

Use of Cannabis Protective Behavioral Strategies During Pregnancy

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ABSTRACT

Objective: Prenatal cannabis use is increasing in prevalence and associated with potential harm to maternal-fetal health. Pregnant individuals who use cannabis seek information about prenatal cannabis use informally (e.g., online) and adopt practices perceived to reduce harm. However, no evidence-based harm reduction interventions address prenatal cannabis use. Cannabis protective behavioral strategies (PBS) are associated with less cannabis use and fewer cannabis-related negative consequences among non-pregnant populations. There is a lack of research exploring PBS during pregnancy. **Method:** This study combined two samples of pregnant individuals who use cannabis ($N = 48$; $M_{age} = 30.33$; 2% American Indian or Alaska Native, 2% Asian, 19% Black, 15% multiracial, 58% White). Participants completed the Protective Behavioral Strategies for Marijuana scale (PBSM; Pedersen et al., 2017), adapted for pregnancy, and an open-ended question about prenatal PBS. We examined relationships between prenatal cannabis use, PBS, consequences, and perceived harm of prenatal cannabis use. **Results:** Participants reported using PBS ($M = 4.07$, $SD = 0.93$) and experiencing consequences in the past 30 days ($M = 3.77$, $SD = 3.30$). Higher perceived harm of cannabis to fetal health ($B = 0.02$, $p = .010$) and use in later trimesters (second: $B = 0.69$, $p = .011$; third: $B = 0.82$, $p = .013$) were positively associated with PBS. PBS was associated with lower weekly (IRR = 0.79, 95% CI [0.69, 0.90], $p < .001$) and daily prenatal cannabis use frequency (IRR = 0.41, 95% CI [0.33, 0.51], $p = .001$) but was not significantly associated with consequences. Open-ended responses revealed pregnancy-specific practices perceived to reduce harm (e.g., "I had a date set to quit and slowly decreased the amount I was smoking"). **Conclusions:** Results underscore the need for harm reduction research and validation of PBS and consequence measures for prenatal cannabis use to support informed decision-making among pregnant individuals who use cannabis.

Key words: = cannabis; pregnancy; protective behavioral strategies; prenatal cannabis use; harm reduction

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Rates of prenatal cannabis use have increased over time (Alshaarawy & Vanderziel, 2022; Volkow et al., 2019) and are associated with risks to fetal and maternal health (Lo et al., 2024; Young-Wolff et al., 2024). Prenatal cannabis use is most common during the first trimester of pregnancy, even after knowledge of pregnancy, and declines later in pregnancy (Brik et al., 2024; Odom et al., 2020; Volkow et al., 2019). This decline might reflect the use of cannabis for managing symptoms during early pregnancy (e.g., nausea; Greyson et al., 2021; Gunn et al., 2024) and growing concern about potential risks (e.g., adverse maternal-fetal health outcomes, legal consequences; Lo et al., 2024; Skelton et al., 2022; Young-Wolff et al., 2024) as pregnancy progresses (Brik et al., 2024). Pregnancy is a period of heightened attention to health-promoting and harm-reducing behaviors (e.g., lifestyle changes; Davis & Narayan, 2020; Herzog-Petropaki et al., 2022), making it a unique context for examining how individuals attempt to reduce negative consequences associated with prenatal cannabis use.

Prenatal cannabis use is associated with various negative consequences. Some studies link prenatal cannabis use to adverse fetal and neonatal outcomes (e.g., preterm birth, perinatal mortality, small-for-gestational age; Lo et al., 2024) and maternal outcomes (e.g., gestational hypertension, preeclampsia, placenta abruption; Young-Wolff et al., 2024), with some risks (e.g., perinatal mortality) showing stronger associations with more frequent cannabis use (Lo et al., 2024). Beyond health outcomes, individuals may face psychosocial consequences, such as fear of judgment from others and stigma associated with prenatal cannabis use (Howe et al., 2025).

Many individuals who use cannabis during pregnancy believe it poses minimal risk of harm (Odom et al., 2020; Volkow et al., 2019). Some report cannabis as helpful for alleviating nausea, reducing stress, and managing pain (Boerner et al., 2024; Brown et al., 2023; Gunn et al., 2024; Volkow et al., 2019). Others express uncertainty that prenatal cannabis use has negative consequences (Volkow et al., 2019). This uncertainty is compounded by limited dissemination of evidence-based harm reduction resources for prenatal cannabis use and by healthcare professionals often lacking guidance on how to discuss both harm reduction and

cannabis use during pregnancy (Dominguez-Cancino et al., 2025). In the absence of formal guidance beyond encouraging abstinence, many pregnant individuals turn to informal sources of information such as online forums and peers (Greyson et al., 2021; Gunn et al., 2024; Micalizzi et al., 2024; Skelton et al., 2022). Seeking out these sources may reflect intentions to learn about prenatal cannabis use and harm reduction, yet such sources likely lack evidence-based information and may emphasize benefits while minimizing risks. There is a need to better understand if and how individuals practice harm reduction (such as via protective behavioral strategies [PBS]) when using cannabis during pregnancy, as well as how best to support them.

