

Research Article

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## Higher Marijuana use among Young Adults Persists Even during Pregnancy

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### Abstract

**Background:** Marijuana is linked to adverse pregnancy health effects, yet limited data exist regarding demographic and regional differences in marijuana use during pregnancy.

**Objective:** To determine the prevalence of prenatal marijuana use among reproductive-age women and assess regional and age-related differences.

**Methods:** This study secondarily analyzed cross-sectional, population-based Pregnancy Risk Assessment Monitoring System data from states querying about marijuana use. It included 10,350 women with live births in 2009–2011. Primary outcome was “any use of marijuana” during pregnancy. Logistic regression analysis examined associations between marijuana use, age, and other socio demographic characteristics.

**Results:** In all states, marijuana use during pregnancy was more likely in adolescent and young adults (AYA; <25 years) than older mothers: Alaska, prevalence rate ratio (PRR), 2.07 (95% confidence interval [CI], 1.5–2.6); Hawaii, PRR, 1.55 (95% CI, 1.2–1.9); Vermont, PRR, 2.44 (95% CI, 1.9–2.9). Regression analyses, controlling for other demographic characteristics, showed that age <25 was associated with higher odds of marijuana use in Alaska (adjusted odds ratio [aOR], 2.24 [95% CI, 1.9–2.5]) and Vermont (aOR, 1.74 [95% CI, 1.5–1.9]). Smoking cigarettes during pregnancy was associated with higher odds of concomitant marijuana use in Alaska (aOR, (P<0.05)) and Vermont (aOR, 1.2 (P<0.05)).

**Conclusions:** AYA reported higher marijuana use rates during pregnancy than older women. Cigarette use during pregnancy was associated with marijuana use. Additional research, examining national marijuana use patterns and maternal and child health outcomes in the context of evolving marijuana policies, is warranted.

### Background

The most commonly used illicit drug among women of reproductive age in the United States is marijuana, with one in ten reproductive-aged women reporting lifetime use [1]. Rates of use among adolescents and young adults (AYA) are even higher [2]. Data from the National Survey of Drug Use and Health indicate

that 14.8% of women of reproductive age, and 5.4% of pregnant women, between the ages of 18 and 44 years, reported marijuana use within the past month in 2019, compared with 2.37% in 2002 [3]. One motivator for marijuana use during pregnancy is its antinausea effects [4].

Marijuana during pregnancy has been found to negatively impact gestational growth, contribute to anemia in the infant, increase neonatal intensive care admissions, and possibly alter the normal trajectories of fetal development [4–6]. More recent data also suggest that marijuana use during pregnancy may lead to genetic mutations linked to serious medical conditions, such as fetal malformations and the induction of cancer, and subsequent inheritance of these mutations transmits the conditions to future generations [7, 8]. In addition, marijuana use during pregnancy has been associated with continued use after the pregnancy, which may potentially undermine effective parenting behavior through its impact on parental decision-making and judgment [9].

National data indicate that nearly one third of AYA have used marijuana in their lifetime [2]. Despite recent declines in unplanned pregnancies, rates remain disproportionately higher among AYA 15-19 years (75% of pregnancies) [10, 11]. The combination of unplanned pregnancies and marijuana use may make AYA especially vulnerable to potential adverse outcomes associated with marijuana exposure during pregnancy [4].

While prenatal alcohol, tobacco, and cocaine exposure have been widely studied, fewer studies have examined the extent of marijuana use among women during pregnancy [12]. Surveillance data, regarding the prevalence of marijuana use, are not consistently collected, and such data have significant implications for pregnant women. Prevalence data, regarding marijuana use, are often collected from substance abuse registries and among women with documented use of alcohol and cigarettes [3]. These data suggest that marijuana use in pregnancy is highly correlated with tobacco (cigarette) use. Furthermore, much of this small body of work was conducted before the shifting regulatory climate favoring marijuana use in the United States, which began with the legalization of marijuana for medical use in the late 1990s and continued with the legalization of marijuana for recreational use in many states and jurisdictions [13].

