Drug and Alcohol Dependence Reports 20 (2026) 100452

Contents lists available at ScienceDirect

Drug and Alcohol Dependence Reports

journal homepage: www.elsevier.com/locate/dadr

Prevalence of substance use during pregnancy in New Jersey: Investigating the effects of the COVID-19 public health emergency

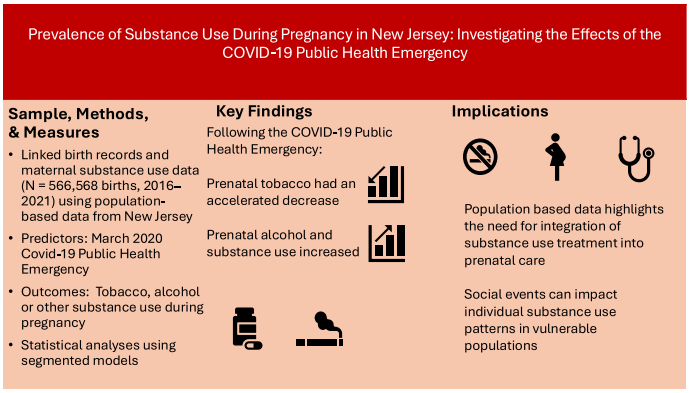
Abigail Gulchin [1], Jiawen Zhao [1], Megan E. Cooke, Sally I-Chun Kuo, Jessica E. Salvatore [*]

Department of Psychiatry, Robert Wood Johnson Medical School, Rutgers Health, 671 Hoes Lane – Room D205, Piscataway, NJ 08854, United States

HIGHLIGHTS

- Alcohol and other substance use during pregnancy increased after the COVID-19 public health emergency was declared.
- These increases were more pronounced among unemployed mothers.
- Tobacco use during pregnancy continued to decline after the COVID-19 public health emergency was declared.
- Population-based data reduces bias compared to selected samples.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Pregnancy
Substance Use
Alcohol
Tobacco
COVID-19

ABSTRACT

Background: Emerging evidence suggests that maternal substance use patterns may have changed following the declaration of the COVID-19 pandemic. We used comprehensive administrative birth record data to examine these changes at the population level.

Methods: We examined trends in prenatal substance use (alcohol, tobacco, and other substances) in New Jersey using birth certificate data from January 2016 to June 2021 (N = 566,568). Segmented logistic regression models were used to evaluate changes in substance use odds around the declaration of the COVID-19 public health emergency (March 1, 2020). All models were adjusted for maternal age and race/ethnicity. Interaction analyses were conducted to test whether observed changes differed by maternal employment and education.

Results: Alcohol and other substance use increased significantly after the declaration of COVID-19 public health emergency, while tobacco use decreased. Those changes in odds-ratios corresponded to an estimated 312 and 155 additional babies exposed to prenatal alcohol and other substance use, and 221 fewer babies exposed to prenatal tobacco during the year following declaration of the COVID-19 pandemic. Changes in alcohol and other substance use following the COVID-19 public health emergency differed as a function of maternal employment and education.

* Corresponding author.
E-mail addresses: abigail.gulchin@rutgers.edu (A. Gulchin), jiawen.zhao@rutgers.edu (J. Zhao), mec280@rwjms.rutgers.edu (M.E. Cooke), sally.kuo@rutgers.edu (S.I.-C. Kuo), jessica.salvatore@rutgers.edu (J.E. Salvatore).
[1] These authors contributed equally to this work and share first authorship

https://doi.org/10.1016/j.dadr.2026.100452
Received 12 March 2026; Received in revised form 11 May 2026; Accepted 27 May 2026
Available online 28 May 2026

Conclusions: The COVID-19 pandemic was associated with significant shifts in trends in maternal substance use during pregnancy in New Jersey.

1. Introduction

Substance use during pregnancy is increasing in the United States and remains a public health concern (ELNahas and Thibaut, 2023). Data from the 2020 National Survey on Drug Use and Health indicate that between 8% and 11% of pregnant women aged 15–44 used illegal drugs, tobacco products, or alcohol in the past month (Delphin-Rittmon, 2022). About one-fifth of pregnant individuals who use substances report polysubstance use, increasing risk of adverse consequences, such as premature birth, low birth weight and poor developmental outcomes (Andrade, 2024; Kotelchuck et al., 2017; Piske et al., 2021), and complicating intervention efforts (Board et al., 2023). Substance use during pregnancy can also have devastating effects on maternal outcomes, and drug-related deaths are a leading cause of non-obstetric related mortality in pregnant women (ELNahas and Thibaut, 2023).

Recent studies demonstrate that social events, like the COVID−19 pandemic, can influence substance use in pregnancy. In California, several studies reported an increase in cannabis use at the onset of the COVID−19 pandemic in the pregnant population (Young-Wolff et al., 2021; Young-Wolff et al., 2022; Avalos et al., 2022). In a study examining the use of multiple substances in a Tennessee sample of pregnant women, fentanyl and tobacco use increased significantly during the pandemic, but there were no statistically significant changes for other substances, including alcohol, cocaine, or cannabis (Lien et al., 2023). A national study found increases in alcohol and cannabis related emergency department visits among pregnant people during the pandemic (González-Alvarez et al., 2025). Finally, a toxicology-based study using meconium drug screening in Arkansas found substance use generally increased during the pandemic period, with THC-containing substances continuing to increase two to three years after the declaration of the pandemic (Gómez Pomar et al., 2025).

While these initial studies have provided information about how social events are associated with changes in maternal substance use, they have typically relied on selected samples that capture only a subset of the pregnant population. We address this gap by using comprehensive administrative data encompassing all births in New Jersey, reducing selection bias and enhancing population-level inference. New Jersey includes rural, urban, and suburban populations, and its residents vary widely in terms of race, ethnicity, and socioeconomic status, reflecting the range of the United States population (U.S. Census Bureau, 2024). The availability of statewide data also permits examination of trends in substance use as a function of sociodemographic factors including employment status and educational attainment. These moderators were selected based on prior evidence demonstrating their association with substance use during pregnancy, as well as their theoretical relevance as indicators of socioeconomic position. For example, there is some evidence that pregnant women who are employed have higher rates of past month alcohol use and binge drinking than those who are unemployed (Peltier et al., 2025), but others report no difference (Denny et al., 2019). Likewise, some studies find that pregnant women with lower educational attainment have higher rates of tobacco use and cannabis use (Azagba et al., 2020; Vadukapuram et al., 2022), but others have reported no differences or non-linear associations between educational attainment and pregnant women's alcohol use and binge drinking (Denny et al., 2019; Peltier et al., 2025). Understanding changes in maternal substance use in the context of sociodemographic factors may help identify groups at especially high risk who would benefit from targeted preventive interventions.

In summary, the goal of this study was to analyze statewide birth record data from 2016 to 2021 to investigate changes in maternal substance use following the declaration of the COVID−19 public health emergency on March 1, 2020 (Trump, 2020).

We had two research questions:

Did rates of maternal substance use (alcohol, tobacco, other substance use) change following the declaration of COVID−19 public health emergency?

Did changes in maternal substance use differ as a function of maternal employment status and educational attainment?

Prior studies have documented increases in maternal substance use following the COVID−19 public health emergency potentially due to heightened stress, mental health concerns, and reduced access to prenatal care (Kar et al., 2021; Lien et al., 2023; Smith et al., 2022). On this basis, we hypothesized that maternal substance use would increase after the declaration of COVID−19 public health emergency in New Jersey.

2. Method

2.1. Sample

Data came from the New Jersey Birth Dataset compiled by the New Jersey Integrated Population Health Data (iPHD) Project. This dataset includes birth certificate information reported to the New Jersey Department of Health's Office of Vital Statistics and Registry between 2000 and 2021. The current study focused on births recorded between January 1, 2016 and June 30, 2021 (N = 566,568), encompassing the available years of data surrounding the declaration of the COVID−19 public health emergency. The study end period was defined based on data availability at the time of analysis.

2.2. Variables and measures

2.2.1. Maternal substance use

Information regarding maternal use of alcohol, tobacco, and other substances during pregnancy was collected from the New Jersey Birth Registration System in accordance with National Center for Health Statistics (NCHS) guidelines. Items were completed by trained staff at the birthing facility based on information available in the prenatal medical record, which may include maternal self-report, physician documentation, and laboratory findings. Source-specific identifiers were not retained. The measure of other substance use was inclusive of cocaine, heroin, marijuana, or methamphetamines during pregnancy. All three maternal substance use measures during pregnancy were coded as "Yes," "No," or "Unknown" in the original questionnaire. Consistent with other studies using administrative records data (Kendler et al., 2016; Salvatore et al., 2018), affirmative ("yes") responses were treated as endorsements of maternal use of that substance, while "no" or "unknown" were treated as non-endorsements and coded as not indicative of use. In total, 5.1% of individuals were coded as "Unknown" for other substance use, and 5.4% were coded as "Unknown" for tobacco use. Alcohol use was recorded only as "Yes" or "Unknown," with no separate "No" response category provided. Accordingly, alcohol use was treated as a binary variable indicating endorsement ("Yes") versus non-endorsement ("Unknown").

