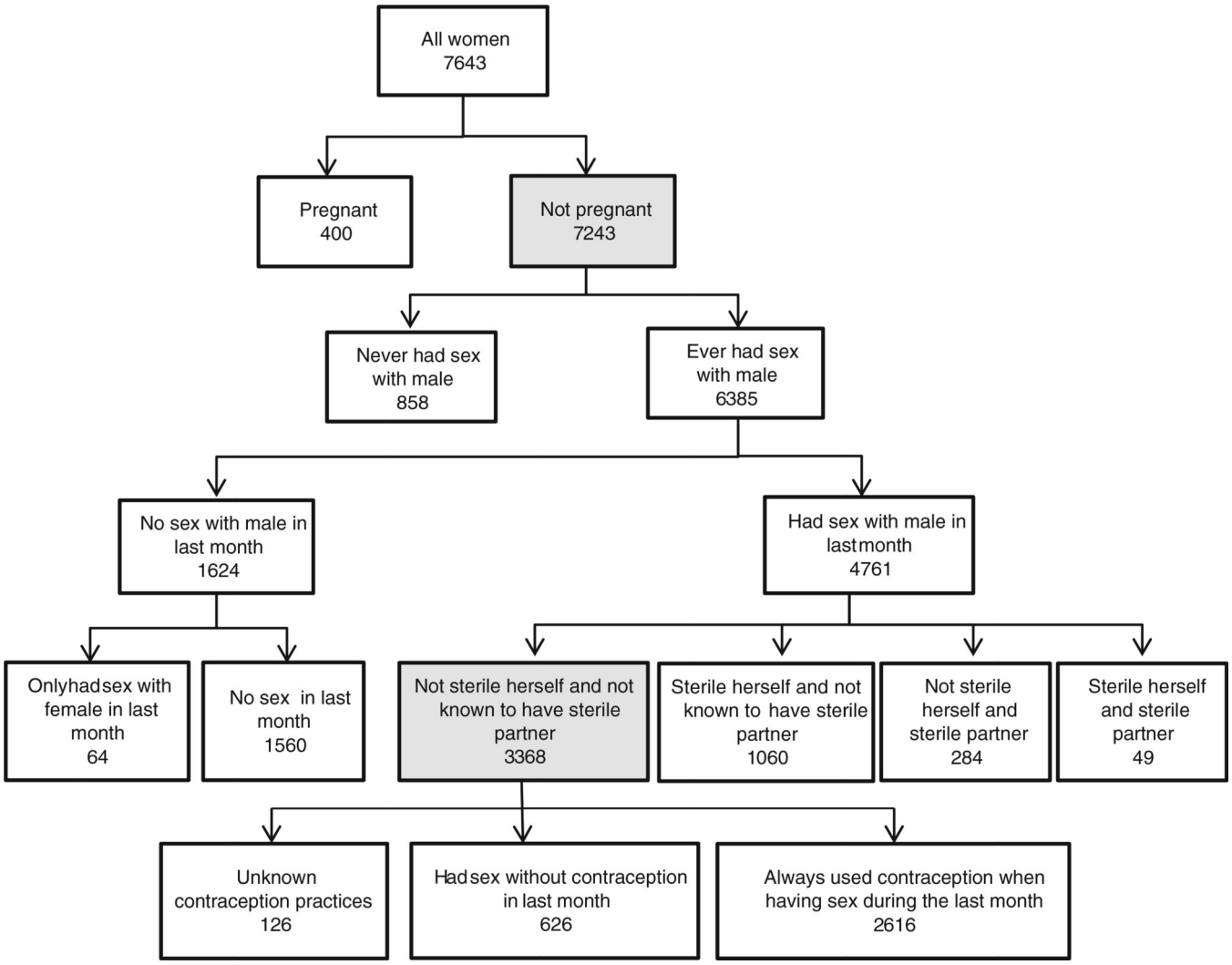

Fig. 1.