Given the relatively high rate of marijuana use among AYA, their disproportionate risk for unplanned pregnancies [10], and evidence of potential adverse outcomes with exposure to marijuana during pregnancy [5, 9], it is of substantial clinical and public health importance to understand the prevalence of marijuana use among pregnant AYA. Our study aims to describe the prevalence of prenatal marijuana use among women of reproductive age, compare rates of use across states, and determine the relationship between prenatal cigarette and marijuana use. Based on current general use patterns, we hypothesize that 1) AYA mothers (age <25 years) are more likely to use marijuana during pregnancy than older mothers, and 2) AYA mothers who report using cigarettes during pregnancy are also more likely to report marijuana use during pregnancy.

## Methods

### Participants

We utilized data from the Pregnancy Risk Assessment Monitoring System (PRAMS) dataset, collected from 2009 to 2011. PRAMS is a cross-sectional survey designed to collect state-specific, population-based data regarding maternal characteristics and behaviors before pregnancy, during pregnancy, and during the early postpartum period. The sampling methodology for PRAMS has been previously described and is briefly described here [14]. In each state, between 100 to 250 new mothers are sampled each month using stratified, random sampling of all resident birth certificates. Sampled mothers are mailed a self-administered questionnaire 2 to 6 months after delivery of a live-born infant. Repeat mailings or telephone interviews are conducted for initial non-responses. State-specific response rates for the survey range from 65% to 80%. Data from individual questionnaires are combined with birth certificate data and weighted to adjust for selection probability, non-response, and non-coverage of the sampling frame. The resulting state-specific databases are representative of each state's entire population of women delivering a live infant.

We examined birth data between 2009 and 2011 in the three participating states that collected data regarding marijuana use and had response rates of >70%: Alaska, Hawaii, and Vermont. Tennessee also collected data regarding marijuana but did not meet the PRAMS 70% response rate threshold for release of data.

### Measures

Our primary outcome variable, *marijuana use*, was defined by the mother's self-report of "any use of marijuana" during the most recent pregnancy. Our primary explanatory variable, *age at time of pregnancy*, was dichotomized as <25 years old (n=3208) or ≥25 years old (n=7142) (Table 1). Other independent variables included cigarette use, which was defined by the mother's self-report of "any use while pregnant." Demographic covariates, included in the analyses, were race (White, Black, Asian, American Indian, Hawaiian, or Alaskan Native), parity (number of pregnancies resulting in live births), and socioeconomic status. Vermont did not report data regarding race; however, 2014 census data for the state indicated that the population was 95% White.<sup>16</sup> Because income was inconsistently reported, the type of medical insurance during pregnancy was used as a proxy for socioeconomic status. Lower socioeconomic status was defined as having public or no insurance, and higher socioeconomic status was defined as having private insurance.

## Statistical Analysis

Descriptive statistics were used to calculate the prevalence rate (PR) of marijuana use during pregnancy and the prevalence rate ratios (PRRs) of marijuana use between age groups. The analytic strategy consisted of 1) descriptive analysis, 2) multivariable logistic regression analysis to evaluate independent associations between covariates and marijuana use, and 3) weighted analysis to account for the complex sampling strategy of PRAMS. A weighting variable was used to account for the complicated survey design, including non-response units. Data were analyzed using STATA 13.1 (2013; College Station, TX). The Johns Hopkins Institutional Review Board and the Centers for Disease Control and Prevention PRAMS Working Group approved this study.

## Results

### Participant Characteristics

Our final analytic sample included 10,350 women with live births, between 2009 and 2011, in Alaska, Hawaii, and Vermont. AYA women constituted approximately 1/3 of the total sample in each state: Alaska, 37.3%; Hawaii, 30.6%; and Vermont, 26.9%. The racial distribution of the sample population varied from state to state, with White being the most common racial subgroup in the two states that collected data on race. Approximately 40% of the population was primigravidas (reporting use during their first pregnancy resulting in a live birth) in all three states. Socioeconomic status varied from state to state (Table 1).

