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# Screening and early intervention for substance use during pregnancy: A retrospective case note review of antenatal care records

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## Abstract

**Introduction:** Screening for substance use during pregnancy is critical for enhancing maternal health and perinatal outcomes. However, disparities persist in screening and intervention rates within maternity services. This retrospective case note review explored contemporaneous practices around screening and interventions for substance use among pregnant women during routine antenatal care.

**Methods:** A random sample of 100 sets of maternity records were reviewed. Eligible cases included any woman attending initial pregnancy assessments at one of two South Australian metropolitan Hospital-based antenatal clinics, from July 2019–September 2020. Screening rates for past and current alcohol, tobacco and other substance use were identified and compared with data from a subset of a nationally representative survey. Intervention details and referral pathways were also assessed.

**Results:** The final sample of eligible cases ($n = 93$) demonstrated prioritisation of screening for current use, over past use, across all substances ($p < 0.001$). Screening was most likely for tobacco and least likely for e-cigarettes ($p < 0.001$). Significant underreporting of past use compared with the benchmark was identified for all substances (except tobacco, $p = 0.224$). Interventions typically involved written resources, which were usually declined by clients.

**Discussion and Conclusions:** Despite longstanding recommendations, screening and intervention practices for substance use appear inconsistent. With the recent emergence of vaping, no evidence of updated approaches to identifying e-cigarette consumption in pregnant women was found. Several opportunities for enhancing routine screening and intervention practices within antenatal clinics were identified, and will inform the development of policy directives, targeted training modules, and other resources for health professionals working in these services.

**KEYWORDS**
antenatal screening, perinatal care, pregnancy, prevention and early intervention, substance-related disorder

## 1 | INTRODUCTION

Consumption of alcohol, tobacco or illicit drugs during pregnancy is harmful to maternal health and foetal development. These harms include foetal alcohol spectrum disorders (FASD) [1–3], sudden infant death syndrome (SIDS) [4], and a range of other serious conditions, such as placental insufficiency, placental abruption, stillbirth, low birthweight, preterm birth and birth defects [5–11]. Many of these adverse outcomes can be modified or prevented with abstinence from alcohol, tobacco and other drugs [12]. Moreover, women who use substances during pregnancy, or who are substance dependent, may experience challenges with parental responsibilities, including providing adequate physical and/or emotional care, maintaining a stable environment and ensuring the child's safety [13]. Consequently, children born to parents with substance-related issues face increased risks of psychosocial harms, which in turn increases the likelihood of their own substance use in the future [14–16].

Multiple proximal and distal social determinants of health impact the likelihood of individuals experiencing substance use disorders or dependence [17]. For instance, these include factors, such as FASD, comorbid mental health disorders, experiences of trauma, employment, stigma and discrimination, and inadequate access to healthcare. Therefore, from a public health perspective, early detection and intervention for substance use are crucial for improving short- and longer-term health outcomes for both women and their offspring.

Addressing substance use during pregnancy is a public health priority in Australia. Despite recommendations for abstinence by the National Health and Medical Research Council [18], a significant proportion of women continue to consume alcohol, tobacco and illicit drugs, even after confirming their pregnancy [19, 20]. In 2022–2023, the National Drug Strategy Household Survey (NDSHS) of families in Australia reported 14.9% of women continued to drink alcohol after becoming aware of their pregnancy, whereas 11.2% continued to smoke tobacco [21]. A large South Australian study found that 20% of women who used illicit drugs during pregnancy used more than one substance, and 86% of those who used drugs also smoked tobacco [19]. These statistics underscore the need for greater focus, more funding, and targeted commitment from health professionals to implement strategies that support harm-minimisation and abstinence.

Antenatal clinics provide an ideal opportunity to identify and support women to achieve abstinence through screening and early intervention. Although a review and update of the 2020 Australian Pregnancy Care Guidelines is underway [22], the World Health Organization, Royal Australian and New Zealand College of Obstetricians and Gynaecologists and the Australian College of Midwives all recommend routine antenatal screening for every pregnant woman, to identify those requiring further investigation, intervention or referral to additional support services, including specialist treatment [23, 24]. Meanwhile, the most recent National Midwifery Guidelines published by the Australian College of Midwives in 2021 also recommend consultation with medical professionals, and referral for alcohol or other drug dependence at the commencement of care for all pregnant women [25].

Antenatal clinics in Australia are legally required to collect and report data on smoking and alcohol consumption during pregnancy to maintain accreditation. Despite these requirements, and recommendations from key professional organisations, the degree to which universal screening and early intervention for substance use during pregnancy are implemented remains dependant on the setting and resources available. While screening for tobacco use and provision of smoking cessation materials are common in antenatal settings, screening for alcohol and other illicit substances is less frequent [26, 27]. This variation is often due to a combination of structural and individual barriers [28–31] compounded by challenges in engaging women in treatment [32].