Selected characteristics of women ages 15–44 who responded to the National Survey on Family Growth (NSFG). All values are unweighted. The *gray boxes* are two different denominators used in the percentage calculations of Tables 1 and 2

Table 1

Number and percentage of U.S. women at risk of an alcohol-exposed pregnancy (AEP) during the last month according to drinking pattern, where AEP risk was defined as drinking (daily, binge, or any use) combined with not using contraception while having sex with a male

Drinking pattern during month	Number and percentage of women at AEP risk among all non-pregnant women (weighted denominator = 7,236[a], weighted denominator = 58,486,902)			
	Unweighted numerator	Weighted numerator	Percentage	95 % CI
Daily	38	224,371	0.4	0.2–0.5
Binge	91	611,190	0.9	0.8–1.3
Any use	264	1,994,757	3.4	3.0–3.9
Drinking pattern during month	Number and percentage of women at AEP risk among non-pregnant women who were not sterile and whose partner was not known to be sterile (unweighted denominator = 3,173[b], weighted denominator = 24,934,732)			
	Unweighted numerator	Weighted numerator	Percentage	95 % CI
Daily	32	189,225	0.8	0.5–1.1
Binge	80	533,083	2.1	1.6–2.7
Any use	227	1,643,539	6.6	5.7–7.5

Daily drinking refers to having at least one drink per day; binge drinking refers to 5 or more drinks on one occasion; any use refers to any drinking during the relevant time period

[a] Unweighted denominator is less than the corresponding number (i.e., 7,243) in Fig. 1 because 6 women had missing values for drinking and/or contraceptive practices

[b] Unweighted denominator is less than the corresponding number (i.e., 3,368) in Fig. 1 because 76 women had missing values for drinking, contraceptive practices, and/or sterility

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Table 2

Percentage of U.S. non-pregnant women at risk of an alcohol-exposed pregnancy (AEP, defined here as any alcohol use and vaginal sex with a man without using contraception) during the last month, stratified by demographic and behavioral characteristics

Characteristics	Univariate analysis				Multivariate analysis		
	Numerator, unweighted	Denominator, unweighted	Prevalence % (95 % CI), weighted	*P* value**	Predictive marginals % (95 % CI)	Prevalence ratio*	*P* value^
Overall	265	7,243	3.4 (3.0–3.9)				
Age				0.001			0.15
15–24	59	2,363	2.1 (1.4–2.8)		4.3 (2.7–5.9)	1	
25–29	47	1,191	4.1 (2.8–5.5)		4.1 (2.7–5.6)	0.95	
30–34	53	1,262	4.5 (3.4–5.6)		4.1 (3.1–5.2)	0.95	
35–39	41	1,231	3.0 (1.9–4.0)		3.5 (2.3–4.8)	0.82	
40–44	65	1,196	4.6 (3.3–5.9)		6.0 (4.2–7.8)	1.39	
Race/ethnicity				0.03			0.33
Non-Hispanic White	165	3,949	3.8 (3.2–4.4)		4.4 (3.7–5.2)	1	
Non-Hispanic Black	52	1,454	3.4 (2.2–4.6)		5.4 (3.6–7.1)	1.21	
Hispanic	38	1,476	2.2 (1.3–3.1)		3.4 (1.8–5.1)	0.78	
Marital status				<0.001			0.75
Married	144	2,847	4.7 (3.8–5.5)		4.6 (3.7–5.6)	1	
Single	59	2,868	1.7 (1.1–2.3)		3.6 (1.9–5.3)	0.78	
Cohabit	29	662	4.4 (2.4–6.5)		4.7 (2.6–6.8)	1.01	
Divorced/separated/widowed	33	866	3.2 (1.8–4.5)		4.9 (2.0–7.7)	1.05	
Education				0.02			0.004
<High school	49	1,689	2.8 (1.6–4.0)		5.7 (3.3–8.0)	1	
High school	60	1,555	3.3 (2.2–4.3)		3.7 (2.5–4.9)	0.65	
1–3 years college	72	2,251	2.7 (2.1–3.3)		3.1 (2.3–3.9)	0.55	
4+ years college	84	1,748	5.0 (3.8–6.2)		6.1 (4.4–7.7)	1.07	
Household income				<0.001			0.02
≤$24,999	81	2,452	3.0 (2.0–4.0)		4.1 (2.8–5.4)	1	
$25,000–$49,999	58	1,992	2.5 (1.8–3.1)		3.1 (2.3–4.0)	0.77	
$50,000–$74,999	51	1,124	4.3 (2.8–5.7)		4.9 (3.4–6.5)	1.2	