**Table 1:** Demographics of Study Population

	Alaska (% N=2,388)	Hawaii (% N=4,735)	Vermont (% N=3,226)
Maternal Age			
Less than 25	37.3 (890)	30.6 (1449)	26.9 (868)
Greater than 25	62.7 (1497)	69.4 (3286)	73.1 (2358)
Maternal Race			
White	49.1 (1173)	24.4 (1155)	--
Black	3.4 (81)	1.7 (82)	--
Asian	6.4 (153)	40 (1894)	--
American Indian	0.9 (22)	1.5 (72)	--
Hawaiian	0.2 (4)	32.1 (1521)	--
Alaskan Native	34.9 (833)	--	--
Other- Nonwhite	5.1(122)	0.12 (11)	--
Insurance			
Medicaid or no insurance	36.8 (879)	7.9 (374)	41.3 (1332)
Private Insurance	63.2 (1509)	92.1 (4361)	58.7 (1894)
Parity			
1	39.6 (946)	42.5 (2012)	47.4 (1529)
2+	60.4 (1442)	57.5 (2723)	52.6 (1697)

**Table 2:** Prevalence of marijuana use and cigarette use during pregnancy stratified by age group and state

	Alaska (N=2,388)			Hawaii (N=4,735)			Vermont (N=3,226)		
	Total (N=2388)	< 25 (N=896)	≥ 25 (N=1492)	Total (N=4735)	<25 (N=1449)	≥25 (N=3286)	Total (N=3226)	<25 (N=868)	≥25 (N=2358)
Marijuana (%)	7.2 [6.2,8.2]	10.2 [8.2, 12.1]	4.9 [3.8, 6.0]	3.5 [2.9, 4.0]	4.6 [3.5, 5.7]	3.0 [2.4, 3.6]	5.8 [4.9, 6.6]	10.0 [8.0, 12.0]	4.0 [3.2, 4.8]
Cigarettes (%)	17.6 [16.1, 19.1]	23.5 [20.7, 26.2]	16.4 [14.5, 18.3]	4.3 [3.7, 4.9]	6.4 [5.1, 7.7]	3.4 [2.8, 4.0]	17.5 [16.1, 18.8]	32.2 [29.1, 35.3]	13.7 [12.3, 15.1]

### Prevalence of Marijuana Use

The overall prevalence of marijuana use in pregnancy in our sample was 4.8%. However, the prevalence varied by state: 7.2% for Alaska, 3.5% for Hawaii, and 5.8% for Vermont.

#### Differences by Age

Marijuana use was higher among pregnant AYA than among women ≥25 years in all three states: *Alaska*, 10.2% versus 4.9%; *Hawaii*, 4.6% versus 3.0%; and *Vermont*, 10.0% versus 4.0%. In unadjusted regression analysis, the odds of marijuana use during pregnancy were higher among AYA compared with older mothers across each state: *Alaska*, PRR, 2.1 (95% confidence [CI], 1.5–2.6); *Hawaii*, PRR, 1.6 (95% CI, 1.2–1.9); and *Vermont*, PRR, 2.4 (95% CI, 1.9–3.0).

Because of demographic variations between the states, state-stratified analyses were performed. After controlling for other demographic characteristics in multivariable logistic regression, the association between age and marijuana use varied by state (Table 3). The results of these analyses for two states supported our hypothesis that AYA mothers have a higher odd of using marijuana in pregnancy compared to mothers' ≥25 years old. After controlling for race, socioeconomic status, parity, and cigarette use, the *adjusted* odds ratio (*aOR*) for Alaska was 2.2 (95% CI, 1.6–2.8), and the *aOR* for Vermont was 1.7 (95% CI, 1.3–2.20). In Hawaii, however, the difference between marijuana use during pregnancy among AYA, versus mothers' ≥25 years, was not statistically significant after controlling for covariates: *aOR*, 0.9 (95% CI, 0.6–1.2).