2.2.2. Sociodemographic covariates

Several maternal sociodemographic characteristics were included as covariates. Maternal age at birth was calculated in years by subtracting the mother's birth date from the child's birth date. Because racial and ethnic disparities are associated with elevated substance use during pregnancy, race and ethnicity were included as covariates and coded

Table 1
Descriptive statistics for key study variables for overall sample by pandemic period.

Variable	Overall (N = 566,568)	Pre-pandemic (N = 432,163)	Transition pandemic (N = 81,580)	Post-transition pandemic (N = 52,825)
Mother's Race				
American Indian or Alaska Native	874 (0.2%)	594 (0.1%)	145 (0.2%)	135 (0.3%)
Asian	63788 (11.3%)	49562 (11.5%)	8872 (10.9%)	5354 (10.1%)
Black or African American	81303 (14.4%)	62411 (14.4%)	11596 (14.2%)	7296 (13.8%)
Native Hawaiian or Other Pacific Islander	–	–	–	–
Other/Unknown	74386 (13.1%)	55445 (12.8%)	11587 (14.2%)	7354 (13.9%)
White	346133 (61.1%)	264090 (61.1%)	49366 (60.5%)	32677 (61.9%)
Mother's Ethnicity				
Hispanic	151841 (26.8%)	115614 (26.8%)	22111 (27.1%)	14116 (26.7%)
Non-Hispanic	407048 (71.8%)	310794 (71.9%)	58424 (71.6%)	37830 (71.6%)
Unknown/Not classifiable	7679 (1.4%)	5755 (1.3%)	1045 (1.3%)	879 (1.7%)
Mother's Education				
Bachelor's Degree	152579 (26.9%)	115315 (26.7%)	22393 (27.4%)	14871 (28.2%)
No High School Diploma	56822 (10.0%)	44794 (10.4%)	7545 (9.2%)	4483 (8.5%)
High School Graduate or GED completed	131115 (23.1%)	99910 (23.1%)	19007 (23.3%)	12198 (23.1%)
Some College Credit, but no Degree	71553 (12.6%)	56024 (13.0%)	9634 (11.8%)	5895 (11.2%)
Associate Degree	38991 (6.9%)	29690 (6.9%)	5678 (7.0%)	3623 (6.9%)
Advanced Degree (Master's/Doctorate/Professional Degree)	111487 (19.7%)	83709 (19.4%)	16552 (20.3%)	11226 (21.3%)
Missing	4021 (0.7%)	2721 (0.6%)	771 (0.9%)	529 (1.0%)
Mother's Employment status				
No	186917 (33.0%)	144200 (33.4%)	25769 (31.6%)	16948 (32.1%)
Yes	350844 (61.9%)	266103 (61.6%)	51843 (63.5%)	32898 (62.3%)
Missing	28807 (5.1%)	21860 (5.1%)	3968 (4.9%)	2979 (5.6%)
Alcohol Use				
Yes	59017 (10.4%)	44841 (10.4%)	8093 (9.9%)	6083 (11.5%)
Unknown[a]	507551 (89.6%)	387322 (89.6%)	73487 (90.1%)	46742 (88.5%)
Tobacco Use				
Yes	33089 (5.8%)	27154 (6.3%)	3754 (4.6%)	2181 (4.1%)
No	502805 (88.7%)	381661 (88.3%)	73656 (90.3%)	47488 (89.9%)
Unknown	30674 (5.4%)	23348 (5.4%)	4170 (5.1%)	3156 (6.0%)
Other Substance Use[b]				
Yes	12368 (2.2%)	9000 (2.1%)	1939 (2.4%)	1429 (2.7%)
No	525267 (92.7%)	401199 (92.8%)	75672 (92.8%)	48396 (91.6%)
Unknown	28933 (5.1%)	21964 (5.1%)	3969 (4.9%)	3000 (5.7%)

Notes. Values are presented as n (%). The pre-pandemic period includes births occurring from January 1, 2016 to March 1, 2020. The transition period includes births from March 1, 2020 to December 20, 2020 (through 42 weeks post-declaration). The post-transition period includes births occurring from December 21, 2020 to June 30, 2021.
Groups with small cell sizes are suppressed ("–") in accordance with data use agreement policies.
[a] In the state administrative data, alcohol use was recorded only as "Yes" or "Unknown," with no separate "No" response category provided.
[b] Other substance use referred to any reported use of cocaine, heroin, marijuana, or methamphetamines during pregnancy.

following NIH standard classifications (Harrison and Sidebottom, 2009). Detailed coding procedures are provided in Supplementary Material S1. Maternal education was classified into nine levels in the questionnaire. For this analysis, those categories were collapsed into six levels, ranging from "No high school diploma" to "Advanced Degree (Master's/Doctorate/Professional Degree)". Employment status reflected whether the mother had been employed in the past year and was categorized as employed or unemployed.

2.3. Statistical analysis

We used segmented regression to evaluate changes in maternal substance use patterns during pregnancy associated with the declaration of the COVID−19 public health emergency. Separate models were run for each outcome: alcohol, tobacco, and other substance use (including cocaine, heroin, marijuana, or methamphetamines). Adjusted models controlled for maternal age, race, and ethnicity. These models estimate differences in the slope of substance use rates before and after the COVID−19 public health emergency declaration. The timing variable, "days from COVID−19 declaration," measured days between the child's birth date and the official declaration of the COVID−19 public health emergency in the United States (3/1/2020) (Trump, 2020). Negative values reflected births occurring before the event, while positive values indicated births occurring after.

To examine whether temporal trends differed for pregnancies spanning the COVID−19 public health emergency declaration, we began with a series of preliminary analyses to determine whether inclusion of an additional breakpoint at 42 weeks following COVID−19 public health emergency declaration improved model fit from a model with a single breakpoint associated with the declaration. The two breakpoint model thus defined three periods: (1) births that occurred in the pre-pandemic period (days from COVID−19 declaration < 0), (2) births that occurred during transition period corresponding to the first 42 weeks following COVID−19 public health emergency declaration, and (3) births that occurred beyond 42 weeks following the COVID−19 public health emergency declaration. We note that the rationale for selecting 42 weeks is that this is the cutoff for a term pregnancy; accordingly, births occurring during this transitional period cover a full cycle of term pregnancies occurring early in the pandemic period. We compared models with one versus two breakpoints using likelihood ratio tests (LRT), Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC). As presented in Supplementary Material S2, for the alcohol use outcome, including the additional breakpoint demonstrated improved fit and thus a two-breakpoint model was retained. In contrast, for tobacco and other substance use outcomes, inclusion of a second breakpoint did not meaningfully improve model fit, and thus single-breakpoint segmented regressions were used in the subsequent inferential analyses.

For interpretability, daily odds ratios after the breakpoint were exponentiated to the 365th power to summarize the cumulative increase or decrease in odds over a year. In addition, model-estimated odds ratios for maternal substance use trends were converted into cumulative

Table 2
Rate of change in maternal alcohol use, tobacco use and other substance use during pregnancy following the declaration of the COVID−19 public health emergency.