PBS for cannabis are specific behaviors (e.g., setting limits on the quantity or frequency of cannabis use) intended to reduce cannabis misuse and cannabis-related harm (Pedersen et al., 2017). In non-pregnant populations, such as college students and Veterans, more frequent use of PBS is associated with less frequent cannabis use, fewer cannabis-related negative consequences (Bolts et al., 2023; Bravo et al., 2017, 2019; Pearson et al., 2019; Pedersen et al., 2017, 2018), and higher perceived risk of harm associated with cannabis use (Bolts et al., 2023). Social behavior theories (e.g., Hochbaum, 1958; Rosenstock, 1974; Rosenstock et al., 1988) suggest that perceived benefits and risks influence intentions to engage in, and actual engagement with, health behaviors. Thus, individuals who perceive greater harm of prenatal cannabis use may be more likely to engage in harm-reducing behaviors (e.g., PBS), whereas those who perceive greater benefit than harm might continue using cannabis with fewer protective strategies. Although PBS use is frequently studied in non-pregnant populations, there is a lack of research examining whether pregnant individuals use these strategies and if pregnancy-specific adaptations to PBS exist.

The present study addresses gaps in the literature by examining cannabis PBS among pregnant individuals who use cannabis. We tested associations between PBS use and prenatal cannabis use frequency, cannabis-related negative consequences, and perceived harm of prenatal cannabis use. Based on prior work with non-pregnant populations (e.g., Pedersen et al., 2017, 2018), we hypothesized that higher PBS use

frequency would be associated with lower prenatal cannabis use frequency, fewer negative consequences, and higher perceived harm. We also explored open-ended responses to identify pregnancy-specific practices perceived to reduce harm. This study extends the PBS literature to prenatal cannabis use and provides insights into if and how pregnant individuals attempt to modify their cannabis use and mitigate related risk.

METHODS

Study Overview

Data were collected between August 2023 and September 2024 from baseline assessments of two IRB-approved studies: a remote national survey (Study 1) and a longitudinal multimethod study (laboratory and ecological momentary assessment [EMA]; Study 2; Micalizzi et al., 2025). Participants were pregnant individuals who reported cannabis use since learning of pregnancy (Study 1) or current cannabis use (Study 2). All participants provided informed consent and received monetary compensation for participating.

Study 1: Remote National Survey Study

Recruitment and procedure. Participants ($N = 28$) were recruited via targeted social media advertisements. Interested individuals completed an online screener survey to determine eligibility. Those who were initially eligible via the online screener were followed up via telephone to confirm eligibility and scheduled for a single remote session where they confirmed identity via government ID and completed informed consent and brief study interviews before being sent a link to complete the survey. Pregnancy was self-reported. Eligibility criteria included: a) over 18 years of age; b) living in the United States; c) currently pregnant; d) reporting use of cannabis since learning about pregnancy; and e) reporting use of cannabis products with THC (i.e., not exclusive CBD-only use).

Study 2: Longitudinal Multimethod Study

Recruitment and procedure. Participants ($N = 20$) were recruited via social media, community flyers, and BuildClinical (BuildClinical, 2024). Initially eligible participants screened online were

followed up via telephone to confirm initial eligibility and scheduled for an in-person baseline laboratory session. At the baseline session, potentially eligible participants provided informed consent and completed eligibility verification procedures, including a pregnancy test, urine drug screen, and mental health screening interview. Eligibility criteria included: a) age 18 years or older; b) English-speaking; c) average past 60-day cannabis use of 2 times or more per week; d) pregnant with one child and 28 weeks or less gestational age; e) not in substance use treatment; f) no past-month mania, psychosis, or suicidal ideation; g) no substance use other than cannabis, tobacco, or alcohol; and h) own a smartphone (for the EMA phase). Full protocol details for Study 2 are available in Micalizzi et al. (2025).

Combined Analytic Sample

The analytic sample ($N = 48$) consisted of participants from both studies who completed baseline assessments. Participants were on average 30.3 years old ($SD = 5.3$). All participants identified as female, and 48% were in the second trimester of pregnancy. Seventeen percent of participants identified as Hispanic, Latino/a/x, or of Spanish origin, and 58% identified as White. Demographic characteristics by study are reported in Table 1.

Measures

Cannabis use. Because participants were recruited in any trimester of pregnancy, and patterns of use tend to vary across trimesters (Brik et al., 2024; Odom et al., 2020; Volkow et al., 2019), we queried cannabis use during all relevant trimesters (i.e., current and past, if relevant). For purposes of the present analysis, cannabis use variables reflect use during the trimester participants were in when they completed the baseline assessment.

Cannabis use weekly frequency during pregnancy was assessed by asking participants “How often do/did you use cannabis on average?” with response options 0 (0 times) to 8 (6–7 days per week). Cannabis use daily frequency (i.e., times used per day) during pregnancy was assessed by asking “How many times per day on average do/did you typically use cannabis?” with

an open numeric response. Higher scores indicate more frequent weekly cannabis use and more times used per day, respectively. Participants also reported the number of days per week they used cannabis by method (e.g., joint, bong) and whether they used the same, less, or more cannabis compared to pre-pregnancy.