#### Differences by Cigarette Use

Overall, the prevalence of cigarette use in pregnancy in our sample was 11.4%; the prevalence was 17.6% for Alaska, 4.3% for Hawaii, and 17.5% for Vermont. Smoking cigarettes during pregnancy was associated with higher odds of marijuana use in Alaska and Vermont after controlling for age, race, socioeconomic status, and parity: *Alaska*, *aOR*, 1.3 ( $p < .05$ ); and *Vermont*, *aOR*, 1.2 ( $p < .05$ ). In Hawaii, however, smoking during pregnancy was not significantly

associated with concomitant marijuana use, after controlling for covariates: *aOR*, 1.8 ( $p > .05$ ). We also conducted a stratified analysis by age to examine whether there was a potential interaction between age and cigarette use. The results did not suggest that the relationship between cigarette use and marijuana use was modified by age in any of the three states.

#### Differences by Socioeconomic Status

Across all three states, women with a lower socioeconomic status were more likely to use marijuana during pregnancy than those with a higher socioeconomic status, after controlling for age, race, parity, and cigarette use: *Alaska*, *aOR*, 2.38 ( $p < 0.05$ ); *Hawaii*, *aOR*, 2.63 ( $p < 0.05$ ); and *Vermont*, *aOR*, 2.64 ( $p < 0.05$ ).

### Discussion

Five percent of women in our study population used marijuana during pregnancy, which is somewhat lower than the 8.3% of the United States general population that reported marijuana use in the last month [15]. While representing a small percentage of pregnancies in the PRAMS sample, a higher proportion of AYA mothers reported using marijuana during pregnancy compared with older mothers. These results are consistent with the results of previous studies examining the distribution of cannabis use across ages [3] and add to that work by demonstrating that age disparity persists among racial subgroups not previously examined, including Asian and Hawaiian Americans. Whereas the rate of marijuana use was slightly lower among pregnant women than in all women, the data indicate possible *in utero* exposure to cigarettes in almost 1200 babies and concurrent marijuana exposure in almost 500. This is particularly salient, considering the changing climate of the perceived risks of marijuana in the setting of legalization [13, 15], which may lead to continuing increases in marijuana use among pregnant women concurrent with trends observed in the general population.

Our work also provides information regarding marijuana use in mothers of Asian American and Hawaiian American descent,

which have not been heretofore examined in detail. Native Hawaiians experience the highest reported rate of unintended pregnancies of any ethnic group in Hawaii [16]. Prior research suggests that women of Hawaiian ancestry continue to smoke and use illicit drugs during pregnancy at higher rates compared with women who are not of Hawaiian descent [17, 18]. Our results, however, show both lower tobacco and marijuana use during pregnancy in the Native Hawaiian population. Cultural norms and practical factors related to healthcare utilization may contribute to lower use of these substances during pregnancy for AYA within this group, thereby affording

**Table 3:** Associated variables of marijuana use during pregnancy

Explanatory variables	Alaska		Hawaii		Vermont	
	Odds Ratio	CI	Odds Ratio	CI	Odds Ratio	CI
<b>Age</b>						
<25 years old <sup>t</sup>	2.2*	1.6, 2.8	0.88	.6, 1.2	1.7*	1.3, 2.2
≥ 25 years old <sup>t</sup>	1 [reference]		1 [reference]		1 [reference]	
<b>Maternal race</b>			1 [reference]		1 [reference]	
White						
Black	0.5	0.2, 0.8	1.4	1.1, 1.7	--	--
Asian	0.3*	0.1, 0.5	0.4*	0.2, 0.6	--	--
Am. Indian	1.8	1.3, 2.3	3.1	2.6, 3.6	--	--
Hawaiian	--	--	.99	0.7, 1.3	--	--
Alaskan Native	0.8	0.4, 1.2	--	--	--	--
Other	--	--	1.2	0.9, 1.5	--	--
<b>SES: Health Insurance</b>						
Private Insurance	1 [reference]		1 [reference]		1 [reference]	
Public Insurance <sup>#</sup>	2.4*	1.8, 3.0	2.6*	2.2, 3.1	2.6*	2.1, 3.2
<b>Parity</b> (Reference group: no prior live births)						
No live births	1 [reference]		1 [reference]		1 [reference]	
1+	.96	0.6, 1.4	.49*	0.3, 0.7	.89	0.6, 1.2
<b>Cigarettes</b>						
Did not smoke	1 [reference]		1 [reference]		1 [reference]	
Smokes	1.3*	1.1, 1.8	1.8	1.4, 2.2	1.2*	1.1, 1.6