Given the variations in rates of implementation of screening and early intervention found in previous studies, and the significant number of women who continue to use alcohol, tobacco and other drugs during pregnancy [19, 33], it is important for research to identify current rates of screening and early intervention within antenatal settings and pinpoint areas and strategies for improvement. As yet, little is known about the current rates of screening and early intervention within South Australian antenatal clinics. Moreover, research in the United States has consistently shown that self-reported rates of alcohol and other drug use during pregnancy are lower than national benchmarks [34, 35]. Therefore, studies that compare detection rates with established benchmarks can help clinicians and policy-makers identify underreporting and inform policy frameworks and clinical practices to improve health outcomes for women and their children.

This study is part of a larger project aimed at improving current practices for assessing and responding to substance use among pregnant women in South Australia [36]. Its primary purpose was to establish a baseline against which to evaluate the effectiveness of this broader initiative through a retrospective case note review. As such, this review had three broad aims: first, to explore current rates of screening for substance use among a subset of pregnant women receiving antenatal care in two metropolitan South Australian maternity services. Second, to determine the prevalence of substance use in pregnancy among women screened at these services and assess whether these rates align with nationally representative data. Third, to evaluate the types of interventions currently provided to women reporting substance use during pregnancy. The case note review also explored variations in screening rates and prevalence based on demographic characteristics.

## 2 | METHODS

### 2.1 | Study design

#### 2.1.1 | Participants and setting

One hundred sets of maternity case notes were randomly selected for review. Cases were drawn from the pregnancy records of women attending antenatal services at two metropolitan hospitals in South Australia, between 1 April 2019 and 30 September 2020. An additional date filter was used to identify cases of women who gave birth on one of three specific dates each month within the time period. The first four cases for each date were selected until 100 cases were extracted. Maternity notes were pulled by medical records and details were cross referenced with electronic patient records to clarify details as required (e.g., details of intervention/referral).

*Inclusion/exclusion criteria*

The inclusion criteria covered case notes for women who had their initial antenatal booking assessment at either maternity service during the specified dates. Cases were excluded for those women who transferred to another care provider later in pregnancy; or gave birth at, but did not receive antenatal care at either clinic during their pregnancy.

#### 2.1.2 | Data extraction

Two of the authors (AB and MC), both midwives, reviewed the maternity records and extracted the relevant information into a password protected Microsoft Excel Spreadsheet pro-forma. To ensure data privacy, the data extraction occurred in the medical records reading room in the hospital where all records for both centres are retained. A third reviewer (LC) subsequently cross-checked all extracted data independently for consistency and reliability. No disagreements arose during this process.

### 2.2 | Measurements

#### 2.2.1 | Case note demographics

To safeguard privacy and reduce the risk of identifiability, de-identified demographic information was extracted. This included the woman's birth month and year (rather than exact date of birth), ethnicity, parity, date of the first antenatal appointment and estimated due date. *Approximate age at screening* was also calculated for each case, based on the woman's birth month and year, and the appointment date.

#### 2.2.2 | Case note substance use history

All data relating to substance use were extracted from each record. This included responses to pre-defined questions around current use, and past but not current (i.e., within-lifetime) use of alcohol, tobacco, amphetamine-type stimulants, cannabis and non-medical use of prescription medication. This information was recorded in the case notes in the form of a yes/no checkbox for each substance/class of substances. Further information was entered by midwives, for example e-cigarettes, and the names of some illicit drugs and preparations. Additionally, details of any interventions provided in the comments section were extracted, as well as information about the professional group of the clinician conducting the screening and implementing any intervention (i.e., midwife, nurse or doctor).

#### 2.2.3 | Benchmark prevalence rates

The National Drug Strategy Household Survey 2019 [37] was used as the reference to identify the prevalence of substance use among women in the hospital's catchment area who were aware of their pregnancy at the time of the survey. The NDSHS is an Australian household survey, conducted every 3 years by the Australian Institute of Health and Welfare (AIHW). Data requested from AIHW aligned with the data collected in our sample. AIHW provided data on current use, and within-lifetime use of alcohol, tobacco, e-cigarettes, cannabis, pain-killers/pain-relievers and opioids for non-medical purposes, and any other illicit drugs.

These data were available for women aged 14–49 years, living within the Adelaide Primary Healthcare Network catchment area, who were aware of their pregnancy when completing the survey.

Because the list of substances provided by AIHW did not perfectly match those in the case notes, some categories were grouped for comparison. Alcohol, tobacco, e-cigarettes and cannabis categories were identical in both cases, and did not require grouping. However, *amphetamine-type stimulants* (our sample) were grouped with *any illicit drugs* (AIHW), which included some additional substances (e.g., hallucinogens). *Non-medical use of prescription medication* (case notes) was paired with *pain-killers, pain-relievers and opioids for non-medical purposes* (AIHW), potentially including some additional substances (e.g., benzodiazepines). A summary the inclusion/exclusion criteria for both datasets is found in the Data S1.