Cannabis consequences. Negative consequences of cannabis use were measured using the 21-item Brief Marijuana Consequences Questionnaire (BMACQ; Simons et al., 2012). Participants indicated whether each item (e.g., “I have driven a car when I was high”) describes something they have experienced during pregnancy (0 = no, 1 = yes). BMACQ responses were summed for a total consequence score. Higher scores indicate more consequences experienced.

Perceived harm. Perceived harm was assessed by asking participants how harmful they believed cannabis use during pregnancy is to their health and to fetal health, using a visual analogue scale ranging from 0 (not at all harmful) to 100 (very harmful) for both questions. Higher scores indicate greater perceived risk of harm from using cannabis during pregnancy.

Protective behavioral strategies (PBS). PBS use frequency was measured using the 17-item Protective Behavioral Strategies for Marijuana Scale (PBSM-17; Pedersen et al., 2017), adapted for pregnancy in both studies. The question stem was edited to specify “during pregnancy.” Participants rated each item (e.g., “use only among trusted peers”) from 1 (never) to 6 (always) for how often they engage in the behavior when using cannabis during pregnancy. PBSM responses were averaged for a mean PBSM score. Higher scores indicate more frequent PBS use during pregnancy. Additionally, participants responded to an open-ended question: “What other things do you do to help you avoid some of the not so good things about using cannabis while you are pregnant?”

Data Analysis

Analyses were conducted using R version 4.4.2 (R Core Team, 2025). Descriptive statistics were calculated to characterize cannabis use and study variables, including weekly cannabis use, daily cannabis use, consequences, perceived harm to self and fetus, and PBS frequency. We reported

methods of cannabis use given the limited literature. Pearson correlations were used to examine associations among study variables. To further explore PBS use, we calculated means and standard deviations for PBSM items and reviewed open-ended responses.

Regression analyses were used to evaluate the relations between study variables. All models included pregnancy trimester as a covariate. In models examining cannabis use frequency, PBS frequency was the independent variable and weekly and daily cannabis use were the dependent variables. In the model examining cannabis consequences, PBS frequency was the independent variable, and total consequence score was the dependent variable. Cannabis use frequency variables were included as additional covariates to examine the PBS-consequence association above and beyond cannabis use. In models examining PBS frequency, perceived harm scores were the independent variables, and PBS frequency was the dependent variable. With 2–3 predictors per model, the analytic sample provided over 15 observations per predictor variable, which is adequate for estimating regression models (Austin & Steyerberg, 2015; Jenkins & Quintana-Ascencio, 2020) and detecting medium to large effects.

Model selection was based on dispersion ratios, fit indices, and model diagnostics (Baggio et al., 2018; Fernandez & Vatcheva, 2022; Jenkins & Quintana-Ascencio, 2020). Cannabis use frequency variables were count-distributed, and there was no evidence of overdispersion or zero-inflation (e.g., the daily frequency variable contained 5.9% zeros). Thus, Poisson regressions were used for cannabis use frequency. Poisson regression with robust standard errors addressed heteroscedasticity in the daily use model. The cannabis consequences variable was count-distributed and overdispersed; thus, we used negative binomial regression. PBS frequency was treated as continuous and normally distributed. Ordinary least squares regressions examined the relationships between perceived harm and PBS frequency.

RESULTS

Descriptive Statistics

Table 2 presents descriptive statistics. Participants reported frequent cannabis use, with 44% using 6–7 days per week and on average 2.91 ($SD = 3.48$) times per day. Participants experienced few cannabis consequences ($M = 3.77$, $SD = 3.30$). Perceived harm to the fetus ($M = 23$, $SD = 30$) was higher than perceived harm to self ($M = 18$, $SD = 25$). Average PBS frequency was 4.07 ($SD = 0.93$), falling between 4 (sometimes) and 5 (usually).

Participants reported most frequently using cannabis via bong, using on average 1.81 ($SD = 2.75$) days per week. Most (68.75%) reported using multiple methods per week. The most frequently co-used methods were edibles and concentrates or joints and pipes. Since becoming pregnant, 60% of participants reported using less cannabis, 35% reported using the same amount, and 4.2% reported using more.

Correlations

Correlations are presented in Table 3. Higher PBS frequency was significantly associated with lower weekly cannabis frequency ($r = -.72$, $p < .01$), lower daily use ($r = -.72$, $p < .01$), and greater perceived harm to self ($r = .35$, $p < .05$) and the fetus ($r = .48$, $p < .01$). PBS frequency was not significantly associated with consequences ($r = -.01$, $p = .92$).

Protective Behavioral Strategies

PBSM item endorsement. Table 4 displays PBSM (Pedersen et al., 2017) item-level data. The most frequently endorsed strategies ($M > 5$) were “avoid mixing cannabis with other drugs,” “only purchase from a trusted source,” “avoid using in public places,” and “use only among trusted peers.” The least frequently endorsed strategies ($M \leq 3$) were “limit use to weekends” and “avoid using habitually.”