Variable	Alcohol Use OR (95% CI)	Tobacco Use OR (95% CI)	Other Substance Use OR (95% CI)
(Intercept)	**0.04301 (0.03295, 0.05613)**	**0.16440 (0.12559, 0.21521)**	**0.25230 (0.16980, 0.37488)**
Mother's Age	**1.00605 (1.00445, 1.00766)**	**0.96134 (0.95938, 0.96332)**	**0.92665 (0.92363, 0.92969)**
Mother's Ethnicity - Hispanic	reference		
Mother's Ethnicity - Non-Hispanic	**2.06823 (2.01582, 2.12201)**	**1.80836 (1.75012, 1.86853)**	**1.35008 (1.28405, 1.41952)**
Mother's Ethnicity - Unknown/Not classifiable	**1.61357 (1.48559, 1.75258)**	**1.97874 (1.79619, 2.17984)**	**2.10915 (1.84898, 2.40594)**
Mother's Race - American Indian or Alaska Native	reference		
Mother's Race - Asian	**0.34458 (0.26439, 0.44909)**	**0.13441 (0.10247, 0.17630)**	**0.11378 (0.07560, 0.17124)**
Mother's Race - Black or African American	0.91562 (0.70403, 1.19081)	0.84582 (0.64984, 1.10090)	1.28665 (0.87393, 1.89429)
Mother's Race - Native Hawaiian or Other Pacific Islander	–	–	–
Mother's Race - Other/ Unknown	1.01100 (0.77694, 1.31558)	**0.47165 (0.36171, 0.61500)**	**0.47785 (0.32374, 0.70533)**
Mother's Race - White	**1.51820 (1.16856, 1.97244)**	0.77240 (0.59405, 1.00430)	0.68627 (0.46667, 1.00921)
Daily change in slope prior to breakpoint 1 (COVID Declaration)	**0.99993 (0.99991, 0.99995)**	**0.99971 (0.99969, 0.99974)**	**1.00014 (1.00009, 1.00018)**
Daily change in slope after breakpoint 1 (COVID Declaration)	1.00010 (0.99994, 1.00025)	**0.99978 (0.99964, 0.99991)**	**1.00037 (1.00019, 1.00056)**
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration)	**1.00127 (1.00082, 1.00172)**	–	–

Notes. An additional breakpoint was included for alcohol use to account for a secondary change in slope occurring 42 weeks after the COVID−19 public health emergency declaration. This post-declaration slope was not included for tobacco or other substance use outcomes due to a lack of evidence supporting an additional breakpoint in those models.
Results for groups with small cell sizes are suppressed ("–") in accordance with data use agreement policies.

effects by estimating the change in affected births over a year following the COVID−19 public health emergency declaration.

For exploratory analyses, interaction terms between the sociodemographic moderators (maternal education and employment) and timing variables were added to test potential moderation effects. Statistically significant interactions were explored in stratified analyses.

All analyses were conducted in R (version 4.4.1), and a two-tailed p-value < 0.05 was considered statistically significant. The analytic plan and study hypotheses were pre-registered on the Open Science Framework (OSF) and are publicly available at https://doi.org/10.17605/OSF.IO/X5FH6.

3. Results

Descriptive statistics for key study variables are summarized in Table 1. The analytic sample included 566,568 live births registered in New Jersey between 2016 and 2021, with a mean maternal age of 30.7 years (SD = 5.64). Most mothers were White (61.1%), followed by Black or African American (14.4%), Asian (11.3%), and Other/Unknown race (13.1%). Regarding ethnicity, 26.8% of mothers were Hispanic and 71.8% were non-Hispanic. For substance use outcomes, 10.4% of mothers indicated alcohol use, 5.8% indicated tobacco use, and 2.2% indicated other substance use. In terms of employment and education, 61.9% of mothers were employed at the time of delivery, 26.9% of mothers held a Bachelor's degree, 23.1% had completed high school or earned a GED, 19.7% had an advanced degree (Master's, Doctorate, or Professional), 6.9% held an Associate's degree, 12.6% had some college but no degree, and 10% had not completed high school.

3.1. Segmented models

We tested our hypotheses regarding the association between the COVID−19 public health emergency and changes in substance use rates using segmented logistic regression models with one or more breakpoints. The pre-specified breakpoint at March 1, 2020 (i.e., the declaration of the public health emergency) was included in all models, and an additional breakpoint at 42 weeks post-declaration was incorporated for alcohol use based on model fit criteria. We found statistically significant changes in slope for all three maternal substance use outcomes. Complete results for each of these models are presented in Table 2, and effects of interest are detailed below.

As shown in Fig. 1A, alcohol use had a relatively flat and slightly declining trend of 0.007% daily (OR = 0.99993) before the declaration of the COVID−19 public health emergency, followed by an increase of 0.010% daily (OR = 1.00010) for the 42-week transitional period after the COVID−19 public health emergency declaration, and then followed by an additional increase of 0.127% daily (OR = 1.00127) for births occurring more than 42 weeks post-declaration. This equals a 13.5% increase in odds over a year, and approximately 312 additional children born to mothers who reported alcohol use during pregnancy during the year following the COVID−19 public health emergency declaration, relative to the expected number under continuation of pre-pandemic trends.

As shown in Fig. 1B, tobacco use showed a decreasing trend of 0.029% daily (OR = 0.99971) prior to the COVID−19 public health emergency declaration, which continued and even accelerated after the declaration of the COVID−19 pandemic with an additional 0.022% daily reduction (OR = 0.99978). This equals a 7.72% decline in odds over a year, and approximately 221 fewer children born to mothers who reported tobacco use during pregnancy during the year following the COVID−19 public health emergency, relative to the expected number under continuation of pre-pandemic trends.

As shown in Fig. 1C, for other substance use, there was a slight increasing trend in the odds of substance use of 0.014% daily (OR = 1.00014) before the declaration of the COVID−19 public health emergency, and a further upward shift after with an additional 0.037% daily increase (OR = 1.00037). This equals a 14.46% rise in odds over a year and approximately 155 additional children born to mothers who reported other substance use during pregnancy during the year following the COVID−19 public health emergency relative to the expected number under continuation of pre-pandemic trends.

3.2. Exploratory analyses

Interaction analyses were conducted to examine whether the changes in the rates of maternal substance use associated with the COVID−19 public health emergency differed by maternal employment and education. As shown in Table 3, for employment status, interaction terms were significant for all three classes of substance use. When the effect was probed in stratified analyses, and as depicted in Fig. 2, unemployed mothers showed a more rapid increase in alcohol and other substance use compared to employed mothers after the declaration of COVID−19 public health emergency, while employed mothers had a

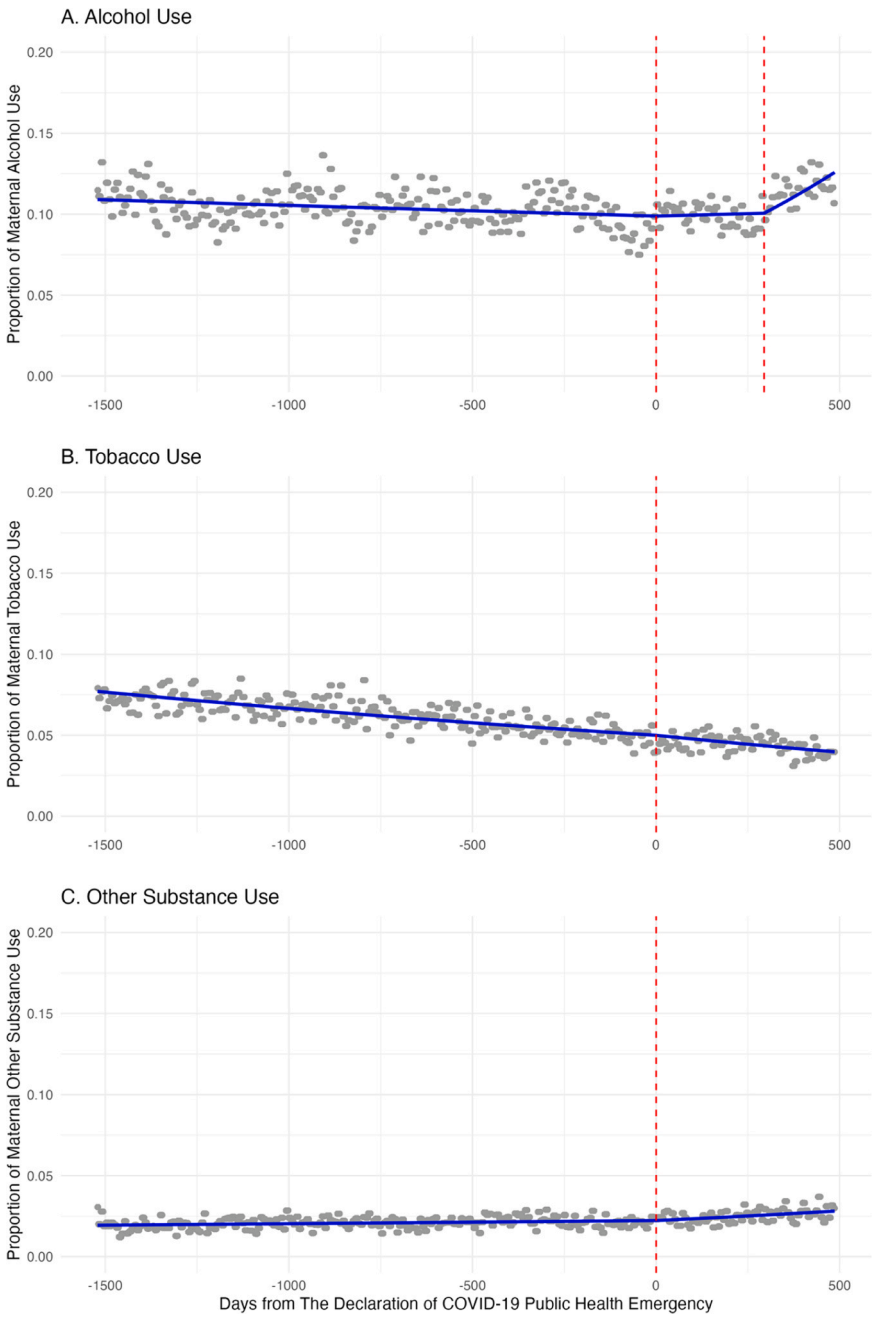


Fig. 1. The segmented logistic regression of days from the declaration of the COVID public health emergency on the prevalence of maternal substance use (alcohol, tobacco and other substance) with observed data by week in grey. Note. Two breakpoints are included for alcohol use, as indicated by preliminary model fitting.