## 2.3 | Data analysis

### 2.3.1 | Assessment of screening rates and prevalence of substance use

An assessment pro-forma was used to identify current use and within-lifetime use of various common substances. Substance-related data were recorded as either 'yes' or 'no', indicating the pregnant woman had responded affirmatively or negatively to inquiry about each substance. If data were not recorded, it was assumed that screening had not occurred. The sample screening rate was established by dividing the number of instances where data were recorded by the total number of eligible case notes in the sample. Prevalence rates were then determined by dividing the number of affirmative cases by the number of women screened. This approach ensured we did not treat women who were not screened as abstinent.

Differences in screening rates between lifetime versus current use were analysed using Wilcoxon Signed Rank non-parametric tests. Screening rates were expressed as proportions with standard error, and significance was determined by a threshold of $p < 0.05$.

Screening rates comparing specific substances (e.g., screening for current alcohol consumption vs screening for current tobacco smoking) were analysed using Friedman's test. Post hoc pairwise comparisons were conducted using Wilcoxon sign-rank tests. The Bonferroni method corrected for the Family Wise Error Rate [38], setting the threshold at $p = 0.003$ for the 15 comparisons. Differences between screening and prevalence rates were reported as proportions with standard error, 95% confidence intervals (CI) and effect size (Kendall's $W$); with categories of small (<0.3), medium (0.3–0.5) and large effect (>0.5) as indicated by previous studies [39].

Rates of screening and of self-reported use were compared across age, parity, and ethnicity. Logistic regression modelling assessed the likelihood of screening and reporting use for continuous variables (e.g., age), whereas Wilcoxon Signed Rank tests were used for categorical demographic variables (e.g., ethnicity). To provide adequate statistical power to the analysis, comparisons were made between Caucasian and non-Caucasian women. Test statistics (proportion differences for categorical variables, odds ratios for continuous variables) were presented with 95% CIs. Significance was indicated by both a $p$-value of <0.05 and a 95% CI that did not include zero.

### 2.3.2 | Comparison of prevalence with NDSHS survey sample

To understand rates of over- or underreporting of substance use within our sample, data were compared with prevalence rates found in the NDSHS. This comparison was conducted using one-sample binomial tests, using the AIHW prevalence for each substance and timepoint (past or current) serving as the reference rate. Likelihood ratios, along with 95% CIs, were calculated to assess the *true estimate* of prevalence in our sample. Significance tests indicated statistically meaningful deviations from the benchmark rate. Significance was indicated by two metrics, a $p$-value of <0.05 and 95% CIs that did not straddle zero.

# 3 | RESULTS

## 3.1 | Sample characteristics

Of the 100 case notes extracted, seven sets of notes related to women who birthed without receiving antenatal care in the service, or for whom notes were missing. This left a total sample of 93 records for inclusion. Demographic characteristics across the cohort of women attending the antenatal clinics during the specified period are summarised in Table 1.

## 3.2 | Sample screening rates

### 3.2.1 | Screening for use within lifetime versus current use

Total sample screening rates are presented in Table 2. Across all substances, significantly higher rates of

**TABLE 1** Basic demographic characteristics of women included case note sample.

| *N* (% of sample) | |
|---|---|
| Age[a] (mean [SD]) | 29.4 (4.8) |
| Ethnicity[b] | |
| Caucasian | 42 (45.2%) |
| South Asian | 20 (21.5%) |
| Southeast Asian | 12 (12.9%) |
| Western Asian | 2 (2.2%) |
| Central Asian | 1 (1.1%) |
| African | 3 (3.2%) |
| European | 3 (3.2%) |
| Aboriginal/Torres Strait Islander | 1 (1.1%) |
| NR | 9 (9.7%) |
| Primiparity | |
| First pregnancy | 32 (34.4%) |
| Non-primiparous | 58 (62.4%) |
| NR | 3 (3.2%) |
| Administering clinician | |
| Midwife | 7 (7.5%) |
| Nurse | 1 (1.1%) |
| NR | 85 (91.4%) |

*Note:* $N = 93$.
Abbreviation: NR, not recorded.
[a]Age at time of assessment was approximated by calculating the woman's age in days (based on current age minus date of assessment) and converting to years by dividing by 365.25.
[b]Regions based on World Health Organization stratifications.

screening occurred for current use versus past use for all substances ($p < 0.001$ in all cases). Within both timeframes, women were most likely to be screened for tobacco and least likely to be screened for e-cigarette use.