Open-ended responses. Participants described various strategies they perceived to reduce harm associated with using cannabis during pregnancy. Some referenced quantity and timing, such as “I use it in small amounts,” “I buy the amount I’d take at a time. I don’t buy too much,” and “I...avoid using cannabis before...exercising.” Others described using cannabis at specific times for symptom relief: “I...only smoke once a day in the morning to help my nausea” and “limit

[cannabis use] to bed time... unless I need it to eat.”

Participants also described strategies involving obtaining and using cannabis. Participants mentioned “only take edibles from dispensaries” and “I try not to smoke blunts...so I’m not also smoking a wrap.” Others shared preferences regarding method: “I vape or use a bowl to smoke rather than an edible” or “I vape to help avoid smell and judgement.” Another shared they were “trying to smoke less and exploring edibles and cbd more.” One referenced cannabis supplies: “I always use a filter...and...clean glass.” Another mentioned physiological cues: “...once I feel a slight high is usually what I use as my cut off.”

Participants described replacing cannabis with non-substance activities, including “walk, cook, paint,” “listen to music...spend time alone,” “surf the internet,” “stay busy with my kids,” “gym,” and “breathing exercises, walking, distractions like music, TV or art.” Others mentioned substituting cannabis with food or beverages: “I eat more and splurge on sweets such as cupcakes and chocolates” and “energy drinks.”

Participants described cannabis use goals. One shared they “have a date set in mind of when to quit and slowly decrease the amount I was smoking until I completely quit.” Another said, “my goal is once the nausea/appetite aversion stops I will cut back to hopefully no cannabis until after my pregnancy.” One participant mentioned “I have stopped using cannabis this week to be prepared more for birth...I don’t want it in my or their systems when born.”

Participants referenced strategies involving social or contextual factors. One mentioned “[I] share my intentions with my partner for support,” while another said “therapy.” Others described use or disclosure in specific contexts: “only talk about it with trusted friends and family and physicians” and “only use it at home...I did go to the dispensary pretty pregnant and felt very nervous of being judged.” One noted cannabis was “not available.”

Participants described using cannabis for perceived therapeutic purposes. One shared “I mainly smoke when I’m stressed or if I know I NEED to eat but don’t feel like it, as well as before I go to sleep because it helps with my RLS.” Others said, “I only use it to medicate” and “I only use to help alleviate insomnia, nausea, and aches

due to stretching ligaments/muscles.” One described using cannabis and non-substance coping skills: “I...use it for physical pain...I’ve cut down and am trying mindful ways of dealing with pain like meditation and progressive relaxation.” Another described spiritual use: “I use it as ceremony. I believe intention setting is everything.”

Some participants did not describe harm reduction efforts: *“nothing, it’s easy to avoid the not so good things while pregnant,” “I have hyperemesis gravidarum. I have to smoke to survive or I will constantly puke and not eat,” and “from experience weed is fine to use while pregnant so I use it the same amount I did before pregnancy.”*

Regression Models

Association between PBS frequency and cannabis frequency. Table 5 summarizes the regression results for all count models. Higher PBS frequency was associated with significantly lower weekly cannabis frequency (IRR = 0.79, 95% CI [0.69, 0.90], $p < .001$) and daily use (IRR = 0.41, 95% CI [0.33, 0.51], $p = .001$). Trimester was not significantly associated with cannabis frequency.

Association Between PBS Frequency and Cannabis Consequences

After controlling for weekly cannabis use, PBS frequency was not significantly associated with consequences (IRR = 0.80, 95% CI [0.57, 1.13], $p = .219$). However, weekly cannabis use was associated with fewer consequences (IRR = 0.84, 95% CI [0.70, 1.00], $p = .033$), and participants in the third trimester reported significantly fewer consequences than those in the first trimester (IRR = 0.33, 95% CI [0.15, 0.70], $p = .005$). Results were consistent when additionally controlling for daily cannabis use, in which PBS frequency remained non-significant (IRR = 0.87, 95% CI [0.50, 1.49], $p = .606$). The weekly-use model is reported in Table 5 due to more stable estimates (e.g., lower multicollinearity) than the model with both weekly and daily use.

Association Between Perceived Harm and PBS Frequency

Table 6 summarizes the regression results for linear models. In separate regressions, perceived harm to self ($B = 0.02$, $p = .002$, $R^2 = .29$) and to the fetus ($B = 0.02$, $p < .001$, $R^2 = .39$) were significantly associated with higher PBS frequency. When entered simultaneously, only perceived harm to the fetus remained significant ($B = 0.02$, $p = .010$, $R^2 = .40$). Trimester was significant in all models, such that participants in the second and third trimesters reported significantly higher PBS frequency than those in the first trimester.