more significant decrease in tobacco use after the declaration of COVID−19 public emergency. As shown in Table 4, maternal education modified the rate of change in maternal alcohol and other substance use following the declaration of COVID−19 public health emergency. As presented in Fig. 3A, the increase in maternal alcohol use for births occurring more than 42 weeks after the declaration of the COVID public health emergency was greater for those with associate's degrees compared to those with bachelor's degrees. As presented in Fig. 3C, there was less of an increase in other substance use following the declaration of the COVID public health emergency among mothers with a high school diploma or GED compared to mothers with bachelor's degrees.

3.3. Sensitivity analyses

To assess the robustness of our findings to the specification of the transition period and to evaluate whether the inclusion of the 42-week transitional period influenced the observed associations, we conducted sensitivity analyses. Specifically, we excluded pregnancies with an estimated start date within 42 weeks prior to the declaration (calculated using gestational age and date of birth) and births occurring within 42 weeks after the declaration. We re-estimated all models using this approach. As shown in Supplementary Material S3, results from these sensitivity analyses were highly consistent with the primary findings. The direction and magnitude of estimated associations remained similar, and substantive conclusions remained the same.

Table 3
Mother's employment status as a moderator of the rate of change in maternal alcohol use, tobacco use and other substance use during pregnancy following the declaration of COVID−19 public health emergency.

Variable	Alcohol Use OR (95% CI)	Tobacco Use OR (95% CI)	Other Substance Use OR (95% CI)
(Intercept)	**0.02782 (0.02124, 0.03644)**	**0.16341 (0.12428, 0.21486)**	**0.24388 (0.16376, 0.36319)**
Mother's Age	**1.00500 (1.00336, 1.00664)**	**0.96783 (0.96583, 0.96983)**	**0.93392 (0.93088, 0.93697)**
Mother's Ethnicity - Hispanic	reference		
Mother's Ethnicity - Non-Hispanic	**1.89690 (1.84787, 1.94723)**	**2.00026 (1.93470, 2.06804)**	**1.51656 (1.44169, 1.59532)**
Mother's Ethnicity - Unknown/Not classifiable	**1.45655 (1.34056, 1.58258)**	**2.03598 (1.84709, 2.24418)**	**2.17206 (1.90367, 2.47830)**
Mother's Race - American Indian or Alaska Native	reference		
Mother's Race - Asian	**0.38908 (0.29826, 0.50755)**	**0.12866 (0.09779, 0.16927)**	**0.10594 (0.07035, 0.15954)**
Mother's Race - Black or African American	0.94588 (0.72664, 1.23126)	0.83315 (0.63822, 1.08762)	1.24773 (0.84699, 1.83807)
Mother's Race - Native Hawaiian or Other Pacific Islander	–	–	–
Mother's Race - Other/ Unknown	1.08136 (0.83029, 1.40834)	**0.45778 (0.35003, 0.59871)**	**0.45997 (0.31142, 0.67938)**
Mother's Race - White	**1.53709 (1.18207, 1.99875)**	0.79095 (0.60653, 1.03144)	0.70026 (0.47591, 1.03037)
Daily change in slope prior to breakpoint 1 (COVID Declaration)	**0.99988 (0.99983, 0.99993)**	**0.99973 (0.99969, 0.99977)**	**1.00007 (1.00001, 1.00014)**
Daily change in slope after breakpoint 1 (COVID Declaration)	**1.00051 (1.00017, 1.00085)**	0.99989 (0.99967, 1.00011)	**1.00059 (1.00030, 1.00087)**
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration)	**1.00188 (1.00091, 1.00286)**	---	---
Mother's Employment Status - No	reference		
Mother's Employment Status - Yes	**2.11741 (2.02026, 2.21923)**	**0.68368 (0.65088, 0.71814)**	**0.69816 (0.64868, 0.75141)**
Mother's Employment Status - Yes * Daily change in slope prior to breakpoint 1 (COVID Declaration)	1.00004 (0.99999, 1.00009)	0.99999 (0.99993, 1.00004)	**1.00014 (1.00006, 1.00023)**
Mother's Employment Status - Yes * Daily change in slope after breakpoint 1 (COVID Declaration)	**0.99956 (0.99918, 0.99994)**	**0.99971 (0.99943, 0.99999)**	**0.99956 (0.99917, 0.99994)**
Mother's Employment Status - Yes * Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration)	0.99923 (0.99813, 1.00033)	---	---

Note. An additional breakpoint was included for alcohol use to account for a secondary change in slope occurring 42 weeks after the COVID−19 public health emergency declaration. This post-declaration slope was not included for tobacco or other substance use outcomes due to a lack of evidence supporting an additional breakpoint in those models. Corresponding fields are marked with ---. Additionally, results for groups with small cell sizes are suppressed ("–") in accordance with data use agreement policies.

4. Discussion

This study examined changes in maternal substance use in New Jersey following the COVID−19 public health emergency in March 2020. Two key findings emerged from our analyses of 566,568 births between January 1st, 2016, to June 30th, 2021. First, following the COVID−19 public health emergency, the rates of maternal alcohol and other substance use accelerated, but tobacco use decelerated. For alcohol use specifically, this change showed a complex, nonlinear pattern that was best characterized by a two-breakpoint model. Alcohol use initially increased during the first 42 weeks following the declaration and showed a more pronounced acceleration after. The findings suggest that maternal use of alcohol was more strongly moderated by the COVID−19 pandemic compared to tobacco and other substance use. These changes corresponded to small but statistically significant effects, with approximately a 13–14% increase in odds of alcohol or other substance use and a 7% decrease in odds of tobacco use over a year. These changes correspond to 312 additional births exposed to alcohol, 155 additional births exposed to other substance use, and 221 fewer births exposed to tobacco over a year. These findings align with the growing body of prior literature documenting increases in opioid use and overdose risk among pregnant and postpartum individuals during this period (Han et al., 2024; Lien et al., 2023). The increases in substance use and alcohol use have been attributed to pandemic-related stressors, including social isolation, financial challenges, and disruptions to healthcare access (Kar et al., 2021).

4.1.

In contrast, maternal tobacco use exhibited a steady decline following the pandemic declaration. This continued downward trend aligns with national data showing sustained reductions in smoking during pregnancy over the past decade, likely driven by increased public health messaging, prenatal care access, and social stigma around smoking (Martin et al., 2023; Rodriguez and Smith, 2019). Interestingly, our data differs from other literature that found an increase in tobacco use among pregnant women in Tennessee during the COVID−19 pandemic, perhaps reflecting different local policies and attitudes regarding tobacco use (Lien et al., 2023). The effects observed in our data may reflect the impact of the American College of Obstetricians and Gynecologists' 2017 and 2020 recommendations for systematic tobacco use screening, brief cessation counseling, and referral to cessation resources during prenatal counseling (American College of Obstetricians and Gynecologists' Committee on Obstetric Practice, 2020). Moreover, national sales data during this time showed a 27.2% decrease in cigarette sales from 2015 to 2021 (Ali et al., 2022). This change may have also been associated with New Jersey's passing and enacting the Tobacco−21 law (effective November 1, 2017) which raised the minimum legal age for purchasing tobacco products from 19 to 21 (Bennett, 2017; Bill S359, 2016). This law was later passed federally and became effective as of January 1, 2020, only a few months before the declaration of the COVID−19 public health emergency (H.R.2411 - Tobacco to 21 Act, H.R. 2411, 2019). The enaction of additional federal penalties imposed on businesses selling to underage individuals may have decreased access to tobacco in this population.