### 3.2.2 | Variations in screening rates by substance type

Friedman's Test found significant differences between screening rates depending on the substance of use within-lifetime ($\chi^2(5) = 34.651$, $p < 0.001$) but not for current use ($p = 0.139$). Post-hoc pairwise comparisons (using Bonferroni-corrected-$p$ [i.e., $p < 0.003$]) found higher screening rates for past tobacco use relative to e-cigarettes ($Z = -3.742$, $p < 0.001$). No other comparisons met the criteria for significance (see Table S2, Supporting Information).

### 3.2.3 | Variations in screening rates by demographic characteristics

Table 3 summarises the differences between screening and prevalence rates according to age, parity and ethnicity. Among the group of primiparous women in our sample ($n = 32$, 34%), all were screened for their current use of tobacco and alcohol. However, a small proportion of primiparous women were not screened for their current use of e-cigarettes (9%), cannabis (3%), stimulants/other drugs (3%) or opioids/sedative drugs (3%). No significant differences were observed between rates of screening and parity. Odds of being screened for current e-cigarette use increased by 12% with each year of maternal age (odds ratio 1.12, CI [1.01, 1.25], $p = 0.033$), with Caucasian women 17% more likely than those from other ethnicities, to be screened for e-cigarette use (SE = 5.8, CI [4.8, 30.6], $p = 0.006$). No other differences in rates of screening depending on age or ethnicity were observed.

## 3.3 | Sample prevalence rates

Eight women in this sample reported some type of current substance use. Tobacco use only ($n = 5$) was most common, with single numbers of women reporting use of other substances or combinations, including alcohol only ($n = 1$), tobacco and alcohol ($n = 1$), or tobacco and cannabis ($n = 1$). Twenty-two individuals reported some type of substance use within-lifetime. Of those, 17 women reporting single substance use, which was either tobacco ($n = 15$) or alcohol ($n = 2$); four women reported lifetime use of two substances, which included tobacco in combination with either alcohol (n = 2), cannabis (n = 1) or e-cigarettes (n = 1); and one woman reported lifetime use of tobacco, alcohol and cannabis.

### 3.3.1 | Variations in prevalence rates by demographic characteristics

Table 3 also presents an overview of variation in prevalence rates based on demographic characteristics. Odds of reporting ever smoking decreased by 12% with each year of maternal age (odds ratio 0.88, CI [0.77, 0.98]; $p = 0.031$). Caucasian women were ~40% less likely to report ever smoking (CI [19.7, 56.2]; $p < 0.001$) and ~18% less likely to report current use of tobacco compared with women of other ethnicities (CI [5.4, 31.9]; $p = 0.005$). All other comparisons between maternal age, ethnicity and parity were unrelated to prevalence.

**TABLE 2** Proportion of women screened for lifetime, and current substance use, with tests of significance.

| | Proportion of women | | Wilcoxon signed rank test | | |
|---|---|---|---|---|---|
| | For use within lifetime, *N* (%) | For current use, *N* (%) | Z | Diff. (SE) | *p* |
| **Screened** | | | | | |
| Tobacco | 77 (82.8) | 90 (96.8) | **−3.61** | **−14.0 (3.6)** | **<0.001** |
| E-cigarettes | 63 (67.7) | 85 (91.4) | **−4.49** | **−23.7 (4.7)** | **<0.001** |
| Alcohol | 71 (76.4) | 88 (94.6) | **−4.12** | **−18.3 (4.0)** | **<0.001** |
| Cannabis | 71 (76.4) | 87 (93.5) | **−3.58** | **−17.2 (4.5)** | **<0.001** |
| Stimulants and other drugs[a] | 71 (76.4) | 87 (93.5) | **−3.90** | **−18.3 (4.0)** | **<0.001** |
| Opioids/sedatives[a] | 71 (76.4) | 87 (93.5) | **−3.90** | **−18.3 (4.0)** | **<0.001** |

*Note:* $N = 93$. Bold values indicate statistically significant differences between rates.

[a]Categories combined for the purposes of the analysis (see Section 2.2.3). Screening rates calculated by dividing number of instances where data were recorded by total number of cases. Prevalence rates calculated by dividing number of positive instances by number of screening instances (see Section 2.3.1). Diff. (SE): Differences between screening rates, with standard errors in parentheses.

## 3.4 | NDSHS subset comparisons

### 3.4.1 | Sample characteristics

Overall, the number of women eligible for comparison with the benchmark dataset ranged between 50 (current use for any substances, except e-cigarettes [$N = 59$]) and 60 (lifetime use of tobacco, cannabis, stimulants/other drugs and opioids/sedatives).