Table 1. Participant Demographic Characteristics

Variable	Overall <i>N</i> = 48	Study 1 <i>N</i> = 28	Study 2 <i>N</i> = 20	<i>p</i>
	<i>M</i> (<i>SD</i>) or <i>n</i> (%)	<i>M</i> (<i>SD</i>) or <i>n</i> (%)	<i>M</i> (<i>SD</i>) or <i>n</i> (%)	
Age (years)	30.3 (5.3)	30.5 (5.6)	30.2 (5.0)	.84
Assigned sex (female)	48 (100%)	28 (100%)	20 (100%)	> .99
Hispanic, Latino/a/x, Spanish	8 (17%)	2 (7.1%)	6 (30%)	.05
Race				.53
American Indian or Alaska Native	1 (2.1%)	0 (0%)	1 (5.0%)	
Asian	1 (2.1%)	1 (3.6%)	0 (0%)	
Black or African American	9 (19%)	7 (25%)	2 (10%)	
Multiracial	7 (15%)	3 (11%)	4 (20%)	
Other	2 (4.2%)	1 (3.6%)	1 (5.0%)	
White	28 (58%)	16 (57%)	12 (60%)	
Highest education level				< .001
Grade 9	1 (2.1%)	0 (0%)	1 (5.0%)	
Grade 10	5 (10%)	0 (0%)	5 (25%)	
Grade 11	6 (13%)	0 (0%)	6 (30%)	
GED	9 (19%)	2 (7.1%)	7 (35%)	

Highschool diploma	5 (10%)	4 (14%)	1 (5.0%)	.16
Some college	6 (13%)	6 (21%)	0 (0%)	
Certificate	1 (2.1%)	1 (3.6%)	0 (0%)	
Associates	4 (8.3%)	4 (14%)	0 (0%)	
Bachelors	7 (15%)	7 (25%)	0 (0%)	
Masters	3 (6.3%)	3 (11%)	0 (0%)	
Doctorate	1 (2.1%)	1 (3.6%)	0 (0%)	
Pregnancy trimester				
First (weeks 0–13)	16 (33%)	12 (43%)	4 (20%)	
Second (weeks 14–27)	23 (48%)	13 (46%)	10 (50%)	
Third (week 28+)	9 (19%)	3 (11%)	6 (30%)	

Note. The overall sample is the analytic sample, which includes combined data from a national survey study (Study 1) and a longitudinal multimethod study (Study 2). The *p*-values represent comparisons between Study 1 and Study 2 using Welch's two sample *t*-test for continuous variables or Fisher's exact test for categorical variables.

Table 2. *Descriptive Statistics for Study Variables and Cannabis Use*

Variable	Overall <i>N</i> = 48 <i>M</i> (<i>SD</i>) or <i>n</i> (%)	Study 1 <i>N</i> = 28 <i>M</i> (<i>SD</i>) or <i>n</i> (%)	Study 2 <i>N</i> = 20 <i>M</i> (<i>SD</i>) or <i>n</i> (%)	<i>p</i>
Weekly cannabis use frequency	6.27 (2.08)	5.85 (2.32)	6.89 (1.53)	.08
0 (0 times)	1 (2.2%)	1 (3.7%)	0 (0%)	
1 (1 time or less per month)	0 (0%)	0 (0%)	0 (0%)	
2 (2–3 times per month)	1 (2.2%)	1 (3.7%)	0 (0%)	
3 (1 time per week)	2 (4.4%)	2 (7.4%)	0 (0%)	
4 (2 times per week)	8 (18%)	6 (22%)	2 (11%)	
5 (3 times per week)	4 (8.9%)	1 (3.7%)	3 (17%)	
6 (4 times per week)	1 (2.2%)	1 (3.7%)	0 (0%)	
7 (5 times per week)	8 (18%)	5 (19%)	3 (17%)	
8 (6–7 times per week)	20 (44%)	10 (37%)	10 (56%)	
Daily cannabis use (times/day)	2.91 (3.48)	3.19 (4.85)	2.67 (1.61)	.69
Consequences (BMACQ)	3.77 (3.30)	4.57 (3.85)	2.65 (1.90)	.03
Perceived harm to self	18 (25)	22 (29)	14 (18)	.25
Perceived harm to fetus	23 (30)	27 (35)	17 (21)	.25
PBS use frequency (PBSM)	4.07 (0.93)	4.09 (1.11)	4.05 (0.63)	.87
Cannabis use method (days/week)				
Blunt	1.07 (2.10)	0.81 (1.79)	1.50 (2.53)	.35
Bong	1.81 (2.75)	1.73 (2.72)	1.94 (2.89)	.82
CBD-only product	1.32 (2.55)	1.72 (2.88)	0.69 (1.85)	.17
Concentrate	1.36 (2.34)	0.62 (1.72)	2.44 (2.73)	.02
Edible	1.63 (2.51)	1.42 (2.61)	1.94 (2.38)	.51
Joint	1.67 (2.24)	2.08 (2.54)	1.00 (1.46)	.09
Pipe	1.00 (1.83)	0.92 (1.70)	1.11 (2.05)	.75
THC beverage	0.81 (1.95)	1.12 (2.37)	0.31 (0.79)	.12
Tincture	0.29 (1.01)	0.24 (1.01)	0.38 (1.02)	.68
Current use versus pre-pregnancy				.47
Same	17 (35%)	12 (43%)	5 (25%)	
Less	29 (60%)	15 (54%)	14 (70%)	
More	2 (4.2%)	1 (3.6%)	1 (5.0%)	