Another possible factor contributing to substance use in New Jersey during this study's time period is the legalization of both medical and recreational cannabis. New Jersey initially legalized medical marijuana in 2010, with an additional expansion in 2019 (Jake Honig Compassionate Use Medical Cannabis Act, 2019; New Jersey Compassionate Use Medical Marijuana Act, 2010). A previous study has shown that living in a state with medical marijuana was associated with increased likelihood of using cannabis prior to pregnancy (Taylor et al., 2021). Other studies have found that living in an area with legalized recreational cannabis and retail availability is associated with higher likelihood of cannabis use during pregnancy (Taylor et al., 2021;

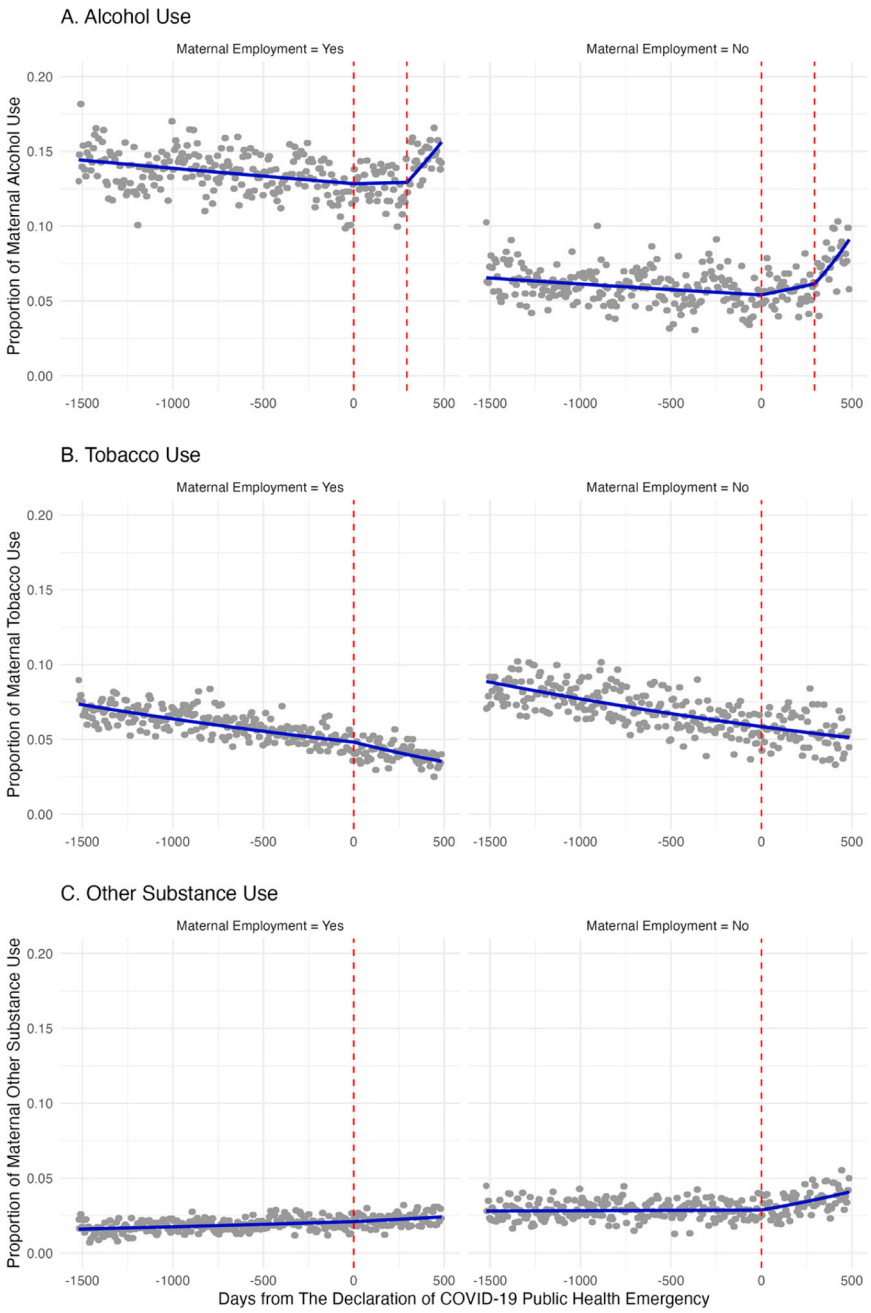


Fig. 2. The segmented regression of days from the declaration of the COVID public health emergency on the prevalence of maternal substance use (alcohol, tobacco and other substance) stratified by employment status. Note. Two breakpoints are included for alcohol use, as indicated by preliminary model fitting.

Young-Wolff et al., 2022). Recreational cannabis legislation was passed in New Jersey in January 2021 (New Jersey Constitution, Art IV, §VII, para 13 [1947]), and this policy change may have contributed to changes in substance use following the COVID−19 public health emergency. Future research may show more significant changes in prenatal cannabis and substance use within New Jersey mothers.

Our exploratory analysis of sociodemographic factors as moderators of change in maternal substance use during COVID−19 highlight important differences. Alcohol and other substance use increased more among unemployed mothers than employed mothers, while declines in tobacco use were smaller among unemployed mothers. Educational attainment was an important modifier as well, but the effects were more nuanced. For births that happened more than 42 weeks after the declaration of the pandemic, the prevalence of alcohol use during pregnancy increased more for women with an associate's degree compared to a bachelor's degree. In contrast, the increase in other substance use following the declaration of the public health emergency was less pronounced for mothers with a high school diploma or GED compared to mothers with bachelor's degrees. Our findings suggest that socioeconomic position may impact changes in prenatal alcohol and other substance use in response to social events, and are consistent with the broader evidence that social determinants of health including maternal employment and education have complex associations with substance use behaviors during pregnancy (Azagba et al., 2020; Denny et., 2019; Jorda et al., 2021; Peltier et al., 2025; Vadukapuram et al., 2022).

4.1.1. Clinical and policy implications

These findings support the need for further integration of substance use treatment into prenatal care settings and for a multimodal approach

Table 4
Mother's educational attainment as a moderator of the rate of change in maternal alcohol use, tobacco use and other substance use during pregnancy following the declaration of COVID−19 public health emergency.