### 3.4.2 | Prevalence rate comparisons

Table 4 presents a comparison of rates of self-reported use in the case note sample with the benchmark data for women who were knowingly pregnant from the same hospital catchment area. Prevalence rates in our sample were significantly lower than the benchmark for within-lifetime use of e-cigarettes (LR = 1.6%, CI [0.1, 6.8]; $p = 0.001$); alcohol (LR = 7.0%, CI [2.6, 14.5]; $p < 0.001$); cannabis (LR = 2.8%, CI [0.3, 9.8]; $p < 0.001$); stimulants or other drugs (LR = 0.0%, CI: [0.0, 2.7]; $p < 0.001$); and opioids/sedative drugs (LR = 0.0%, CI [0.0, 2.7]; $p = 0.005$). Prevalence rates for current use for each substance in our sample did not differ from the benchmark rates.

## 3.5 | Intervention and referral details

To understand pathways of care for women who reported using substances during pregnancy, details about intervention and referral were also assessed. Within our sample, most cases (92%) lacked recorded details about any intervention provided. No intervention details were recorded for pregnant women reporting past use of any substance. For the two women who reported current alcohol use, no details of volume consumed or intervention for alcohol reduction/cessation were provided. However, one of those women (who also reported current tobacco use) had details of smoking consumption recorded. Among the seven women who reported current tobacco use, four cases involved the midwife or nurse offering written resources (which were declined by all the women); two included details on the level of smoking but no indication of intervention or follow-up; and one (who also screened positive for cannabis) was referred to a specialist addiction treatment service.

# 4 | DISCUSSION

Universal screening for alcohol, tobacco and other drug use before and during pregnancy is recommended to prevent adverse perinatal outcomes [22–25]. This study investigated substance use screening practices among pregnant women attending two South Australian antenatal clinics through a retrospective case note review and compared rates of self-reported use with a sub-population drawn from a nationally representative survey [37].

The study found evidence of inconsistent, rather than universal screening approaches. The majority of women were screened for their current use (rates between 91–97% for each substance), whereas significantly fewer were screened for past use (between 67–83%). Screening for current tobacco smoking was most common, while screening for current e-cigarette use was least common. These findings align with previous studies showing tobacco as the most commonly screened and intervened substance in antenatal settings [26, 27].

**TABLE 3** Demographic variations between rates of screening and rates of self-reported use.

| | | Age at time of screening | | | | Parity[a] | | | | Ethnicity[b] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *N* | OR | 95% CI | *p* | *N* | Diff. (SE) | 95% CI | *p* | *N* | *Diff.* (SE) | 95% CI | *p* |
| **Screening** | | | | | | | | | | | | | |
| Tobacco | Use in lifetime | 77 | 0.98 | [0.87, 1.1] | 0.789 | 77 | −7.9 (7.2) | [−21.0, 8.8] | 0.310 | 70 | −9.5 (8.1) | [−25.5, 6.8] | 0.242 |
| | Current use | 90 | - | - | - | 90 | 0.0 (0.0) | [−6.2, 10.7] | - | 82 | 4.8 (3.3) | [−4.3, 15.8] | 0.152 |
| E-cigarettes | Use in lifetime | **63** | **1.12** | **[1.01, 1.25]** | **0.033** | 63 | −7.8 (9.8) | [−25.1, 12.4] | 0.442 | 57 | 16.7 (10.0) | [−3.3, 34.9] | 0.102 |
| | Current use | 85 | 1.15 | [0.90, 1.45] | 0.262 | 85 | 5.9 (5.7) | [−4.4, 21.0] | 0.240 | **77** | **16.7 (5.8)** | **[4.8, 30.6]** | **0.006** |
| Alcohol | Use in lifetime | 71 | 1.04 | [0.93, 1.16] | 0.488 | 71 | −13.4 (8.2) | [−28.0, 4.9] | 0.137 | 65 | 2.4 (9.1) | [−15.4, 20.0] | 0.794 |
| | Current use | 88 | 1.10 | [0.80, 1.15] | 0.568 | 88 | −3.4 (2.4) | [−11.7, 7.6] | 0.288 | 80 | 9.5 (4.5) | [−0.6, 22.1] | 0.040 |
| Cannabis | Use in lifetime | 71 | 1.04 | [0.93, 1.16] | 0.488 | 71 | −13.4 (8.2) | [−28.0, 4.9] | 0.137 | 65 | 2.4 (9.1) | [−15.4, 20.0] | 0.794 |
| | Current use | 87 | 1.03 | [0.81, 1.33] | 0.795 | 87 | −0.3 (3.9) | [−9.0, 12.5] | 0.935 | 80 | 9.5 (4.5) | [−0.6, 22.1] | 0.040 |
| Stimulants and other drugs* | Use in lifetime | 70 | 1.05 | [0.94, 1.17] | 0.355 | 70 | −15.1 (8.3) | [−29.8, 3.3] | 0.099 | 65 | 2.4 (9.1) | [−15.4, 20.0] | 0.794 |
| | Current use | 87 | 1.03 | [0.81, 1.33] | 0.795 | 87 | −0.3 (3.9) | [−9.0, 12.5] | 0.935 | 80 | 9.5 (4.5) | [−0.6, 22.1] | 0.040 |
| Opioid/sedative drugs* | Use in lifetime | 70 | 1.05 | [0.94, 1.17] | 0.355 | 70 | −15.1 (8.3) | [−29.8, 3.3] | 0.099 | 65 | 2.4 (9.1) | [−15.4, 20.0] | 0.794 |
| | Current use | 87 | 1.03 | [0.81, 1.33] | 0.795 | 87 | −0.3 (3.9) | [−9.0, 12.5] | 0.935 | 80 | 9.5 (4.5) | [−0.6, 22.1] | 0.040 |
| **Prevalence** | | | | | | | | | | | | | |
| Tobacco | Use in lifetime | **20** | **0.88** | **[0.77, 0.98]** | **0.031** | 20 | 2.9 (10.2) | [−17.9, 21.3] | 0.775 | **20** | **−39.9 (9.2)** | **[−56.2, −19.7]** | **<0.001** |
| | Current use | 7 | 0.90 | [0.75, 1.09] | 0.277 | 7 | −7.3 (6.5) | [−23.3, 4.4] | 0.214 | **7** | **−17.5 (6.0)** | **[−31.9, −5.4]** | **0.005** |
| Alcohol | Use in lifetime | 5 | 0.97 | [0.79, 1.18] | 0.748 | 5 | −6.1 (6.7) | [−22.9, 6.8] | 0.329 | 5 | −9.5 (6.6) | [−25.2, 4.9] | 0.152 |
| | Current use | 2 | 1.23 | [0.88, 1.70] | 0.223 | 2 | 3.6 (2.5) | [−7.5, 12.1] | 0.280 | 2 | −0.3 (3.5) | [−11.3, 9.9] | 0.943 |
| Cannabis | Use in lifetime | 2 | 0.83 | [0.97, 1.32] | 0.833 | 2 | −7.1 (4.9) | [−22.6, 2.5] | 0.075 | 2 | −6.3 (4.3) | [−20.1, 5.1] | 0.145 |