\* indicates p value <0.05. <sup>t</sup> logit regression; <sup>#</sup> Medicaid or no insurance; Adjusted odds ratio (aOR) and p values from logistic and logit regression models examining association between demographic characteristics with marijuana use during pregnancy adjusting for woman's age, race, income and parity.

potential protective advantages.

Lower socioeconomic status was identified as an independent risk factor for marijuana use during pregnancy within all three states. Our data cannot explain this relationship; however, one may postulate that the impact of poverty on reproductive decision-making may stem from factors in the social ecology of pregnancy in lower income women [19, 20].

Our results are also consistent with prior research demonstrating that women who smoke cigarettes during pregnancy are more likely to also use marijuana, when compared with non-smokers [18, 21]. This underscores the importance of screening all pregnant cigarette users for marijuana use. Guidelines for prenatal risk assessment, issued by the American College of Obstetricians and Gynecologists, American Academy of Family Physicians, and the American Medical Association, endorse universal screening of all pregnant women for substance use. However, universal screening is often not performed, and the two commonly used screening questionnaires only ask about alcohol and cigarette use [22]. Updated clinical practice guidelines for substance use screening during pregnancy and additional protections for vulnerable populations during pregnancy should be established to support patients and ensure accurate reporting of substance use.

The findings from this study must be considered in light of several general limitations. The study has limited generalizability, as most (83%) of the 47 states that participate in PRAMS do not ask about marijuana use during pregnancy [23, 24]. We were able to obtain data from only three states that queried about marijuana use and had >70% response rates. Data regarding race or ethnicity distribution were not collected in all states, and the available data were not generalizable to the United States population based on census data [25]. The study also utilized secondary data analyses with self-reported past-use measures of marijuana use during pregnancy by women in the post-partum period. The survey items did not allow determination of the frequency or timing of marijuana use during pregnancy. Additionally, the cross-sectional nature of the data allowed for the examination of associations but did not enable us to draw inferences about causality. Despite these limitations, PRAMS is the premier source of surveillance data for birth outcomes and behaviors in the country, and ours is the first study to examine marijuana use during pregnancy using this resource. We were also able to demonstrate regional differences in use among AYA women.

At the time these data were collected, none of the three states had legalized marijuana [15]. Since then, Alaska has legalized recreational marijuana [26], and medical marijuana is now legal in Alaska, Hawaii, and Vermont [12]. Legalization has occurred without enhanced data collection strategies to examine health effects. Given the variability of results across states and geographic regions, and in light of only a few states participating in PRAMS-

related queries about marijuana use, this study highlights the need for further research to more thoroughly understand the national prevalence and implications of marijuana use during pregnancy, especially in AYA.

## Conclusion

Overall, approximately 5% of mothers reported marijuana use during pregnancy, and marijuana use was associated with concurrent cigarette use. Whereas AYA constitute a small percentage of pregnancies compared to older women, AYA are more likely to use marijuana during pregnancy. Expanded epidemiological data collection is necessary to obtain information about marijuana use among all pregnant women in the United States and to explore substance use prevention strategies for this vulnerable population, especially in light of recent liberalization of marijuana policies and increased use in the general population.

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## Roles

Study design and conceptualization: Priya Sarin Gupta, Pamela Matson, Krishna Upadhy, Maria Trent

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## Conflict of interest statement

The authors have no conflicts of interest.

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