Variable	Alcohol Use OR (95% CI)	Tobacco Use OR (95% CI)	Other Substance Use OR (95% CI)
(Intercept)	**0.07108 (0.05429, 0.09304)**	**0.01073 (0.00808, 0.01425)**	**0.02264 (0.01493, 0.03433)**
Mother's Age	**0.99784 (0.99611, 0.99957)**	**1.00349 (1.00146, 1.00553)**	**0.96322 (0.96007, 0.96639)**
Mother's Ethnicity - Hispanic	reference		
Mother's Ethnicity - Non-Hispanic	**1.74779 (1.70147, 1.79536)**	**2.93271 (2.83380, 3.03508)**	**1.92727 (1.82936, 2.03043)**
Mother's Ethnicity - Unknown/Not classifiable	**1.41869 (1.30266, 1.54506)**	**2.57022 (2.31959, 2.84794)**	**2.30632 (1.99691, 2.66367)**
Mother's Race - American Indian or Alaska Native	reference		
Mother's Race - Asian	**0.34651 (0.26587, 0.45162)**	**0.23762 (0.18023, 0.31326)**	**0.18292 (0.12133, 0.27579)**
Mother's Race - Black or African American	1.01772 (0.78256, 1.32355)	**0.64543 (0.49338, 0.84434)**	1.01436 (0.68792, 1.49570)
Mother's Race - Native Hawaiian or Other Pacific Islander	–	–	–
Mother's Race - Other/ Unknown	1.10335 (0.84799, 1.43560)	**0.48441 (0.36953, 0.63499)**	**0.45744 (0.30929, 0.67656)**
Mother's Race - White	**1.57338 (1.21112, 2.04398)**	0.89597 (0.68561, 1.17086)	0.74196 (0.50378, 1.09275)
Daily change in slope prior to breakpoint 1 (COVID Declaration)	**0.99992 (0.99988, 0.99996)**	**0.99976 (0.99968, 0.99983)**	1.00011 (0.99997, 1.00025)
Daily change in slope after breakpoint 1 (COVID Declaration)	1.00014 (0.99988, 1.00041)	0.99972 (0.99934, 1.00010)	**1.00098 (1.00042, 1.00154)**
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration)	**1.00084 (1.00004, 1.00163)**	–	–
Mother's Education - Bachelor's Degree	reference		
Mother's Education - No High School Diploma	**0.39855 (0.36241, 0.43828)**	**5.59284 (5.08497, 6.15144)**	**4.98707 (4.29401, 5.79199)**
Mother's Education - High School Graduate or GED completed	**0.71406 (0.67734, 0.75278)**	**5.26094 (4.87625, 5.67598)**	**4.81281 (4.24061, 5.46221)**
Mother's Education - Some College Credit, but no Degree	**0.88463 (0.83260, 0.93990)**	**4.30359 (3.95190, 4.68657)**	**3.80233 (3.29911, 4.38231)**
Mother's Education - Associate Degree	0.99756 (0.92741, 1.07301)	**2.83073 (2.54274, 3.15133)**	**2.44587 (2.03736, 2.93629)**
Mother's Education - Advanced Degree (Master's/Doctorate/ Professional Degree)	**0.94890 (0.90173, 0.99854)**	**0.43934 (0.38604, 0.49999)**	**0.63825 (0.51944, 0.78424)**
Daily change in slope prior to breakpoint 1 (COVID Declaration) * No High School Diploma	1.00001 (0.99990, 1.00011)	0.99999 (0.99989, 1.00010)	0.99999 (0.99981, 1.00017)
Daily change in slope prior to breakpoint 1 (COVID Declaration) * High School Graduate or GED completed	0.99999 (0.99993, 1.00005)	0.99993 (0.99984, 1.00001)	1.00004 (0.99989, 1.00019)
Daily change in slope prior to breakpoint 1 (COVID Declaration) * Some College Credit, but no Degree	0.99998 (0.99991, 1.00005)	0.99996 (0.99987, 1.00006)	1.00010 (0.99993, 1.00027)
Daily change in slope prior to breakpoint 1 (COVID Declaration) * Associate Degree	1.00004 (0.99996, 1.00013)	1.00000 (0.99988, 1.00012)	1.00006 (0.99983, 1.00028)
Daily change in slope prior to breakpoint 1 (COVID Declaration) * Advanced Degree (Master's/ Doctorate/Professional Degree)	1.00004 (0.99998, 1.00010)	0.99989 (0.99974, 1.00003)	0.99995 (0.99970, 1.00020)
Daily change in slope after breakpoint 1 (COVID Declaration) * No High School Diploma	1.00045 (0.99968, 1.00122)	1.00016 (0.99962, 1.00071)	0.99954 (0.99879, 1.00029)
Daily change in slope after breakpoint 1 (COVID Declaration) * High School Graduate or GED completed	1.00019 (0.99976, 1.00062)	1.00008 (0.99965, 1.00051)	**0.99935 (0.99872, 0.99997)**
Daily change in slope after breakpoint 1 (COVID Declaration) * Some College Credit, but no Degree	1.00000 (0.99950, 1.00050)	1.00027 (0.99978, 1.00076)	0.99942 (0.99871, 1.00014)
Daily change in slope after breakpoint 1 (COVID Declaration) * Associate Degree	0.99942 (0.99880, 1.00003)	0.99994 (0.99932, 1.00056)	0.99929 (0.99835, 1.00023)
Daily change in slope after breakpoint 1 (COVID Declaration) * Advanced Degree (Master's/ Doctorate/Professional Degree)	0.99976 (0.99934, 1.00019)	1.00041 (0.99969, 1.00114)	0.99937 (0.99832, 1.00042)
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration) * No High School Diploma	1.00097 (0.99871, 1.00324)	---	---
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration) * High School Graduate or GED completed	1.00024 (0.99898, 1.00151)	---	---
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration) * Some College Credit, but no Degree	1.00108 (0.99957, 1.00260)	---	---
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration) * Associate Degree	**1.00211 (1.00029, 1.00393)**	---	---
Daily change in slope after breakpoint 2 (42 weeks after COVID Declaration) * Advanced Degree (Master's/Doctorate/ Professional Degree)	1.00000 (0.99874, 1.00125)	---	---

Note. An additional breakpoint was included for alcohol use to account for a secondary change in slope occurring 42 weeks after the COVID−19 public health emergency declaration. This post-declaration slope was not included for tobacco or other substance use outcomes due to a lack of evidence supporting an additional breakpoint in those models. Corresponding fields are marked with ---. Results for groups with small cell sizes are suppressed ("–") in accordance with data use agreement policies.

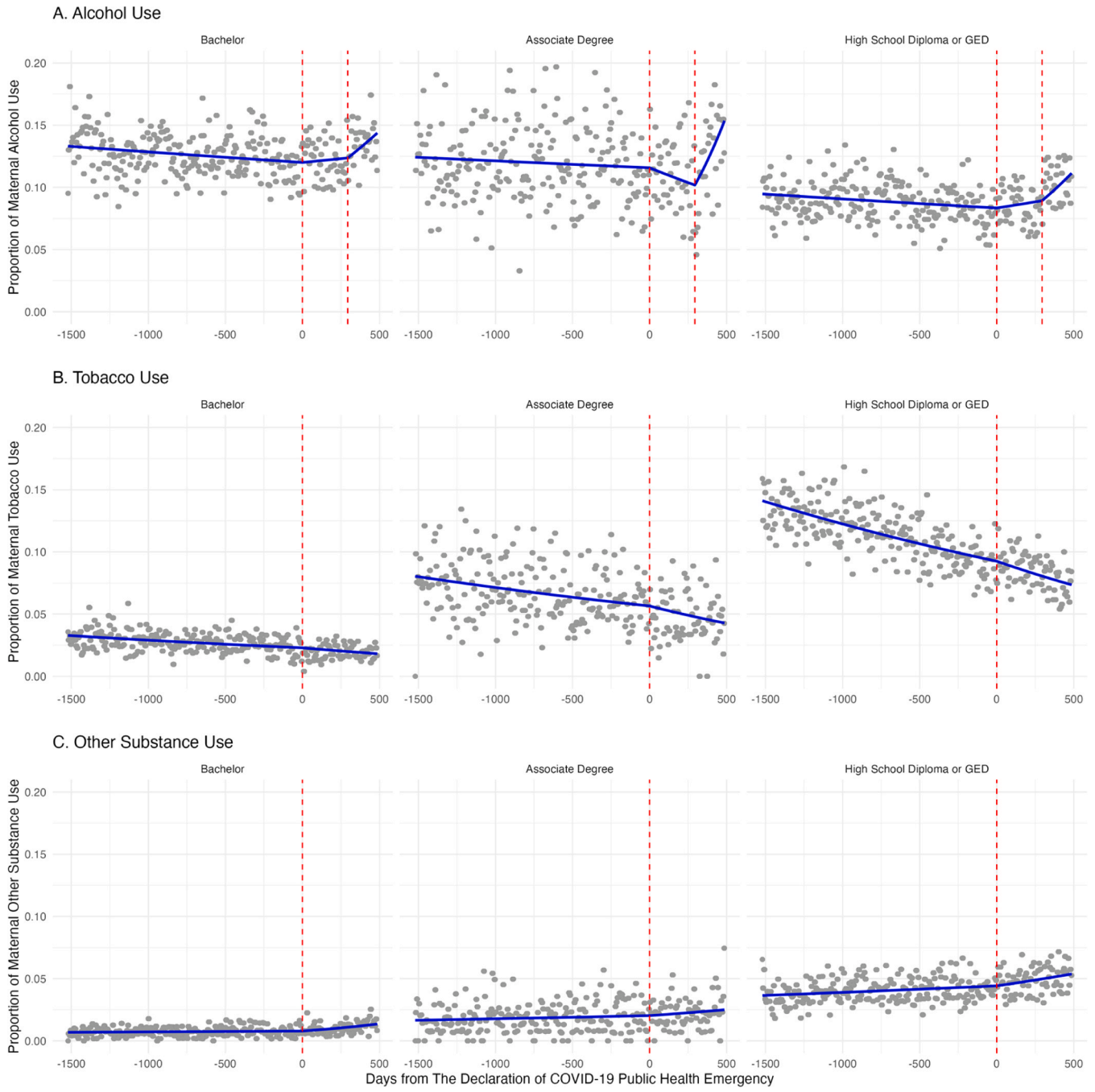


Fig. 3. The segmented regression of days from the declaration of the COVID public health emergency on the prevalence of maternal substance use (alcohol, tobacco and other substance) stratified by educational attainment. Note. Two breakpoints are included for alcohol use, as indicated by preliminary model fitting.

to treating pregnant people, especially as mental distress and substance use tend to be comorbid (ELNahas and Thibaut, 2023; Vadukapuram et al., 2022). Second, as COVID−19 related policies including social quarantines and increased telehealth availability reframed access to healthcare, it would be valuable to understand whether and how these changes in health care services impacted substance use among pregnant women. These issues are further tested and exacerbated by the increasing access to substances as many states over the past few years have chosen to enact cannabis recreational legalization (Lampe, 2024; NJCRC 2022–2023 Report on Adult Use Cannabis, 2023).