*Note*: Bold values indicate statistically significant associations. Significant associations determined by $p < 0.05$ and a 95% confidence interval that does not contain zero. Cannabis (current use), e-cigarettes, opioids/sedative-type drugs, and stimulants/other drugs were not included in the prevalence rate comparisons due to insufficient cases for comparison (i.e., $n < 2$).

Abbreviations: CI, confidence interval; Diff. (SE), Differences between prevalence rates, with standard errors in parentheses; OR, odds ratio.

[a]Reference group: non-primiparous women. Difference represents change in prevalence relative to primiparous women.

[b]Reference group: Caucasian women. Difference represents change in prevalence relative to non-Caucasian women.

*Categories combined for the purposes of the analysis (see Section 2.2.3).

**TABLE 4** Likelihood ratios with 95% confidence intervals for the prevalence of substance use for each drug and time-frame, using Australian Institute of Health and Welfare as the reference benchmark.

| | Case notes | Benchmark | One sample binomial test | | |
|---|---|---|---|---|---|
| | Prevalence (%) | Prevalence (%) | Likelihood ratio | [95% CI] | *p* |
| Tobacco | | | | | |
| Use in lifetime | 20 (26.0) | 18 (30.6) | 26.0 | [17.1, 36.5] | 0.224 |
| Current use | 7 (7.8) | 4 (8.0) | 7.8 | [3.4, 14.5] | 0.500 |
| E-cigarettes | | | | | |
| Use in lifetime | 1 (1.6) | 10 (16.5) | **1.6** | **[0.1, 6.8]** | **0.001** |
| Current use | 0 (0.0) | 1 (2.5) | 0.0 | [0.0, 2.2] | 0.129 |
| Alcohol | | | | | |
| Use in lifetime | 5 (7.0) | 56 (94.8) | **7.0** | **[2.6, 14.5]** | **<0.001** |
| Current use | 2 (2.3) | 2 (3.6) | 2.3 | [0.4, 6.9] | 0.351 |
| Cannabis | | | | | |
| Use in lifetime | 2 (2.8) | 28 (46.7) | **2.8** | **[0.5, 8.4]** | **<0.001** |
| Current use | 1 (1.1) | 0 (0.0) | 1.1 | [0.1, 5.0] | 0.081 |
| Stimulants and other drugs | | | | | |
| Use in lifetime | 0 (0.0) | 29 (48.5) | **0.0** | **[0.0, 2.7]** | **<0.001** |
| Current use | 0 (0.0) | 0 (0.0) | 0.0 | [0.0, 2.2] | 0.500 |
| Opioid/sedative drugs[a] | | | | | |
| Use in lifetime | 0 (0.0) | 6 (10.0) | **0.0** | **[0.0, 2.7]** | **0.005** |
| Current use | 0 (0.0) | 0 (0.0) | 0.0 | [0.0, 2.2] | 0.500 |

*Note:* Cases where screening did not occur, or were not reported, were excluded from the analysis. Bold values indicate statistically significant differences between rates.