Note. The overall sample is the analytic sample, which includes combined data from a national survey study (Study 1) and a multimethod study (Study 2). Cannabis use method values represent the number of days per week participants reported using cannabis via the given method. PBS = protective behavioral strategies. BMACQ = Brief Marijuana Consequences Questionnaire (Simons et al., 2012). PBSM = Protective Behavioral Strategies for Marijuana Scale (Pedersen et al., 2017). The *p*-values represent comparisons between Study 1 and Study 2 using Welch's two sample *t*-test for continuous variables or Fisher's exact test for categorical variables.

Table 3. *Correlations with Confidence Intervals*

Variable	1	2	3	4	5
1. Weekly cannabis use frequency	—	—	—	—	—
2. Daily cannabis use	.43* [.11, .67]	—	—	—	—
3. Consequences (BMACQ)	-.13 [-.40, .17]	.14 [-.21, .46]	—	—	—
4. Perceived harm to self	-.38* [-.61, -.10]	-.24 [-.54, .10]	.59** [.37, .75]	—	—
5. Perceived harm to fetus	-.52** [-.71, -.27]	-.22 [-.52, .13]	.59** [.37, .75]	.87** [.78, .93]	—
6. PBS use frequency (PBSM)	-.72** [-.83, -.53]	-.72** [-.85, -.50]	-.01 [-.30, .27]	.35* [.07, .58]	.48** [.23, .68]

Note. $N = 48$. Values in square brackets indicate the 95% confidence intervals. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). BMACQ = Brief Marijuana Consequences Questionnaire (Simons et al., 2012). PBS = protective behavioral strategies. PBSM = Protective Behavioral Strategies for Marijuana Scale (Pedersen et al., 2017).

* indicates $p < .05$. ** indicates $p < .01$.

Table 4. *Means and Standard Deviations for PBSM Items*

Item	$M(SD)$
1. Use only among trusted peers	5.00 (1.47)
2. Avoid use while spending time with family	4.29 (1.57)
3. Avoid using before work or school	4.21 (1.95)
4. Avoid using to cope with emotions such as sadness or depression	3.42 (1.81)
5. Limit use to weekends	2.40 (1.80)
6. Only purchase from a trusted source	5.83 (0.48)
7. Avoid using habitually (that is, every day or multiple times a week)	2.77 (1.81)
8. Use a little and then wait to see how you feel before using more	4.35 (1.59)
9. Avoid mixing with other drugs	5.90 (0.59)
10. Avoid using in public places	5.12 (1.28)
11. Take periodic breaks if it feels like you are using too frequently	4.40 (1.80)
12. Buy less at a time so you smoke less	3.52 (1.91)
13. Have a set amount of “times” you take a hit (e.g., passing on a shared joint if you have already hit that limit)	3.35 (1.93)
14. Avoid methods of using that can make you more intoxicated than you would like (e.g., using large bongs, volcano, “edibles,” etc.)	4.19 (1.81)
15. Only use one time during a day/night	3.40 (1.76)
16. Limit the amount you smoke in one sitting	3.67 (1.75)
17. Avoid using before engaging in physical activity (i.e., exercise, hiking)	3.42 (1.85)

Note. $N = 48$. Values reflect the frequency of protective behavioral strategy (PBS) use on a 6-point scale (1 = *never*, 2 = *rarely*, 3 = *occasionally*, 4 = *sometimes*, 5 = *usually*, 6 = *always*). PBSM = Protective Behavioral Strategies for Marijuana Scale (Pedersen et al., 2017).

Table 5. *Regression Results: Associations Between PBS Use and Cannabis Use and Consequences*

Independent Variable	IRR	CI	p
Weekly Cannabis Use Frequency			
(Intercept)	16.14	[9.97, 25.72]	< .001
PBS frequency	0.79	[0.69, 0.90]	< .001
Second trimester	0.99	[0.75, 1.30]	.921
Third trimester	0.93	[0.64, 1.33]	.695

Daily Cannabis Use				
(Intercept)	55.05	[12.01, 252.42]	< .001	
PBS frequency	0.41	[0.33, 0.51]	.001	
Second trimester	1.66	[0.55, 5.00]	.365	
Third trimester	2.06	[0.74, 5.71]	.167	
Cannabis Consequences				
(Intercept)	34.74	[3.49, 367.82]	.002	
Weekly cannabis use frequency	0.84	[0.70, 1.00]	.033	
PBS frequency	0.80	[0.57, 1.13]	.219	
Second trimester	0.75	[0.44, 1.25]	.277	
Third trimester	0.33	[0.15, 0.70]	.005	

Note. $N = 48$. IRR = Incidence rate ratio. CI = 95% confidence interval for the IRR. PBS = protective behavioral strategies. First trimester was the reference category for trimester.