4.1.2. Strengths and limitations

The strengths of this study include the use of a large population cohort from administrative birth records. This allowed us to analyze the entire population of New Jersey using comprehensive records, making it more likely that we captured all vulnerable populations in our sample. This sample was not limited to a specific hospital system, increasing generalizability. However, the conclusions from this work must be considered in the context of important limitations. First, the information from our dataset is based on birth records, which likely comes from a combination of self-report or medical provider documentation of maternal substance use at the time of delivery. This documentation may not have been externally validated with an objective measure, which may lead to underestimation of the true rate of prenatal substance use. Administrative data often includes incomplete or inconsistently recorded responses, particularly for sensitive behavioral indicators. In such cases, missingness is frequently nonrandom and may reflect non-disclosure or lack of documentation (Heins and Pujol, 2024; Wells

et al., 2013). There is also some evidence to suggest that data abstracted from birth certificates may underreport maternal substance use compared to medical records (Howland et al., 2015).

Encouragingly, we found that alcohol, tobacco, and other substance prevalences as recorded in the NJ Birth Data closely resemble rates reported in collateral surveillance data from the state Pregnancy Risk Assessment Monitoring System (PRAMS). For example, according to PRAMS data (2016–2021) accessed via the New Jersey State Health Assessment Data (NJSHAD) query system, there was a decline in reported smoking during the last 3 months of pregnancy with rates decreasing from 4.5% to 2.2% (New Jersey Department of Health, n.d.-a.). Similarly, a NJSHAD query on alcohol consumption during the last three months of pregnancy shows rates fluctuating but overall increasing from 8.9% in 2016–10.3% in 2021 (New Jersey Department of Health, n.d.-b.). Data on other substance use is not available through the publicly accessible NJSHAD query interface.

Second, the other substance use measure was inclusive of several drug classes, which precludes a fine-grained understanding of whether the patterns differed across different drugs. In the state vital events registration and information system, substances like cannabis, cocaine, and methamphetamines are not queried individually. Since the data is collected centrally, we could not disaggregate this composite variable, which represents a limitation of administrative data. The decision to analyze other substance use as a composite variable is consistent with prior population-based studies using administrative records, including a study using the PRAMS data (Nidey et al., 2022). Nonetheless, this approach limits our ability to detect substance-specific patterns. Finally, follow-up was limited to June 2021 due to data availability, restricting our ability to assess the long-term persistence of observed trends.

5. Conclusions

In our study, we found that alcohol consumption and other substance use increased, while tobacco use decreased amongst pregnant mothers following the declaration of the COVID−19 public health emergency in New Jersey. These findings suggest that public health emergencies are associated with prenatal health behaviors, thus potentially influencing maternal and infant birth outcomes. Future research is needed to better characterize the long-term effects of major social events to inform intervention strategies and create a targeted public health response.

CRediT authorship contribution statement

Abigail Gulchin: Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Jessica E. Salvatore:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Kuo Sally I-Chun:** Writing – review & editing, Validation, Methodology, Conceptualization. **Cooke Megan E.:** Writing – review & editing, Validation, Methodology, Conceptualization. **Jiawen Zhao:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Jessica E. Salvatore reports a relationship with Research Society on Alcohol that includes: board membership. All other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Funding for this research was received from the New Jersey Integrated Population Health Data (iPHD) Project through a waiver of data access fees. The authors thank the iPHD Project for facilitating access to the data referenced in this work.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.dadr.2026.100452.

References

Ali, F.R.M., Seaman, E.L., Schillo, B., Vallone, D., 2022. Trends in annual sales and pack price of cigarettes in the US, 2015-2021. JAMA Netw. Open. 5 (6), e2215407. https://doi.org/10.1001/jamanetworkopen.2022.15407.

Andrade, C., 2024. Maternal cannabis use during pregnancy and maternal and neonatal adverse outcomes. J. Clin. Psychiatry 85 (4), 24f15611. https://doi.org/10.4088/JCP.24f15611.

Avalos, L.A., Ray, G.T., Alexeeff, S.E., Adams, S.R., Does, M., Ansley, D., Tucker, L.-Y., Conway, A., Ettenger, A., Goler, N., Young-Wolff, K.C., 2022. The effect of the COVID-19 pandemic on prenatal cannabis use by pre-conception depression and anxiety status. J. Affect. Disord. Rep. 10, 100432. https://doi.org/10.1016/j.jadr.2022.100432.

Azagba, S., Manzione, L., Shan, L., King, J., 2020. Trends in smoking during pregnancy by socioeconomic characteristics in the United States, 2010–2017. BMC Pregnancy Childbirth 20, 52. https://doi.org/10.1186/s12884-020-2748-y.

Bennett, C.D. (2017). Legal Age to Purchase Smoking Products to Increase to 21. ⟨https://www.nj.gov/health/news/2017/20171027a.shtml⟩

Bill S359, S359, New Jersey State Legislature 2016–2017 (2016). ⟨https://njleg.state.nj.us/bill-search/2016/S359/bill-text?f=S0500&n=359_S2⟩

Board, A., D'Angelo, D.V., von Essen, B.S., Denny, C.H., Miele, K., Dunkley, J., Baillieu, R., Kim, S.Y., 2023. Polysubstance use during pregnancy: the importance of screening, patient education, and integrating a harm reduction perspective. Drug. Alcohol. Depend. 247, 109872. https://doi.org/10.1016/j.drugalcdep.2023.109872.

Delphin-Rittmon, M.E., Secretary for Mental Health, A., Use, S., Abuse, S., & Health Services Administration, M. (2022). 2020 National Survey on Drug Use and Health: Women Substance Abuse and Mental Health Services Administration.

Denny, C.H., Cristian, S., Acero, M.P.H., Timothy, S., Naimi, M.D., Shin, Y., Kim, M.P.H., 2019. Consumption of alcohol beverages and binge drinking among pregnant women aged 18–44 years—United States, 2015–2017. Mmwr. Morb. Mortal. Wkly. Report. 68. https://doi.org/10.15585/mmwr.mm6816a1.

ELNahas, G., Thibaut, F., 2023. Perinatal psychoactive substances use: a rising perinatal mental health concern. J. Clin. Med. 12 (6), 2175. https://doi.org/10.3390/jcm12062175.

Gómez Pomar, E., Berryhill, J., Bhattacharyya, S., 2025. Evaluating maternal drug use disparities, risk factors and outcomes in Northeast Arkansas: a pre, during, and post-COVID-19 pandemic analysis. BMC Public. Health 25 (1), 509. https://doi.org/10.1186/s12889-025-21636-4.

González-Alvarez, A.D., Kapukotuwa, S., Hurst, L., Owusu-Ansah, A.G., Guo, Y., Vaderlaan, J., Shen, J.J., 2025. Socioeconomic disparities in perinatal substance use emergency department visits before and during COVID-19. J. Women'S. Health 34 (12), 1548–1557. https://doi.org/10.1177/15409996251370887.

H.R.2411 - Tobacco to 21 Act, H.R. 2411, United States House of Representatives 116th Congress, 1st Session (2019). ⟨https://www.congress.gov/bill/116th-congress/house-bill/2411/text⟩

Han, B., Compton, W.M., Einstein, E.B., Elder, E., Volkow, N.D., 2024. Pregnancy and postpartum drug overdose deaths in the US before and during the COVID-19 pandemic. JAMA Psychiatry 81 (3), 270–283. https://doi.org/10.1001/jamapsychiatry.2023.4523.

Harrison, P.A., Sidebottom, A.C., 2009. Alcohol and drug use before and during pregnancy: an examination of use patterns and predictors of cessation. Matern. Child. Health J. 13 (3), 386–394. https://doi.org/10.1007/s10995-008-0355-z.

Heins, S.E., Pujol, T.A., 2024. Using administrative claims data to address maternal health disparities: benefits, pitfalls, and methodological solutions. Women'S. Health Issues 34 (3), 217–220. https://doi.org/10.1016/j.whi.2024.04.002.

Howland, R.E., Mulready-Ward, C., Madsen, A.M., Sackoff, J., Nyland-Funke, M., Bombard, J.M., Tong, V.T., 2015. Reliability of reported maternal smoking: comparing the birth certificate to maternal worksheets and prenatal and hospital medical records, New York City and Vermont, 2009. Matern. Child. Health J. 19 (9), 1916–1924. https://doi.org/10.1007/s10995-015-1722-1.