Abbreviation: CI, confidence interval.

[a]Categories combined for the purposes of the analysis (see Section 2.2.3).

Among those screened, fewer women reported having ever used a substance (except for tobacco) compared with prevalence rates in the representative survey, though rates of current use were comparable. This is consistent with previous research demonstrating underreporting of current substance use in antenatal settings compared with other forms of detection [33–35]. Additionally, intervention details were often not recorded, particularly relating to past use. For those currently using substances, the primary intervention provided was written resources, which were mostly declined by the pregnant woman, suggesting that this form of intervention may be ineffective and unacceptable in this population.

The pattern of screening identified may indicate an approach where women are first asked about their current use of common substances (i.e., tobacco, alcohol and cannabis), with further investigation into other substances, and/or use within-lifetime occurring depending on the initial response. Although this approach may be time-efficient, it risks missing opportunities for health professionals to provide advice, care and support; particularly for those women with a history of substance use. This is problematic, as evidence suggests that while many women with a history of substance use remain abstinent during pregnancy, a significant proportion will return to use post-birth [40]. Women who return to tobacco smoking after birthing increase the risk of SIDS [41, 42], whereas women who return to alcohol consumption and are breastfeeding increase the risk of alcohol passing to the child, with inherent health issues. Identifying women at-risk of returning to use or relapsing to dependence may prevent further harm to those women and their children.

Demographic predictors were generally unrelated to variations in rates of screening and prevalence; except for Caucasian women who reported lower rates of past and current tobacco consumption compared with other ethnicities. Surprisingly, the odds of reporting ever consuming tobacco decreased with maternal age. This finding is counterintuitive, given that various data sources have demonstrated reductions in smoking incidence over time across successive cohorts of women [21, 37]. It may be that older women were less likely to disclose past use relative to younger women. Nevertheless, these findings require further investigation.

Lower screening rates for e-cigarettes compared with other substances may point to a reduced understanding about the potential risks and benefits of such products. This finding is consistent with previous research showing that pregnant women and healthcare professionals had limited awareness of the risks posed by e-cigarette use [42]. This may be exacerbated by reports that e-cigarettes are less harmful to pregnant women and their infants, than traditional cigarettes, despite limited evidence [43]. While the absolute prevalence of e-cigarette use among pregnant women remains low, the rising rate of e-cigarette use in Australia highlights the need for more comprehensive healthcare education and training about these products given they do not appear to be a risk-free alternative [44, 45]. Greater awareness among health professionals around risks and harms can help to inform discussions with women [46]; and can lead to better health outcomes for pregnant women and their developing babies.

The evidence presented here may suggest a degree of underreporting of past alcohol, e-cigarette, cannabis, stimulants and opioid use among women in this sample. Underreporting of past substance use creates missed opportunities for intervention to maintain support for abstinence. Some argue that self-reporting for substance use is less reliable in clinical settings than in anonymous research settings [47]. However, self-reporting can be as reliable, provided there is trust between clinician and client, and an absence of perceptions of adverse consequences for disclosing use. For pregnant women, this requires midwives and other health professionals to sensitively manage a range of issues to extract reliable information, including avoiding stigmatising and shaming language, when working with women who use drugs, as well as clarifying processes around criminal justice involvement or removal of the child from custody resulting from mandatory reporting [31, 48].

In addition to the challenges faced by potential underreporting, this study also identified lack of clear intervention strategies and referral pathways for at-risk women. This presents an opportunity to enhance integrated and stepped-care pathways through staff education. Within our sample, there was no evidence of interventions offered to pregnant women based on their past substance use or current alcohol use. Among the seven women who disclosed current tobacco use, most were offered written materials but declined them. This suggests that the current resources may be inadequate, inappropriate and ineffective for this population. It may also suggest that even awareness of pregnancy-related risks does not lead to abstinence for some women.

Lack of uptake of written resources can occur for various reasons, including a lack of perceived relevance, cultural appropriateness, literacy and health literacy issues or understanding of the information provided. Therefore, it is essential that written resources and materials are developed collaboratively with stakeholder groups, such as FASD support groups and consumers, with end-users in mind, to ensure the language and information are clear and relevant. While psychosocial brief interventions, including motivational interviewing (MI), are more effective for reducing alcohol, tobacco and other drug consumption than printed materials alone [49, 50]; MI as a standalone brief intervention may not be adequate for women with more complex needs. However, such approaches can be valuable components of a clinicians' toolkit, as they are designed to enhance pregnant women's self-efficacy and motivation to engage with other services. Although MI and other interventions may require additional time and specific training to administer, they can be adapted for use in antenatal settings for health professionals with varying levels of training through brief interventions and referral to specialised services.