Table 6. *Regression Results: Associations Between Perceived Harm and PBS Use*

Independent Variable	B (<i>SE</i>)	CI	<i>p</i>	<i>R</i> ²
Perceived Harm to Self				
(Intercept)	3.25 (0.23)	[2.78, 3.72]	< .001	0.29
Perceived harm	0.02 (0.00)	[0.01, 0.03]	.002	
Second trimester	0.82 (0.27)	[0.28, 1.37]	.004	
Third trimester	0.79 (0.34)	[0.11, 1.48]	.023	
Perceived Harm to Fetus				
(Intercept)	3.21 (0.21)	[2.79, 3.63]	< .001	0.39
Perceived harm	0.02 (0.00)	[0.01, 0.02]	< .001	
Second trimester	0.73 (0.25)	[0.24, 1.23]	.005	
Third trimester	0.83 (0.31)	[0.19, 1.46]	.012	
Combined Perceived Harm Model				
(Intercept)	3.25 (0.22)	[2.81, 3.68]	< .001	0.40
Perceived harm to self	-0.01 (0.01)	[-0.03, 0.01]	.516	
Perceived harm to fetus	0.02 (0.01)	[0.01, 0.04]	.010	
Second trimester	0.69 (0.26)	[0.17, 1.20]	.011	
Third trimester	0.82 (0.32)	[0.18, 1.46]	.013	

Note. $N = 48$. B = unstandardized regression coefficient. SE = standard error. CI = 95% confidence interval for B. PBS = protective behavioral strategies. First trimester was the reference category for trimester.

DISCUSSION

The present study examined the use of protective behavioral strategies (PBS) among pregnant individuals who use cannabis, as well as the associations between PBS and prenatal cannabis use frequency, cannabis-related negative consequences, and perceived harm of prenatal cannabis use. Findings extend the PBS literature and provide preliminary evidence that pregnant individuals who use cannabis also use PBS, including strategies drawn from the PBSM (Pedersen et al., 2017) and pregnancy-specific strategies. Higher PBS use frequency was associated with lower prenatal cannabis use frequency, higher perceived harm, and later trimesters, but did not significantly associate with cannabis-related negative consequences. Open-ended responses offered further insight into

practices perceived to reduce harm associated with prenatal cannabis use.

Consistent with research in non-pregnant populations (e.g., Pedersen et al., 2017, 2018), more frequent PBS use was associated with less frequent prenatal cannabis use. Nearly half of participants reported using cannabis on 6–7 days per week, suggesting PBS may support reductions in cannabis use among pregnant individuals who use cannabis frequently. Participants endorsed using strategies from the PBSM (Pedersen et al., 2017), though the frequency of using certain strategies may differ from non-pregnant populations. For example, “limit use to weekends” and “avoid using habitually” were rarely reported by participants in the present study. However, prior data suggest these strategies are among the most frequently endorsed PBSM items by young adult college students (Bolts et al., 2024). Our

findings suggest the PBSM (Pedersen et al., 2017) provides a useful framework for examining cannabis PBS during pregnancy, but adaptations are needed to capture protective strategies that are unique to prenatal cannabis use.

Perceived harm and pregnancy trimester also played a role in PBS use. Participants in the second and third trimesters reported more frequent PBS use compared to those in the first trimester, and greater perceived harm of cannabis to self and to the fetus was associated with more frequent PBS use. When perceived harm to self and to the fetus were examined simultaneously, only fetal harm remained significant. This finding suggests that, in the context of prenatal cannabis use, concerns about fetal health may be a more salient motivator of PBS use than concerns about one's own health. Broadly, this aligns with health behavior theories that posit greater perceived risk increases the likelihood of engaging in health-promoting and harm-reducing behaviors (e.g., Hochbaum, 1958; Rosenstock, 1974; Rosenstock et al., 1988). Together these findings suggest opportunities for intervention by introducing PBS resources early in pregnancy, when cannabis use is most prevalent, and tailoring resources to trimester-specific needs. For example, early nonjudgmental conversations that explore personal goals and emphasize fetal health may help individuals identify and adapt protective behaviors during the first trimester, whereas later in pregnancy such discussions may help reinforce and refine protective strategies already in use. These approaches are consistent with the American College of Obstetricians & Gynecologists (ACOG) recommendations that healthcare professionals utilize person-centered approaches (e.g., motivational interviewing skills) and psychobehavioral strategies to reduce cannabis use, reduce cannabis-related risk, and promote protective behaviors throughout pregnancy (American College of Obstetricians & Gynecologists, 2025).