Jake Honig Compassionate Use Medical Cannabis Act, No. A20, Senate and General Assembly of the State of New Jersey (2019). ⟨https://pub.njleg.gov/bills/2018/PL19/153_.HTM⟩

Jorda, M., Conant, B.J., Sandstrom, A., Klug, M.G., Angal, J., Burd, L., 2021. Protective factors against tobacco and alcohol use among pregnant women from a tribal nation in the Central United States. PLoS. ONE 16 (2), e0243924. https://doi.org/10.1371/journal.pone.0243924.

Kar, P., Tomfohr-Madsen, L., Giesbrecht, G., Bagshawe, M., Lebel, C., 2021. Alcohol and substance use in pregnancy during the COVID-19 pandemic. Drug. Alcohol. Depend. 225, 108760. https://doi.org/10.1016/j.drugalcdep.2021.108760.

Kendler, Kenneth S., Lönn, Sara Larsson, Salvatore, Jessica, Sundquist, Jan, Sundquist, Kristina, 2016. Effect of Marriage on Risk for Onset of Alcohol Use Disorder: A Longitudinal and Co-Relative Analysis in a Swedish National Sample. American Journal of Psychiatry 173, 911–918. https://doi.org/10.1176/appi.ajp.2016.15111373.

Kotelchuck, M., Cheng, E.R., Belanoff, C., Cabral, H.J., Babakhanlou-Chase, H., Derrington, T.M., Diop, H., Evans, S.R., Bernstein, J., 2017. The prevalence and impact of substance use disorder and treatment on maternal obstetric experiences and birth outcomes among singleton deliveries in Massachusetts. Matern. Child. Health J. 21 (4), 893–902. https://doi.org/10.1007/s10995-016-2190-y.

Lampe, J., 2024, May 14. State marijuana "Legalization" and federal drug law: a brief overview for congress [Legislation]. Libr. Congr. ⟨https://www.congress.gov/crs-product/LSB10482⟩.

Lien, J., Hayes, T., Liu-Smith, F., Rana, D., 2023. Comparing maternal substance use and perinatal outcomes before and during the COVID-19 pandemic. J. Perinatol. 43 (5), 664–669. https://doi.org/10.1038/s41372-023-01613-8.

Martin, J.A., Osterman, M.J.K., Driscoll, A.K., 2023 Jan. Declines in Cigarette Smoking During Pregnancy in the United States, 2016-2021. NCHS Data Brief (458), 1–8. PMID: 36723453.

New Jersey Compassionate Use Medical Marijuana Act, No. S119 3R, Senate and General Assembly of the State of New Jersey (2010). ⟨https://pub.njleg.gov/bills/2008/PL09/307_.HTM⟩

New Jersey Constitution | NJ Legislature, § Article IV, Section VII, Paragraph 13. Retrieved August 27, 2025, from ⟨https://www.njleg.state.nj.us/constitution⟩

New Jersey Department of Health, Center for Health Statistics. (n.d.). Pregnancy Risk Assessment Monitoring System (PRAMS) dataset query: Alcohol use in the last 3 months of pregnancy, New Jersey, 2016–2021. New Jersey State Health Assessment Data (NJSHAD). ⟨https://www-doh.nj.gov/doh-shad/query/result/prams/PRAMS/DrankLast3MonthPreg.html⟩

New Jersey Department of Health, Center for Health Statistics. (n.d.). Pregnancy Risk Assessment Monitoring System (PRAMS) dataset query: Smoking in the last 3 months of pregnancy, New Jersey, 2016–2021. New Jersey State Health Assessment Data (NJSHAD). ⟨https://www-doh.nj.gov/doh-shad/query/result/prams/PRAMS/SmokeLast3MonthPreg.html⟩

Nidey, N., Kair, L.R., Wilder, C., Froelich, T.E., Weber, S., Folger, A., Marcotte, M., Tabb, K., Bowers, K., 2022. Substance use and utilization of prenatal and postpartum care. J. Addict. Med. 16 (1), 84–92. https://doi.org/10.1097/ADM.0000000000000843.

NJCRC 2022-2023 Report on Adult Use Cannabis. (2023). Cannabis Regulatory Commission. ⟨https://www.nj.gov/cannabis/resources/reports-stats-info/⟩

Peltier, M.R., Verplaetse, T.L., Bici, V., Mokwuah, A.A., Chavez, C.L.J., Zakiniaeiz, Y., Kohler, R., Garcia-Rivas, V., Banini, B.A., Zhou, H., Raval, N.R., Pittman, B., McKee, S.A., 2025. Alcohol use during pregnancy: the impact of social determinants of health on alcohol consumption among pregnant women. Biol. Sex. Differ. 16, 49. https://doi.org/10.1186/s13293-025-00731-6.

Piske, M., Homayra, F., Min, J.E., Zhou, H., Marchand, C., Mead, A., Ng, J., Woolner, M., Nosyk, B., 2021. Opioid use disorder and perinatal outcomes. Pediatrics 148 (4), e2021050279. https://doi.org/10.1542/peds.2021-050279.

Rodriguez, J.J., Smith, V.C., 2019. Epidemiology of perinatal substance use: exploring trends in maternal substance use. Semin. Fetal Neonatal Med. 24 (2), 86–89. https://doi.org/10.1016/j.siny.2019.01.006.

Salvatore, Jessica E., Larsson Lönn, Sara, Sundquist, Jan, Sundquist, Kristina, Kendler, Kenneth S., 2018. Genetics, the Rearing Environment, and the Intergenerational Transmission of Divorce: A Swedish National Adoption Study. Psychological Science 29, 370–378. https://doi.org/10.1177/0956797617734864.

Smith, C.L., Waters, S.F., Spellacy, D., Burduli, E., Brooks, O., Carty, C.L., Ranjo, S., McPherson, S., Barbosa-Leiker, C., 2022. Substance use and mental health in pregnant women during the COVID-19 pandemic. J. Reprod. Infant. Psychol. 40 (5), 465–478. https://doi.org/10.1080/02646838.2021.1916815.

Taylor, D.L., Bell, J.F., Adams, S.L., Drake, C., 2021. Factors associated with cannabis use during the reproductive cycle: a retrospective cross-sectional study of women in states with recreational and medical cannabis legalization. Matern. Child. Health J. 25 (9), 1491–1500. https://doi.org/10.1007/s10995-021-03197-1.

American College of Obstetricians and Gynecologists' Committee on Obstetric Practice, 2020. Tobacco and Nicotine Cessation During Pregnancy: ACOG Committee Opinion, Number 807. Obstetrics & Gynecology 135 (5), e221–e229. https://doi.org/10.1097/AOG.0000000000003822.

Trump, D.J. (2020, March 13). Proclamation declaring a national emergency concerning the novel coronavirus disease (COVID-19) outbreak. The White House. ⟨https://trumpwhitehouse.archives.gov/presidential-actions/proclamation-declaring-national-emergency-concerning-novel-coronavirus-disease-covid-19-outbreak/⟩

U.S. Census Bureau. (2024). American Community Survey 1-Year Estimates 2024. ⟨https://data.census.gov/profile/New_Jersey?g=040XX00US34#populations-and-peopl⟩

Vadukapuram, R., Chaudhari, G., Trivedi, C., Vora, D., Memon, A., Giri, D., Tazin, F., Reddy, P., Mansuri, Z., Jain, S.B., 2022. The association of psychological stressors with cannabis use during pregnancy: findings from the National Survey on Drug Use and Health 2017–2019. J. Nerv. Ment. Dis. 210 (8), 633. https://doi.org/10.1097/NMD.0000000000001507.

Wells, B.J., Nowacki, A.S., Chagin, K., Kattan, M.W., 2013. Strategies for handling missing data in electronic health record derived. Data. eGEMs (Gener. Evid. & Methods Improv. Patient Outcomes) 1 (3). ⟨https://up-j-gemgem.ubiquityjournal.website/articles/10.13063/2327-9214.1035⟩.

Young-Wolff, K.C., Ray, G.T., Alexeeff, S.E., Adams, S.R., Does, M.B., Ansley, D., Avalos, L.A., 2021. Rates of prenatal cannabis use among pregnant women before and during the COVID-19 pandemic. JAMA 326 (17), 1745–1747. https://doi.org/10.1001/jama.2021.16328.

Young-Wolff, K.C., Slama, N.E., Padon, A.A., Silver, L.D., Soroosh, A., Alexeeff, S.E., Adams, S.R., Does, M.B., Campbell, C.I., Ansley, D., Conway, A., Goler, N., Avalos, L.A., 2022. Geographic accessibility of retail cannabis in Northern California and prenatal cannabis use during the COVID-19 pandemic. JAMA Netw. Open. 5 (11), e2244086. https://doi.org/10.1001/jamanetworkopen.2022.44086.