Cost-effectiveness studies suggest that MI can be a valuable addition to standard care for pregnant women in reducing alcohol, tobacco and other drug use [51, 52], potentially offsetting costs by reducing adverse outcomes and improving maternal and child health. This is particularly salient as six of the eight women reporting current use did so for a single substance (i.e., tobacco or alcohol), whereas the other two used tobacco in combination with either cannabis or alcohol. Conducting a targeted risk assessment for these women, providing a brief intervention to those at low and moderate risk, and offering active referral for those who are likely to be at higher risk or dependent should be the aim. This approach requires training and development of staff working with pregnant women, as well as support from management to ensure staff confidence in implementation.

### 4.1 | Limitations

Although the current study has a number of strengths, the findings should also be considered with respect to its limitations. First, our methodological approach may have introduced biases in some areas. Common among all retrospective reviews, our approach relies on routinely recorded data, which may be biased by both the health professional and the client in terms of recall and reliability. Additionally, by drawing samples of cases born on the same predetermined dates each month, we may have also introduced a small risk of sampling bias, though this is unlikely given births are distributed uniformly across given dates of each month. Furthermore, the inclusion of only those women who were screened (rather than the entire sample) as the denominator for prevalence may

have also biased rates upward; while the small sample size of the NDSHS dataset for this cohort, raises questions about the reliability of some of the data estimates. Nevertheless, our sample prevalence reflects only the prevalence across the two sites where the broader project will be carried out.

Second, the impact of COVID-19 on face-to-face screening should be considered. However, it is reasonable to assume that any impact on self-reported substance use behaviour would be negligible, since documentation of alcohol, tobacco and other drug use was collected regardless of whether the consultation occurred in-person or online. It is also worth noting that the pattern of substance use changed during COVID-19, both globally and in Australia [53–55]. Moreover, the timing of data collection also coincides with the release of the latest National Health and Medical Research Council low-risk alcohol guidelines which included clearer recommendations around abstaining from alcohol prior to, during and after pregnancy; as well as campaigns by other health agencies in Australia (e.g., Foundation for Alcohol Research and Education). While modelling of the effects of these campaigns is outside the scope of this paper, it is worthwhile considering the potential impact of these on rates found here.

Third, there are potential limitations with the benchmark comparison. For example, although the NDSHS subset included pregnant women living within the Adelaide Primary Healthcare Network catchment, it was not possible to match the samples based on age or other demographic characteristics. Consequently, the benchmark cohort contained a slightly broader age range of women than our sample; introducing the possibility of age-differences across cohorts. While overall comparability to other factors (e.g., mental health, socioeconomic status, etc.) remains uncertain. The use of unweighted data should also be considered, given women are likely to reduce consumption after gaining awareness of their pregnancy. Nevertheless, the benchmark data only includes women who were aware of their pregnancy at the time.

Finally, grouping specific substances for analysis may have introduced inconsistencies with counting. It was not always possible to match the data provided by AIHW to that in our sample. Therefore, some illicit substances may have been double counted as a result, though this possibility is unlikely as no women past or current use of either stimulants or opioids/sedatives; while no women in the AIHW dataset reported any current illicit substance use. Despite these issues, the findings from this study provide important insights into the types of substances being consumed by pregnant women in Adelaide and will inform the development of a training package for midwives and other health professionals working at these services as part of a larger systems reform initiative [36].

## 4.2 | Conclusions and future directions

Improving health outcomes from substance use during pregnancy requires comprehensive public health approach. The introduction of standardised screening, coupled with training and support for healthcare professionals providing antenatal care is vital for increasing reliable self-disclosure of substance use among pregnant women. Enhancing the quality of resources and interventions, coupled with clearly mapped referral pathways, can empower health professionals to provide effective care and advice for pregnant women with substance use issues, ultimately benefiting foetal and child development and maternal health and wellbeing.

### AUTHOR CONTRIBUTIONS

RA, AB, LC and MC conceived and designed the original study. MS analysed the data and drafted the manuscript. RA, AB, LC, MC and CH subsequently revised the manuscript critically and provided feedback. All authors approved the final version. Each author certifies that their contribution to this work meets the standards of the International Committee of Medical Journal Editors.

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### CONFLICT OF INTEREST STATEMENT

None to declare.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### ETHICS STATEMENT

Details around management of patient data, and procedures to ensure privacy and confidentiality of the case notes are outlined in a published protocol [36]. Ethical approval for this project was provided by the Northern

Adelaide Local Health Network Human Research Ethics Committee (number: 14178).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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