Characteristics	Univariate analysis				Multivariate analysis		
	Numerator, unweighted	Denominator, unweighted	Prevalence % (95 % CI), weighted	*P* value**	Predictive marginals % (95 % CI)	Prevalence ratio*	*P* value^
≥$75,000	67	1,070	6.1 (4.6–7.6)		6.2 (4.5–7.8)	1.51	
General health				0.35			0.04
Excellent	75	2,103	3.7 (2.7–4.6)		5.4 (4.2–6.7)	1	
Very good	111	2,843	3.6 (2.9–4.3)		4.6 (3.7–5.5)	0.84	
Good	62	1,710	3.3 (2.2–4.3)		3.8 (2.6–5.1)	0.71	
Fair or poor	17	569	2.2 (0.9–3.6)		2.1 (0.7–3.4)	**0.38**	
Sex partners in last 12 months				0.84			0.66
1	214	4,977	4.1 (3.6–4.7)		4.4 (3.8–5.0)	1	
≥2	40	820	4.0 (2.5–5.4)		4.8 (2.7–6.9)	1.1	
Age at first intercourse				0.01			0.007
≥20	27	1,193	2.2 (1.2–3.2)		2.0 (1.1–2.9)	1	
18–19	56	1,287	4.2 (3.0–5.4)		4.8 (3.4–6.3)	**2.38**	
15–17	137	2,964	4.4 (3.5–5.2)		5.2 (4.1–6.4)	**2.59**	
≤14	44	932	4.3 (2.7–5.9)		4.9 (3.1–6.6)	**2.4**	
Number of live births				<0.001			0.004
0	112	3,102	3.2 (2.6–3.8)		4.4 (3.3–5.5)	1	
1	83	1,374	6.1 (4.6–7.7)		6.4 (4.9–7.9)	1.46	
≥2	70	2,767	2.5 (1.8–3.3)		3.4 (2.3–4.6)	0.79	
Intending pregnancy				<0.001			<0.001
No	167	6,947	2.3 (1.8–2.7)		2.9 (2.3–3.5)	1	
Yes	97	289	33.7 (27.1–40.2)		34.9 (27.1–42.8)	**12.02**	
Ever been forced to have sex				0.88			0.49
No	206	5,350	3.8 (3.2–4.4)		4.5 (3.8–5.2)	1	
Yes	55	1,194	3.7 (2.7–4.7)		4.0 (2.9–5.2)	0.89	
Smoking status last 12 months				<0.001			<0.001
Nonsmoker	104	4,521	2.3 (1.7–2.9)		3.3 (2.5–4.1)	1	
Former smoker	27	600	3.7 (2.2–5.3)		3.5 (2.1–4.9)	1.06	
Current smoker	134	2,096	5.8 (4.8–6.7)		6.8 (5.6–8.1)	**2.06**	
Marijuana use last 12 months				0.001			0.02

Characteristics	Univariate analysis				Multivariate analysis		
	Numerator, unweighted	Denominator, unweighted	Prevalence % (95 % CI), weighted	*P* value**	Predictive marginals % (95 % CI)	Prevalence ratio*	*P* value^
No	195	6,022	3.1 (2.6–3.7)		4.1 (3.4–4.8)	1	
Yes	69	1,193	5.0 (4.0–5.9)		5.9 (4.4–7.4)	**1.44**	

*Significant ($P < 0.05$) pairwise associations with the referent category in bold

**Wald Chi square test

^Satterthwaite adjusted Chi squared tests