In contrast, PBS use frequency was not significantly associated with cannabis-related negative consequences after controlling for cannabis use frequency. This differs from prior work in non-pregnant populations that links higher PBS frequency with experiencing fewer negative consequences (e.g., Bolts et al., 2023; Bravo et al., 2017, 2019; Pearson et al., 2019; Pedersen et al., 2017, 2018). Several factors may

explain this discrepancy. First, the BMACQ (Simons et al., 2012) may not capture consequences that are most relevant to prenatal cannabis use. For example, participants described experiences in the open-ended responses, such as social judgment, that are not assessed by the BMACQ. More broadly, PBS use during pregnancy may relate to pregnancy-specific consequences that were not measured in the present study. Second, participants reported relatively few consequences, which limited variability. Third, the inverse association between weekly cannabis use and consequences was unexpected and may reflect underreporting among participants who use cannabis more frequently, normalization of consequences, residual confounding (e.g., unmeasured changes across pregnancy), or the use of pregnancy-specific strategies to mitigate harm. The latter possibility is consistent with the notion that individuals who use cannabis more frequently may develop more experience managing cannabis-related consequences, including through pregnancy-specific protective strategies identified in the open-ended responses. Finally, the modest sample size may have reduced the ability to detect an association between PBS and consequences. Taken together, these findings highlight the need for pregnancy-specific measures to better assess if and how PBS are associated with cannabis-related negative consequences during pregnancy.

Open-ended responses revealed pregnancy-specific practices perceived to reduce harm. Participants described various strategies, including setting limits on cannabis use quantity and frequency of use, using methods and supplies perceived as safer, reducing cannabis use over time, seeking social support, and replacing cannabis use with non-substance activities. Similar to prior research (Boerner et al., 2024; Brown et al., 2023; Gunn et al., 2024; Volkow et al., 2019), participants also described using cannabis for perceived therapeutic purposes. Some strategies align with reducing prenatal cannabis use frequency (e.g., *"have a date set in mind of when to quit"*) while other strategies sought to mitigate negative consequences without reducing cannabis use (e.g., *"I vape to avoid judgment"*). The narratives reflect the complexity of cannabis PBS during pregnancy and suggest that pregnant individuals adapt PBS in nuanced

and personalized ways, often embedded within broader psychosocial and environmental contexts.

Not all participants endorsed specific harm reduction intentions. Some expressed confidence in the safety of using cannabis during pregnancy (“*from experience weed is fine to use while pregnant so I use it the same amount I did before pregnancy*”) and others described cannabis as medically necessary (e.g., “*I have hyperemesis gravidarum. I have to smoke to survive or I will constantly puke and not eat*”). Open-ended responses reflect the heterogeneity of experiences, perceived harm, and motives for prenatal cannabis use. For individuals who do not endorse specific harm reduction intentions, PBS can still serve as a flexible toolkit to support safer cannabis use. Aligning PBS with individuals’ goals may help them make informed decisions about cannabis during pregnancy and adopt realistic protective behaviors that match their contexts.

Limitations

There are limitations in the present study. The modest sample size ($N = 48$) limits generalizability and statistical power to detect small effects, although the sample was adequate for detecting medium to large effects in regression models. Consequently, non-significant associations (e.g., between PBS use and consequences) may reflect insufficient power rather than true null findings. Our analyses used cross-sectional baseline data, which precludes causal inference about the relationship between PBS and cannabis use variables. Additionally, the PBSM (Pedersen et al., 2017) and BMACQ (Simons et al., 2012) were developed with non-pregnant populations and may not capture pregnancy-specific PBS or consequences. Finally, Study 1 did not bioverify pregnancy status, and thus we cannot ensure that self-reported pregnancy was accurate for participants in this study. Despite these limitations, our study contributes valuable preliminary data in a population where recruitment is inherently challenging due to stigma, legal concerns, and the sensitive nature of prenatal cannabis use.

Future Directions

To advance research on prenatal cannabis use and PBS, future studies should explore cannabis PBS among pregnant individuals in larger, diverse samples and develop validated, pregnancy-specific measures. Longitudinal studies could clarify temporal relationships among PBS, prenatal cannabis use, negative consequences, and perceived harm, and how cannabis PBS are adopted and modified throughout pregnancy. These efforts would align with the American Society of Addiction Medicine (ASAM) recommendations that clinicians provide counseling regarding substance use harm-reduction strategies during and after pregnancy (American Society of Addiction Medicine, 2022), as well as ACOG recommendations that healthcare professionals use person-centered approaches (e.g., motivational interviewing) and psychobehavioral strategies to reduce cannabis use and related risk across the perinatal period (American College of Obstetricians & Gynecologists, 2025). Integrating PBS into perinatal care could support these evidence-based, nonjudgmental discussions about cannabis. Aligning PBS with individual goals and contexts and offering nonstigmatizing information about potential fetal outcomes may further encourage engagement. Consistent with narratives in this study and prior work (Howe et al., 2025), many pregnant individuals experience shame, judgment, or fear when discussing cannabis use, which can exacerbate barriers to seeking support. Fostering supportive, nonjudgmental, and collaborative environments may help reduce barriers. Overall, PBS use has potential to facilitate safer cannabis use during pregnancy and to inform strategies that help individuals make informed decisions while mitigating harm during pregnancy.

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